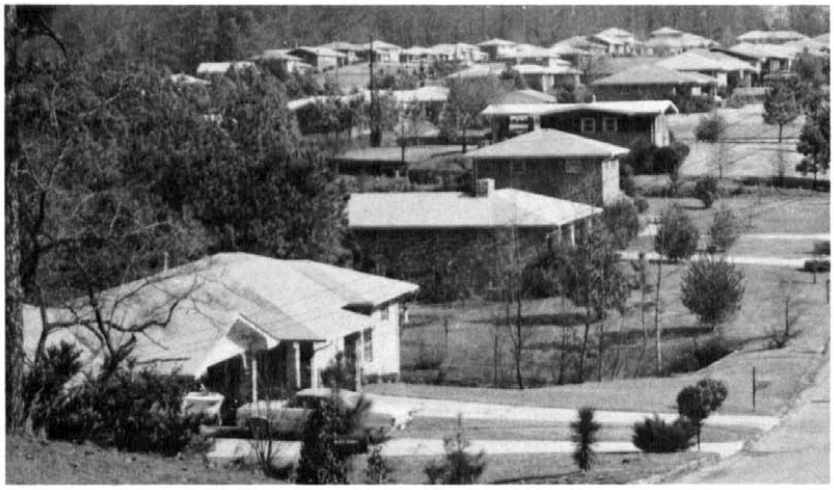
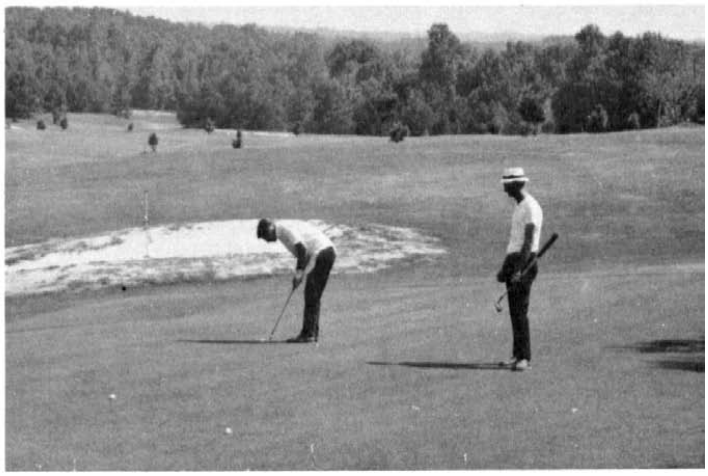
# SOIL SURVEY

# Gwinnett County Georgia





UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
UNIVERSITY OF GEORGIA COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATIONS

ISSUED JULY 1967

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

## HOW TO USE THIS SOIL SURVEY

THIS SURVEY of Gwinnett County contains information that can be applied in managing farms and woodlands; in selecting sites for roads, ponds, buildings, or other structures; and in appraising tracts of land for agriculture, industry, or recreation.

### Locating Soils

All of the soils of Gwinnett County are shown on the detailed map at the back of this survey. This map consists of sheets made from aerial photographs. Each sheet is numbered to correspond with numbers shown on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbol. 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 in the survey. This guide lists all the soils of the county in alphabetic order by map symbol. It shows the page where each soil is described and the page for the capability unit in which the soil has been placed. It also lists the woodland suitability group and wildlife group for each soil.

Individual colored maps showing the relative suitability or limitations of soils for many specific purposes can be developed by using the soil map and information in the text. Interpretations not included in the text can be developed by grouping the soils according to their suitability or limitations for a particular use. 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 in the section that describes the soils and in the section that discusses management of the soils for crops and for pasture.

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

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

Community planners and others concerned with community development can read about the soil properties that affect the choice of homesites, industrial sites, schools, and parks in the section "Use of the Soils for Residential, Industrial, Recreational, and Related Nonfarm Purposes."

Engineers and builders will find under "Engineering Uses of the Soils" tables that give engineering descriptions of the soils in the county and that name soil features that affect engineering practices and structures.

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

Students, teachers, and others will find information about soils and their management in various parts of the text.

Newcomers in Gwinnett County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "Additional Facts About the County," which gives additional information about the county.

CONTENTS



For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402

# SOIL SURVEY OF GWINNETT COUNTY, GEORGIA

BY RAY J. TATE

FIELDWORK BY H. C. AMMONS, S. M. JONES, G. J. THOMAS, R. J. TATE, AND S. M. ROBERTSON, SOIL CONSERVATION SERVICE

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

GWINNETT COUNTY is in the north-central part of Georgia (fig. 1), all of which is in the Upper

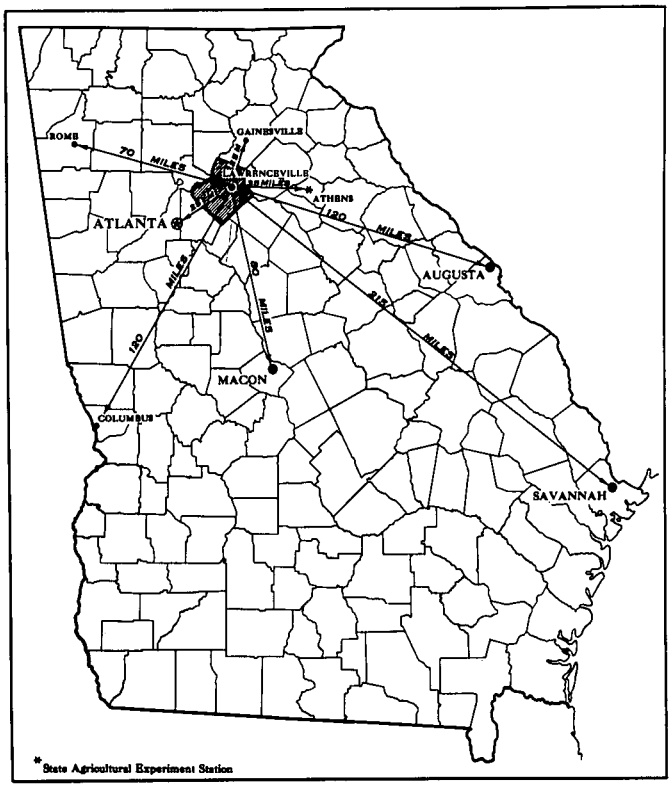



Figure 1.--Location of Gwinnett County in Georgia.

Piedmont section of the State. It is one of the five counties in the Atlanta Metropolitan Area and has a land area of 436 square miles, or 279,040 acres. Lawrenceville, the county seat, is near the center of the county. The area was established as a county in 1818 and was organized in 1820 (*4*)[1]. Settlement was well underway by 1821.

According to the U.S. Bureau of the Census, the population of Gwinnett County was 43,541 in 1960. Much recent increase in population has been in the towns and cities. Population on farms decreased by about 80 percent in the period 1950-60 (*4*).

The soils in Gwinnett County are mostly gently rolling to steep. They are suitable for many different crops, and the climate is favorable for their growth. Summers generally are warm, and winters are only moderately cold. Precipitation generally is ample for the crops grown and is well distributed throughout the year. Excellent sources of water are available for industrial, residential, and farm use.

In 1964, according to the U.S. Census of Agriculture, 33.7 percent of the county, or 93,967 acres, was in farms. The average size of the farms was 94.8 acres. Most of the farms were operated by the owner, but a few were worked by part owners or by tenants. Nearly 60 percent of the operators also worked at other jobs off the farm. Much of the acreage in farms was wooded or pastured. The chief crops grown were corn, cotton, small grain, and hay and pasture. Livestock and livestock products and poultry and poultry products were the chief sources of farm income.

Industries are increasing in the county, particularly in the southwestern part, where people from adjoining counties also find work in the many manufacturing plants. The largest industry manufactures leather goods and employs more than a thousand workers. From 40 to 200 workers are employed in some of the many smaller industries in the county.

The county is crossed by several major highways. One of these is a limited access expressway that enters the county from the northeast and leads into Atlanta to the southwest. It is planned to extend the Lawrenceville spur of this highway, Georgia Highway No. 316, to Athens, the site of the University of Georgia. Railroads, trucklines, airlines, and buses provide shipping facilities and transportation.

Local markets are available for most products, though they are somewhat limited. Most markets are in the Atlanta Metropolitan Area.

Electric power is available throughout the county. Two natural gaslines cross the county and provide gas to most areas. Telephone service can be obtained throughout the county, and almost two-thirds of the farms of the county have telephones.

[1] Italic figures in parentheses refer to Literature Cited, p. 92.

## HOW THIS SURVEY WAS MADE

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

They went into the county knowing they likely would find many soils they had already seen, and perhaps some they had not. As they traveled over the county, they observed steepness, length and shape of slopes; size and speed of streams; kinds of native plants or crops; kinds of rock; and many facts about the soils. They dug or bored many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by roots of plants.

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

Soils that have profiles almost alike make up a soil series. Except for different textures 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. Appling and Cecil, 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 go with their behavior in the natural landscape. Soils of one series can differ in texture of the surface layer and in slopes, stoniness, or some other characteristic that affects use of the soils by man.

Many soil series contain soils that differ in texture of their surface layer. According to such differences in texture, separations called soil types are made. Within a series, all the soils having a surface layer of the same texture belong to one soil type. Appling sandy loam and Appling sandy clay loam are two soil types in the Appling series. The difference in texture of their surface layers is apparent from their names.

Some soil types vary so much in slope, degree of erosion, number and size of stones, or some other feature affecting their use that practical suggestions about their management could not be made if they were shown on the soil map as one unit. Such soil types are divided into phases. The name of a soil phase indicates a feature that affects management. For example, Appling sandy loam, 2 to 6 percent slopes, eroded, is one of several phases of Appling sandy loam, a soil type that ranges from nearly level to gently rolling.

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 show buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this survey was made from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning management of farms and fields, a mapping unit is nearly equivalent to a soil type or a phase of a soil type. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind seen within an area dominantly of a recognized soil type or soil phase.

In preparing some detailed maps, the soil scientists have a problem of delineating areas where different kinds of soils are so intricately mixed, and so small in size, that it is not practical to show them separately on the map. Therefore, they show this mixture of soils as one mapping unit and call it a soil complex. Ordinarily, a soil complex is named for the major kinds of soil in it, for example, Wilkes-Iredell cobbly complex, 6 to 15 percent slopes.

The soil scientists may also show as one mapping unit two or more soils that have differences not significant enough to make it practical to show them separately on the map. Such a mapping unit is called an undifferentiated soil group. An example is Augusta soils.

On most soil maps, areas are shown that are so rocky, so shallow, or so frequently worked by wind and water, or so modified by man that they scarcely can be called soils. These areas are shown on a soil map like other mapping units, but they are given descriptive names, such as Made land or Rock land, and are called land types rather than soils.

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

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in a way that is readily useful to different groups of readers, among them farmers, managers of woodland, engineers, and homeowners. Grouping soils that are similar in suitability for each specified use is the method of organization commonly used in the soil surveys. The soil scientists set up trial groups, based on the yield and practice tables and on other data, and then test them by further study and by consultation with farmers, foresters, engineers, and others. Then the scientists adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

## GENERAL SOIL MAP

The general soil map at the back of this soil survey shows, in color, the soil associations in Gwinnett County. 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 farming or other land use. Such a map is not suitable for planning the management of a farm or field, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect management.

The 11 soil associations in Gwinnett County have been placed in four main groups, as shown on the legend for the general soil map. In the first group are soils on flood plains; in the second, soils on stream terraces; in the third, soils on ridgetops; and in the fourth, soils on side slopes in the uplands. Following are descriptions of the 11 soil associations in Gwinnett County.

### 1. Chewacla-Congaree-Wehadkee Association

Well-drained, somewhat poorly drained, and poorly drained soils subject to overflow.

This association is characterized by broad to narrow, nearly level flood plains along streams that are subject to overflow. In most places the areas are flooded once in 5 years, but about two-thirds of the area along the Chattahoochee River is flooded less than once in 10 years. The stream channels are well defined and in some places have cut into bedrock, but in many places the channels are clogged with silt. This association occurs throughout the county and makes up about 10 percent of the total area.

Dominant in the association are the Chewacla, Congaree, and Wehadkee soils. Also in the association are small areas of the Altavista, Augusta, and Wickham soils. The Chewacla soils make up about 70 percent of the association; Congaree soils, 17 percent; Wehadkee soils, 5 percent; and the minor soils, about 8 percent.

The Chewacla soils are somewhat poorly drained, the Congaree are well drained, and the Wehadkee are poorly drained. Chewacla soils have a surface layer that is predominantly reddish-brown silt loam and that overlies reddish-brown, stratified silty clay loam. Congaree soils have a surface layer of dark-brown or dark yellowish-brown fine sandy loam to silt loam. Their subsoil is strong-brown or brown fine sandy loam or sandy clay loam. In the Wehadkee soils, the surface layer is light brownish-gray loam or silt loam that is underlain by dark-gray silty clay loam mottled with dark yellowish brown.

The minor soils are all on stream terraces. They formed in older alluvium than the Chewacla, Congaree, and Wehadkee soils and have more distinct horizons. Altavista soils are moderately well drained, Augusta are somewhat poorly drained, and Wickham are well drained.

Some of the better drained areas in this association have been cultivated and used for improved pasture. The more poorly drained areas support mixed stands of hardwoods.

The size of the farms in this association, as well as land ownership and management, vary. Most of the association is wooded, and about one-third of the acreage is too wet for cultivated crops. Soils of capability classes II, III, and IV are predominant. Some supplemental drainage is needed on about 75 percent of the soils in classes II, III, and IV. In this association only the Congaree soils on flood plains, and the Altavista and Wickham soils on stream terraces are suitable for tilled crops without drainage. If the soils in this association are adequately drained, pastures on them are good to excellent.

### 2. Wickham-Altavista-Red Bay Association

Deep soils that have a clayey or loamy subsoil

This association consists of broad, nearly level to gently sloping areas on terraces and of a few short, moderately steep, discontinuous escarpments. In about four-fifths of the association, slopes are uniform and range from 2 to 6 percent. Slopes of more than 10 percent are along the escarpments and are minor in extent. This association, which covers about 1 percent of the county, is northwest of Duluth along the Chattahoochee River.

The Wickham, Altavista, and Red Bay soils are dominant in this association, but small areas of Chewacla, Congaree, Augusta, and Worsham soils also occur. Wickham soils make up about 65 percent of the association; Altavista soils, 20 percent; Red Bay soils, 10 percent; and the minor soils, about 5 percent.

All of the dominant soils in this association are well drained or moderately well drained. In most places they have a surface layer of friable sandy loam or fine sandy loam, but in a small acreage the surface layer is friable clay loam or sandy clay loam. The subsoil is chiefly yellowish-red sandy clay loam in the Wickham soils, and red or dark-red sandy clay loam in the Red Bay soils. Altavista soils generally have a subsoil of yellowish-brown sandy clay loam that commonly is mottled at a depth of about 20 inches.

The minor Chewacla and Congaree soils are on bottom lands. They are well drained and have less distinct horizons than the Augusta and Worsham soils. The somewhat poorly drained Augusta soils and the poorly drained Worsham occupy small areas in depressions and along drainageways.

About 90 percent of this association is cultivated or pastured. The soils on the escarpments and the somewhat poorly drained and poorly drained soils have a cover of hardwoods and pines of various kinds.

This association is made up of a few large farms. The soils are well suited to general farming and are better suited to row crops than the soils in any other association in the county. Cotton, corn, small grain, sorghum, tall fescue, white clover, and Coastal bermudagrass are some of the crops commonly grown. The soils in most of the acreage are in classes II and III, but small areas are in class IV.

### 3. Appling-Pacolet-Louisburg Association

Soils that have a clayey to loamy subsoil; on broad uniform ridgetops

This association is characterized by very gently sloping to gently sloping, broad uniform ridgetops. Slopes are 2 to 6 percent in about two-thirds of the association and from 6 to 10 percent in the rest. Some areas of this association are south of Lawrenceville and Dacula, and others are near Grayson, Snellville, and Centerville. The association makes up about 15 percent of the county.

Dominant in this association are the Appling, Pacolet, and Louisburg soils. Minor soils are the Worsham, Durham, and Cecil. Appling soils make up about 60 percent of the association; Pacolet soils, 21 percent; Louisburg soils, 10 percent; and the minor soils about 9 percent.

The Appling and Pacolet soils are well drained. They have a surface layer of sandy loam and a subsoil of sandy clay loam to clay. In the more eroded areas, the surface layer is sandy clay loam. The subsoil in the Appling soils is mottled red and yellow, but that in the Pacolet soils is red. Depth to hard rock in the Appling and Pacolet soils ranges from 3 to more than 10 feet, but in a large acreage weathered and broken rock is at a depth of 3 to 5 feet.

Louisburg soils are well drained to excessively drained. Their surface layer is loamy sand. The subsoil is yellowish-brown sandy loam or is a thin, discontinuous layer of mottled yellowish-red to yellowish-brown sandy clay loam to sandy clay. Depth to hard rock ranges from 18 to 48 inches but is predominantly less than 36 inches.

Of the minor soils, the Worsham are grayer and have a more plastic subsoil than the Appling, Pacolet, and Louisburg; the Durham have a sandier subsoil than the Appling and Pacolet; and the Cecil are 10 to 20 inches deeper than the Pacolet. The Worsham soils are poorly drained, and the Durham and Cecil are well drained.

About 60 percent of this association is cultivated or pastured. The rest of the association is wooded or is idle.

This association is made up of many small farms and of a few large farms. The soils are well suited to general farming and are among the soils in the county that are well suited to row crops. Cotton, corn, tall fescue, and Coastal bermudagrass are some of the crops commonly grown. The soils in most of the acreage are in classes II and III.

### 4. Madison-Pacolet-Appling Association

Soils that have a clayey subsoil; on narrow ridgetops

This association consists of narrow, very gently sloping to gently sloping ridgetops. In about two-thirds of the association, slopes range from 6 to 10 percent, but in the rest of the area, slopes range from 2 to 6 percent. This association is in the northwestern part of the county near Buford, Suwanee, Duluth, and Norcross. It makes up about 10 percent of the county.

Dominant in the association are the Madison, Pacolet, and Appling soils, but Gwinnett and Worsham soils occupy small areas. Madison soils make up about 57 percent of the association; Pacolet soils and Appling soils, each 15 percent; and the minor soils, about 13 percent.

All of the dominant soils in this association are well drained. In the less eroded areas, the surface layer is friable gravelly sandy loam to sandy loam, but in the more eroded areas, it is sandy clay loam. The subsoil of the Madison and Pacolet soils is chiefly red, but in the Appling it is mottled red and yellow. The subsoil of the Madison soils is more friable than that of the Pacolet soils. It also contains more mica flakes and feels greasy.

The minor, well-drained Gwinnett soils generally have a browner surface soil and a darker red subsoil than do the Madison soils. The poorly drained Worsham soils are in depressions, near the heads of drainageways, and along the base of slopes.

About 60 percent of this association is wooded. The rest is pastured, is cultivated, left idle, or is used as sites for residences and industries. Most of this association is eroded. In the more eroded areas, all or nearly all of the original surface layer has been washed away and the subsoil of sandy clay loam to clay is exposed.

Because of the many long, narrow ridgetops in this association, the size of the farms vary, and also land ownership and management. Soils of capability classes III and IV are predominant, but soils in small areas are in class II. The areas near Buford and Norcross are residential or are used as sites for manufacturing plants or businesses. The part of the association that extends from west of Norcross to the De Kalb County line is used chiefly as sites for residences and manufacturing plants.

### 5. Gwinnett-Cecil-Davidson Association

Soils that have a clayey subsoil; on narrow to fairly broad ridgetops

This association typically has narrow to fairly broad, very gently sloping to gently sloping ridge-

tops. In slightly less than one-half of the association, slopes range from 2 to 6 percent, but in the rest of the area, slopes range from 6 to 10 percent. This association, which makes up about 9 percent of the area, occupies several tracts scattered throughout the county.

Dominant in this association are the Gwinnett, Cecil, and Davidson soils. Minor soils are the Madison, Pacolet, and Appling. The Gwinnett soils make up about 54 percent of the association; Cecil soils, about 16 percent; Davidson soils, about 13 percent; and minor soils, about 17 percent.

All of the dominant soils are well drained, and their surface layer is primarily dark reddish brown to dark red in color. In the less eroded areas of the Gwinnett soils, the surface layer is reddish brown, dark reddish brown, or dusky red and is predominantly loam, but in the more eroded areas this layer generally is dark-red clay loam. The subsoil of the Gwinnett soils is dark-red to red clay or clay loam.

Cecil soils are not so red as the Gwinnett and Davidson soils. Their surface layer is yellowish-brown to dark-yellowish brown sandy loam in the less eroded areas and reddish-brown to red sandy clay loam in the more eroded areas. The subsoil is red clay.

Davidson soils are thicker than Gwinnett soils. Their surface layer in the less eroded areas is dark-brown to dark reddish-brown and is loamy, but in the more eroded areas it is reddish-brown to dark-red clay loam. The subsoil is dark-red to dusky-red clay.

All of the minor soils are well drained and have a less brown surface layer and a less red subsoil than do the Gwinnett and Davidson soils. The Madison and Pacolet soils are shallower than the Cecil soils, and the Appling soils have a more mottled subsoil.

Most of this association is eroded. In many places all of the original surface layer has been washed away and the dark-red or dusky-red subsoil is exposed.

The farms in this association are small and consist mainly of areas of young pine trees and of improved pasture. The soils are moderately well suited to farming and to nonfarm uses. Most of the farms are owned by farmers who work the farms on a part-time basis. The soils in most of the acreage are in capability classes III and IV, but small areas scattered throughout the association are in class II.

### 6. Appling-Pacolet-Gwinnett Association

Soils that have a clayey subsoil; on fairly broad to narrow interstream divides

This association is characterized by fairly broad to narrow, very gently sloping to gently sloping interstream divides. In nearly two-thirds of the association, slopes range from 6 to 10 percent, but in the rest of the area, slopes are 2 to 6 percent. This association occupies several tracts scattered throughout the county. It makes up about 17 percent of the county.

Dominant in the association are the Appling, Pacolet, and Gwinnett soils, but Madison, Davidson, Durham, and Congaree soils occupy small areas. Appling soils make up about 57 percent of the association; Pacolet soils, 32 percent; Gwinnett soils, 8 percent; and the minor soils, about 3 percent.

All of the dominant soils are well drained. In the less eroded areas, the surface layer is friable sandy loam or loam, but in the more eroded areas, it is clay loam or sandy clay loam. The clayey subsoil is mottled red and yellow in the Appling, is red in the Pacolet, and is dark red or dusky red in the Gwinnett The Appling soils are not so red as the Pacolet and Gwinnett soils. Gwinnett soils have a darker red surface layer and subsoil than do the Pacolet.

Of the minor soils, the Madison, Davidson, and Durham are well drained, but the Congaree are well drained to moderately well drained. The Madison soils are redder than the Appling and contain more mica than the Gwinnett and Pacolet. Davidson soils have a browner surface layer and a darker red subsoil than Pacolet soils, and they are thicker than Gwinnett and Pacolet soils. Durham soils are sandier than the dominant soils, and their subsoil is less red. Congaree soils, local alluvium, occupy small areas along the small drainageways within this association.

About 60 percent of this association is wooded; the rest is cultivated, pastured, or idle. Most of the acreage is eroded, and in the more eroded areas all or nearly all of the original surface layer has been washed away and the subsoil of sandy clay loam to clay is exposed.

This association is made up of many small farms and of a few large ones. The soils are moderately well suited to tilled crops and are well suited to pasture. They are predominantly in capability classes III and IV, but a large acreage is in class II.

### 7. Madison-Pacolet-Louisa Association

Soils that have a red to yellowish-red, clayey to loamy subsoil

This association consists of moderately steep to steep, short side slopes. The soils are gravelly and are along the many branching drainageways in the association that with the streams form a dendritic pattern. In most places the flood plains along these drainageways are narrow. In a few places dikes of hard rock are at a depth of less than 36 inches, and in a few places, rocks crop out. Slopes range from 15 to 25 percent in about two-thirds of the association, from 10 to 15 percent in one-fourth of the area, and from 25 to 45 percent in the rest of it. This association is in the northwestern part of the county near Buford, Suwanee, Duluth, and Norcross. It makes up about 5 percent of the county.

The Madison, Pacolet, and Louisa soils are dominant in this association. Minor soils are the Gwinnett, Musella, and Wilkes. Madison soils make up about 60 percent of the association; Louisa soils, 17 percent; Pacolet soils, 19 percent; and the minor soils, about 4 percent.

The dominant soils are well drained to somewhat excessively drained. They generally have a surface layer of friable gravelly sandy loam. In the more eroded areas, however, the surface layer is yellowish-brown to yellowish-red sandy clay loam or clay loam. The subsoil is chiefly red, micaceous clay loam in the Madison soils, red clay in the Pacolet soils, and yellowish-red to red, micaceous sandy clay loam to fine sandy loam in the Louisa soils.

Of the minor soils, the Gwinnett and Musella are well drained and the Wilkes are somewhat excessively drained. Gwinnett and Musella soils are darker red than the dominant soils. Wilkes soils are stony and contain less mica than the Louisa soils. Also, they lack the distinct red, clayey horizons of the Madison and Pacolet soils.

Most of the farms in this association are small and consist largely of wooded areas that have been cut over. The soils in at least three-fourths of the area are poorly suited to crops, pasture, or nonfarm uses because of steep slopes, droughtiness, or the severe hazard of erosion. They are predominantly in capability classes VI and VII, but some areas scattered throughout the association are in class IV.

### 8. Wedowee-Pacolet-Louisburg Association

Soils that dominantly have a yellowish-red, red, or yellowish-brown, clayey to loamy subsoil

This association typically has moderately steep to steep side slopes, contains many rock outcrops, and is dissected by many well-defined drainageways. More than half of the area has slopes of 10 to 15 percent, one-third has slopes of 15 to 25 percent, and the rest has slopes of 25 to 45 percent. The soils in about 5 percent of the association have a stony surface layer. Depth to bedrock is less than 36 inches in about one-fourth of the area. This association, which makes up about 10 percent of the county, occupies several areas throughout the county.

Dominant in this association are the Wedowee, Pacolet, and Louisburg soils. Minor soils are the Gwinnett, Cecil, and Madison. Wedowee soils make up about 51 percent of the association; Pacolet soils, 30 percent; Louisburg soils, 10 percent; and the minor soils about 9 percent.

The Wedowee and Pacolet soils are well drained. The surface layer is sandy loam in the less eroded areas and sandy clay loam in the more eroded ones. The subsoil is sandy clay loam to clay. It is mottled red and yellow in the Wedowee soils and red in the Pacolet soils. Depth to hard rock in the Wedowee and Pacolet soils is more than 5 feet.

Louisburg soils are well drained to excessively drained and have a surface layer of loamy sand that in some areas is stony. The subsoil is light yellowish-red to yellowish-brown sandy clay loam to sandy clay. Depth to hard rock in the Louisburg soils generally ranges from 15 to 50 inches.

Of the minor soils, the Gwinnett have a browner surface soil and a darker red subsoil than the Wedowee and Pacolet soils, and they have more distinct horizons than the Louisburg soils. Cecil soils are thicker than the dominant soils. The Madison soils contain more mica, especially in the surface layer, than any of the other soils in this association.

Much of this association is eroded. In some areas all or nearly all of the original surface layer has been washed away and the subsoil is exposed. The soils on the steep slopes, and those in the adjacent draws that once were cropped, are now in pines. Some of the steep, stony soils have never been cleared, and these have a cover of various kinds of hardwoods and pines.

Many of the farms in this association are small and consist largely of woodland that has been cut over. They are operated on a part-time basis. At least half of the acreage is poorly suited to crops or pasture because the soils are steep, shallow, or droughty, contain many stones, or are highly erodible. Soils of capability classes IV and VI are predominant, but small areas are in class VII.

### 9. Gwinnett-Musella-Pacolet Association

Soils that have a red, dark-red, or dusky-red, clayey subsoil

This association is characterized by short, moderately steep to steep side slopes and many well-defined drainageways. The flood plains along the drainageways are fairly broad. The surface layer generally is reddish brown to dark red, and the subsoil is red, dark red, or dusky red and is clayey. In about 15 percent of the area, the soils have a stony surface layer and are less than 5 feet deep to bedrock. Slightly less than one-half of the area has slopes of 10 to 15 percent, about one-half has slopes of 15 to 25 percent, and the rest has slopes of 25 to 45 percent. This association is in the central part of the county and consists of several tracts that extend in a northeast-southwest direction from the Barrow County line to Sweetwater Creek. It makes up about 8 percent of the county.

Dominant in the association are the Gwinnett, Musella, and Pacolet soils. Also in the association are the minor Louisburg, Davidson, Wilkes, Madison, and Appling soils, and small local areas of alluvial land. The Gwinnett soils make up about 64 percent of the association; the Musella soils, about 14 percent; the Pacolet soils, about 11 percent; and the minor soils, about 11 percent.

The Gwinnett and Musella soils formed in material weathered chiefly from diorite, hornblende-gneiss, and diabase, and the Pacolet, in material weathered from granite, gneiss, and similar rocks. The Gwinnett and Pacolet soils are well drained, and the Musella soils are somewhat excessively drained to well drained. Depth to fractured rock

ranges from 15 to 36 inches in the Musella soils, and from 48 to more than 120 inches in the Gwinnett and Pacolet soils.

In the Gwinnett soils the surface layer ranges in color from reddish brown or dark reddish brown to dusky red, and in texture, from loam in the less eroded areas to clay loam in the more eroded areas. The subsoil is dark-red to red clay. Gwinnett soils are darker red than the Pacolet soils.

The Musella soils have a surface layer of dark reddish-brown stony silt loam, and a subsoil of dark-red to dusky-red stony clay loam to stony clay. They are shallower than the Gwinnett and Pacolet soils.

Pacolet soils have a surface layer of light yellowish-brown to yellowish-brown sandy loam or cobbly sandy loam in the less eroded areas. In the more eroded areas, however, the surface layer is reddish-yellow to red sandy clay loam. The subsoil is red clay.

Of the minor soils the Madison, Appling, and Louisburg formed in material weathered from rocks that contain light-colored minerals, such as quartz, feldspar, and muscovite. The shallow, somewhat excessively drained Wilkes soils formed in material weathered from rocks that contain light- and dark-colored minerals, but the deep, well-drained Davidson soils formed in material weathered chiefly from rocks, such as diorite, hornblende-gneiss, and diabase that contain dark-colored minerals. Small local areas of alluvial land are along the small drainageways.

Most of this association is eroded. In many places all of the original surface layer has been washed away and the red or dark-red subsoil is exposed. The moderately steep to steep slopes that once were cropped, as well as the adjacent draws, are now mostly in pines or improved pasture. Some of the steep, stony soils have never been cleared, and these have a cover of various kinds of hardwoods and pines.

In this association most of the farms are small and are operated by the owner. Soils of capability classes VI and VII are predominant, but small areas are in class IV.

### 10. Gwinnett-Pacolet-Louisburg Association

Soils that have a red, dark-red, dusky-red, or yellowish-brown, clayey or loamy subsoil

This association typically has short, moderately steep to steep side slopes and many well-defined drainageways. In most places the flood plains along the drainageways are narrow. In about 15 percent of the area, the soils have a stony surface layer. Slopes range from 10 to 15 percent in about two-fifths of the area, from 15 to 25 percent in a slightly larger acreage, and from 25 to 45 percent in the rest of the area. Depth to bedrock is less than 36 inches in about one-fifth of the area. This association is mostly along the Yellow River and the lower reaches of Sweetwater and No Business Creeks. It makes up about 5 percent of the county.

Dominant in the association are the Gwinnett, Pacolet, and Louisburg soils. Also in the association are the minor Davidson, Wilkes, Madison, and Appling soils and small local areas of alluvial land. The Gwinnett soils make up about 39 percent of the association; Pacolet soils, about 30 percent; Louisburg soils, about 11 percent; and the minor soils, about 20 percent.

Gwinnett soils formed in material weathered chiefly from diorite, hornblende-gneiss, and diabase, and the Pacolet and Louisburg soils, in material weathered from such rocks as granite and gneiss. Depth to hard rock ranges from 3 to 4 feet in the Louisburg soils, and from 6 to more than 8 feet in the Gwinnett and Pacolet soils.

The Gwinnett soils are well drained. Their surface layer ranges in texture from sandy loam in the less eroded areas to clay loam in the more eroded areas. The subsoil is dark-red to dusky-red clay.

Pacolet soils also are well drained. Their surface layer is yellowish-brown to brown sandy loam in the less eroded areas, but it is brown to yellowish-red sandy clay loam in the more eroded areas. The subsoil is red clay.

Louisburg soils are well drained to excessively drained and generally are steeper than the other soils in the association. They have a surface layer of stony loamy sand or loamy sand. The subsoil is thin and discontinuous and consists of yellowish-brown to yellowish-red sandy clay loam or sandy loam.

Of the minor soils, the Madison and Appling formed in material weathered from rocks that contain light-colored minerals, such as quartz, feldspar, and muscovite. The shallow, somewhat excessively drained Wilkes soils formed in material weathered from rocks that contain light- and dark-colored minerals, but the deep, well-drained Davidson soils formed in material weathered chiefly from rocks, such as diorite, hornblende-gneiss, and diabase that contain dark-colored minerals. Small local areas of alluvial land are along the small drainageways.

Most of this association is eroded, and in some places all of the original surface layer has been washed away and the red or dark-red subsoil is exposed. The moderately steep to steep slopes that once were cropped, as well as the adjacent draws, are now mostly in pines and improved pasture. Some of the steep, stony soils have never been cleared, and these have a cover of various kinds of hardwoods and pines.

The farms in this association are mostly small and are operated by the owner. About 70 percent of the area is wooded. Soils of capability classes VI and VII are predominant, but small areas are in class IV.

### 11. Louisburg-Pacolet-Wedowee Association

Soils that dominantly have a yellowish-brown, red, or yellowish-red, loamy to clayey subsoil

This association typically has many rock outcrops and moderately steep to steep, short side slopes.

It is dissected by many, narrow drainageways that are well defined. In about one-third of the area, the surface layer is stony loamy sand. Bedrock is at a depth of less than 36 inches in more than one-third of the association. Slopes range from 10 to 15 percent in only a small part of the association, but in one-half of the area they range from 15 to 25 percent. In the rest of the association slopes are 25 to 45 percent. This association, which makes up about 10 percent of the county, is mostly in the northwestern and southeastern parts.

Dominant in this association are the Louisburg, Pacolet, and Wedowee soils. Also in the association are the minor Madison, Louisa, and Gwinnett soils, and small areas of Congaree soils, local alluvium. Louisburg soils make up about 37 percent of the association; Pacolet soils, 35 percent; Wedowee soils, 21 percent; and the minor soils, about 7 percent.

Louisburg soils are well drained to excessively drained and have a surface layer of loamy sand or stony loamy sand. The subsoil is chiefly sandy clay loam to sandy loam, but in some areas it is thin, discontinuous, and clayey. Depth to hard rock ranges from 28 to 48 inches, but it generally is less than 36 inches. Louisburg soils are sandier than the Pacolet and Wedowee soils and have more distinct horizons.

Pacolet soils are well drained. Their surface layer is light yellowish-brown to yellowish-brown sandy loam or cobbly sandy loam in the less eroded areas, and reddish-yellow to red sandy clay loam in the more eroded areas. The subsoil is red clay. Pacolet soils are redder than the Louisburg and Wedowee soils.

Wedowee soils are also well drained. They have a surface layer of sandy loam and a subsoil of mottled red and yellow sandy clay loam to clay. They have more distinct horizons and are less sandy than Louisburg soils, and they are less red than Pacolet soils.

The minor Madison and Gwinnett soils have a redder subsoil than the Louisburg soils and contain more mica than the Wedowee soils. They also have more distinct horizons than the Louisburg soils. Louisa soils lack the distinct horizons of the Wedowee soils and are less sandy and contain more mica than Louisburg soils. Areas of the well drained to moderately well drained Congaree soils, local alluvium, are along the narrow drainageways.

Most of this association is eroded, and in a few areas all of the original surface layer has been washed away and the subsoil is exposed. The steep slopes and adjacent draws that once were cropped are now mostly in pines. Some of the steep, stony soils have never been cleared, and these have a cover of various kinds of hardwoods and pines.

Many of the farms in this association are small, and most of them are operated by the owner. About 85 percent of this association is wooded, and the trees are largely cut over. The soils in this association are not suited to farming, and because the soils are steep, shallow, droughty, or stony, the areas are poorly suited to many nonfarm uses. Soils of capability classes VI and VII are predominant, but small areas scattered throughout the association are in class IV.

## DESCRIPTIONS OF THE SOILS

This section describes the soil series and mapping units of Gwinnett County. The acreage and proportionate extent of each mapping unit are shown in table 1.

In this section, the soil series is described first, and then the mapping units in that series. To get full information on any one mapping unit, it is necessary to read the description of that unit and also the description of the series to which it belongs.

In describing soils, soil scientists assign a letter symbol, for example, A1, B2, C1, to various layers, or horizons, within the soil profile. These symbols have special meaning to soil scientists and others who make detailed studies of soils. Most readers need only remember that symbols beginning with "A" refer to the surface layer or layers; that those beginning with "B" refer to the subsoil; and that those beginning with "C" refer to the substratum. It may be helpful to note that certain small letters are sometimes used in combination with the symbols just named. The small letter "p" indicates a plowed layer, and the small letter "t" indicates a layer in which clay has accumulated.

The color of each horizon is described in words, such as yellowish brown, and is also indicated by symbols for hue, value, and chroma, such as 10YR 5/4). These symbols, called Munsell color notations (13), are used by soil scientists to evaluate the color of the soil precisely.

Some technical terms are used in describing soils because nontechnical terms do not convey precisely the same meaning. Some of these technical terms are defined in the Glossary. For example, pH is a term indicating acidity or alkalinity of the soils. Most of the soils of this county are acid and therefore will have a range of 6.1 to 4.5 and below.

The soil maps at the back of this publication show the location and distribution of each mapping unit. The "Guide to Mapping Units" gives the woodland suitability group, capability unit, and wildlife suitability group to which each mapping unit has been assigned, and the page where each is described.

### Altavista Series

The Altavista series consists of deep, nearly level to very gently sloping soils that are moderately well drained. These soils formed in old alluvium on long, narrow, low stream terraces adjacent mainly to the flood plains along the Chattahoochee River and larger streams in the county. Individual areas range from 5 to 10 acres.

These soils have a surface layer of light yellowish-brown to dark grayish-brown fine sandy loam. The subsoil is yellowish-brown to strong-brown sandy clay loam that commonly is mottled with olive yellow, brownish gray, red, yellowish brown, and brownish yellow at a depth of about 20 to 26 inches. Depth to hard rock is more than 5 feet.

The natural fertility and content of organic matter in these soils are low. Permeability is moderately slow, the available water capacity is medium, and the root zone is deep.

The Altavista soils occur with the Augusta and Wickham soils and occupy similar areas. They are better drained than the Augusta soils, but they are not so well drained as the Wickham soils and have a yellower subsoil.

These soils are suited to most crops grown in the county and can be cultivated intensively. The crops respond well if fertilizer is applied and if other good management is used. About 75 percent of the acreage is used as pasture or is cultivated; the rest is idle or is wooded. In the wooded areas sweetgum, yellow-poplar, hickory, white oak, and loblolly pine are the chief trees.

Representative profile of Altavista fine sandy loam, 0 to 2 percent slopes, in a pasture (2 miles northwest of Duluth, three-fourths mile east of Georgia Highway No. 120, and 500 feet south of the Chattahoochee River):

Ap--0 to 6 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, fine, granular structure; friable; many fine roots; strongly acid; abrupt, smooth boundary.

B1--6 to 11 inches, dark-brown (10YR 4/3) and dark yellowish-brown (10YR 4/4) loam; weak, fine, subangular blocky structure; friable; a few fine roots; very strongly acid; clear, smooth boundary.

B21t--11 to 20 inches, yellowish-brown (10YR 5/6) silty clay loam; moderate, medium, subangular blocky structure; friable; thin clay films on ped faces; a few fine roots; very strongly acid; clear, smooth boundary.

B22t--20 to 37 inches, brownish-yellow (10YR 6/6) sandy clay loam; a few, fine, faint mottles of brownish yellow and a few, fine distinct mottles of light brownish gray; moderate, medium, subangular blocky structure; friable; a few fine roots; a few very fine mica flakes; water table is at a depth of 36 inches; very strongly acid; clear, smooth boundary.

B23t--37 to 52 inches +, yellowish-brown (10YR 5/8) light sandy clay; many, coarse, prominent mottles of light gray (2.5Y 7/2); moderate, medium, subangular blocky structure; slightly sticky when wet; many very fine mica flakes; old root channels have gleyed materials around them; very strongly acid.

The Ap horizon generally is light yellowish-brown or dark grayish-brown to strong-brown fine sandy loam, 4 to 8 inches thick, but in some areas the texture is loam; the Bt horizon is brownish-yellow or yellowish-brown to strong-brown sandy clay loam and silty clay loam. Mottles are at or below a depth of 20 inches. The combined thickness

TABLE 1.--APPROXIMATE ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

| Soil | Acres | Percent | Soil | Acres | Percent |
|---|---|---|---|---|---|
| Altavista fine sandy loam, 0 to 2 percent slopes | 1,230 | 0.4 | Louisburg loamy sand, 10 to 25 percent slopes | 9,835 | 3.5 |
| Appling sandy loam, 2 to 6 percent slopes, eroded | 25,040 | 9.0 | Louisburg stony loamy sand 6 to 15 percent slopes | 1,145 | .4 |
| Appling sandy loam, 6 to 10 percent slopes, eroded | 30,780 | 11.0 | Louisburg stony loamy sand, 15 to 45 percent slopes | 2,955 | 1.1 |
| Appling sandy clay loam, 6 to 10 percent slopes, eroded | 2,820 | 1.0 | Made land | 1,470 | .5 |
| Augusta soils | 445 | .2 | Madison gravelly sandy loam, 2 to 6 percent slopes, eroded | 1,705 | .6 |
| Buncombe loamy fine sand | 340 | .1 | Madison gravelly sandy loam, 6 to 10 percent slopes, eroded | 3,675 | 1.3 |
| Cecil sandy loam, 2 to 6 percent slopes, eroded | 2,690 | 1.0 | Madison sandy clay loam, 2 to 6 percent slopes, eroded | 1,080 | .4 |
| Cecil sandy loam, 6 to 10 percent slopes, eroded | 2,575 | .9 | Madison sandy clay loam, 6 to 10 percent slopes, eroded | 3,335 | 1.2 |
| Cecil sandy loam, 10 to 15 percent slopes, eroded | 1,085 | .4 | Madison sandy clay loam, 10 to 15 percent slopes, eroded | 6,540 | 2.4 |
| Cecil clay loam, 6 to 10 percent slopes, eroded | 980 | .4 | Madison sandy clay loam, 15 to 45 percent slopes, eroded | 7,515 | 2.7 |
| Cecil gravelly sandy loam, 2 to 10 percent slopes | 545 | .2 | Musella cobbly loam, 6 to 15 percent slopes | 1,550 | .6 |
| Chewacla soils, frequently flooded | 21,275 | 7.6 | Musella cobbly loam, 15 to 45 percent slopes | 2,095 | .8 |
| Congaree loam | 945 | .3 | Pacolet sandy loam, 2 to 6 percent slopes, eroded | 5,115 | 1.8 |
| Congaree soils, frequently flooded | 3,145 | 1.1 | Pacolet sandy loam, 6 to 10 percent slopes, eroded | 11,000 | 3.9 |
| Congaree soils, local alluvium | 1,280 | .5 | Pacolet sandy clay loam, 2 to 6 percent slopes, eroded | 4,500 | 1.6 |
| Davidson loam, 2 to 6 percent slopes, eroded | 655 | .2 | Pacolet sandy clay loam, 6 to 10 percent slopes, eroded | 9,015 | 3.2 |
| Davidson loam, 6 to 10 percent slopes, eroded | 570 | .2 | Pacolet sandy clay loam, 10 to 15 percent slopes, eroded | 19,070 | 6.9 |
| Davidson clay loam, 2 to 6 percent slopes, eroded | 865 | .3 | Pacolet sandy clay loam, 15 to 25 percent slopes, eroded | 7,545 | 2.7 |
| Davidson clay loam, 6 to 10 percent slopes, eroded | 1,185 | .4 | Pacolet cobbly sandy loam, 15 to 45 percent slopes | 1,725 | .6 |
| Davidson clay loam, 10 to 15 percent slopes, eroded | 580 | .2 | Red Bay sandy loam, 2 to 6 percent slopes | 310 | .1 |
| Durham sandy loam, 2 to 6 percent slopes | 2,590 | .9 | Rock land | 525 | .2 |
| Gullied land | 345 | .1 | Wedowee sandy loam, 10 to 25 percent slopes, eroded | 20,385 | 7.3 |
| Gwinnett loam, 2 to 6 percent slopes, eroded | 1,670 | .6 | Wehadkee soils, frequently flooded | 1,845 | .7 |
| Gwinnett loam, 6 to 10 percent slopes, eroded | 4,000 | 1.4 | Wickham sandy loam, 2 to 6 percent slopes, eroded | 1,140 | .4 |
| Gwinnett loam, 10 to 25 percent slopes, eroded | 7,125 | 2.6 | Wickham sandy loam, 6 to 10 percent slopes, eroded | 975 | .4 |
| Gwinnett clay loam, 2 to 6 percent slopes, eroded | 8,000 | 2.9 | Wilkes-Iredell cobbly complex, 6 to 15 percent slopes | 640 | .2 |
| Gwinnett clay loam, 6 to 10 percent slopes, eroded | 10,745 | 3.9 | Worsham sandy loam, 0 to 2 percent slopes | 365 | .1 |
| Gwinnett clay loam, 10 to 25 percent slopes, eroded | 8,980 | 3.2 | Worsham sandy loam, 2 to 6 percent slopes | 1,460 | .5 |
| Helena sandy loam, 2 to 6 percent slopes | 240 | .1 | Buford Reservoir | 570 | .2 |
| Louisa gravelly sandy loam, 6 to 15 percent slopes | 330 | .1 | Total | 279,040 | 100.0 |
| Louisa gravelly sandy loam, 15 to 45 percent slopes | 2,230 | .8 | | | |
| Louisburg loamy sand, 2 to 10 percent slopes | 4,670 | 1.7 | | | |

of the A and B horizons ranges between 40 and 60 inches.

Altavista fine sandy loam, 0 to 2 percent slopes (AkA).--This is the only Altavista soil mapped in the county. Its profile is the one described as representative for the series. The areas are on terraces along the flood plains of the Chattahoochee River and are subject to brief flooding in winter.

Included with this soil are small areas of Augusta and Wickham soils. Also included are a few areas of a soil that has slopes of 2 to 6 percent.

Because this Altavista soil has a deep root zone, is in good tilth, and is nearly level, it is suited to most of the crops commonly grown. The crops respond well if fertilizer is applied and if other good management is used.

## Appling Series

The Appling series consists of deep, well-drained soils formed in material weathered from granite, gneiss, and mica schist. These soils are in the uplands on broad, very gently sloping ridgetops and on moderately long and gently sloping or short and strongly sloping hillsides. The largest areas are in the southeastern and north-central parts of the county, but small areas are scattered throughout the rest of the county.

In the less eroded areas, these soils have a surface layer of light yellowish-brown or light olive-brown to brown sandy loam. The subsoil is yellowish-brown to strong-brown sandy clay loam in the upper 3 to 10 inches. Below is mottled red, yellowish-red, reddish-yellow, and yellow sandy clay to clay. Depth to hard rock is more than 8 feet in most places.

These soils are low in natural fertility and in content of organic matter. Permeability is moderately slow, and the available water capacity is medium.

Appling soils occur with the Cecil, Pacolet, Wedowee, Madison, and Durham soils. They are less red than the Cecil and Pacolet. They are deeper than the Pacolet and Wedowee soils, contain less mica than the Madison soils, and are not so yellow as the Durham.

The Appling soils are well suited to farming, and about half of the acreage is cultivated or is used as pasture. In wooded areas white oak, post oak, red oak, and hickory are the chief trees, but sweetgum, yellow-poplar, and loblolly pine grow in some places.

Representative profile of Appling sandy loam, 2 to 6 percent slopes, eroded, in a stand of loblolly pine (one-half mile south of Old Peachtree Road, 1 mile west of Georgia Highway No. 20, and 700 feet west of Cedar Drive):

Ap--0 to 7 inches, light olive-brown (2.5Y 5/4) sandy loam with one-fourth inch of humus on the surface; weak, fine, granular structure; very friable; many fine roots; very strongly acid; abrupt, smooth boundary.

A3--7 to 10 inches, light yellowish-brown (2.5Y 6/4) heavy sandy loam; weak, fine, granular structure; friable; many fine roots; very strongly acid; clear, wavy boundary.

B1--10 to 18 inches, strong-brown (7.5YR 5/8) sandy clay loam; weak, medium, subangular blocky structure; friable; a few fine roots; very strongly acid; clear, wavy boundary.

B21t--18 to 24 inches, strong-brown (7.5YR 5/6) clay loam; many, medium, prominent mottles of red (2.5YR 4/6); moderate, medium, subangular blocky structure; friable; a few fine mica flakes; very strongly acid; clear, wavy boundary.

B22t--24 to 42 inches, red (2.5YR 4/8) light clay; many, medium, prominent mottles of brownish yellow (10YR 6/6); moderate, medium, subangular blocky structure; friable; a few fine mica flakes; very strongly acid; gradual, wavy boundary.

B3--42 to 49 inches, red (2.5YR 5/8) heavy sandy clay loam; weak, medium, subangular blocky structure; friable; many fine mica flakes; extremely acid; gradual, wavy boundary.

C--49 to 52 inches, yellowish-red (5YR 5/8) light sandy clay loam; very friable; extremely acid, partly weathered schist.

The surface layer ranges from sandy loam to sandy clay loam in texture and from light brownish gray to brownish yellow in color. The subsoil ranges from sandy clay loam in the upper part to firm clay or clay loam in the lower part. It is mottled yellowish brown to red. The solum ranges from 35 to 50 inches in thickness but in most places it is more than 40 inches thick. Depth to hard rock ranges from 8 to 15 feet.

Appling sandy loam, 2 to 6 percent slopes, eroded (AmB2).--The profile of this soil is the one described as representative of the series. In this soil the surface layer ranges from 4 to 10 inches in thickness, but it generally is about 5 inches thick. In most places depth to hard rock is more than 10 feet.

This soil generally is in good tilth and has a deep root zone. The hazard of further erosion is slight to moderate in cultivated areas.

Included are a few severely eroded areas and a few other areas in which the surface layer is gravelly sandy loam. In other included areas the subsoil contains mica flakes and feels greasy. Also included are a few areas of a Wedowee soil that is 28 to 40 inches thick, and a few areas of a soil that has a surface layer of coarse sandy loam.

This Appling soil is well suited to moderately intensive use. About 65 percent of the acreage is cultivated or is pastured; the rest is wooded, is idle, or is used as building sites for residences or industries.

Appling sandy loam, 6 to 10 percent slopes, eroded (AmC2).--In this soil the A and B horizons combined generally are 40 to 48 inches thick. Depth to hard rock commonly is about 8 feet.

This soil generally is in good tilth and has a deep root zone. Drainage is good, and the available water capacity is medium. Runoff is medium, and the hazard of further erosion is moderate to severe if this soil is cultivated.

Included with this soil are some areas of a soil that is 25 to 40 inches thick. Also included are small areas of a soil that has a surface layer of coarse sandy loam and of other soils that have many very fine mica flakes in the subsoil. Some other included areas are severely eroded, and here the plow layer is brownish-yellow to light-red sandy clay loam. In these areas infiltration is slow and tilth is poor.

This Appling soil is suited to a wide range of crops, and it can be cultivated if it is well managed. About 60 percent of the acreage is cultivated or is pastured; the rest is idle, is wooded, or is used as building sites for residences.

Appling sandy clay loam, 6 to 10 percent slopes, eroded (AnC2).--This soil consists mainly of areas from which the original surface layer has been removed for use as road fill material and of a few other areas that are severely eroded. In areas left idle, the present surface layer generally is sandy loam to sandy clay loam that is 2 to 3 inches thick over sandy clay to clay loam. In the more eroded areas, the present surface layer is clayey material formerly in the subsoil. The combined thickness of the A and B horizons ranges from 40 to 45 inches. Depth to hard rock commonly is more than 7 feet.

Included with this soil are some areas of a Wedowee soil that is 26 to 36 inches thick. Also included are some areas of a soil which has a subsoil that contains fine mica flakes in the lower part and feels greasy.

Because of the slopes and slow infiltration, runoff is moderately rapid on this Appling soil. This soil is in poor tilth, and the hazard of further erosion is severe in cultivated areas. Nevertheless, if this soil is well managed, it can be cultivated occasionally. It is well suited to permanent pasture and to pine trees. About 55 percent of the acreage is wooded; the rest is cultivated, is pastured, or is used as building sites for residences.

## Augusta Series

The Augusta series consists of deep, nearly level soils that are somewhat poorly drained. These soils formed in old alluvium on low stream terraces adjacent to the larger streams in the county. The areas are small.

The surface layer is light brownish-gray to dark grayish-brown sandy loam, loam, or silt loam that is 6 to 16 inches thick and overlies a thin layer of pale-yellow or yellow sandy loam. The subsoil is mottled light yellowish-brown, light-gray, reddish-yellow, and dark-gray sandy clay loam to clay loam. The underlying material varies in texture, but its color is predominantly gray. Depth to the water table commonly is 15 to 36 inches, and depth to hard rock is more than 10 feet.

The natural fertility and content of organic matter are low in these soils. The surface layer generally is in good tilth. Infiltration and permeability are slow, available water capacity is medium, and runoff is slow. In winter some areas are flooded briefly.

Augusta soils occur on flood plains with the Chewacla, Wehadkee, and Worsham soils, and in slightly higher areas with the Altavista and Wickham soils. They have more distinct horizons than the Chewacla soils and are better drained and have a less gray subsoil than the Wehadkee and Worsham. Augusta soils are wetter than the Altavista and Wickham soils and have gray mottles in the subsoil.

The vegetation on the Augusta soils is chiefly sweetgum, willow, alder, yellow-poplar, and water oak. About 75 percent of the acreage is wooded; the rest is cultivated or used as pasture.

Representative profile of an Augusta sandy loam on 0 to 2 percent slopes, under young pines (1 mile northwest of the junction of Interstate Highway No. 85 and Georgia Highway No. 120, and 50 feet west of the dirt road just south of Fork Creek):

Ap--0 to 6 inches, light brownish-gray (2.5Y 6/2) sandy loam; weak, fine, granular structure; loose; many fine and medium roots; very strongly acid; abrupt, smooth boundary.

A2--6 to 8 inches, pale-yellow (5Y 8/3) sandy loam; weak, fine, granular structure; loose; many fine roots; very strongly acid; abrupt, smooth boundary.

B1--8 to 15 inches, yellow (10YR 8/6) light sandy clay loam; weak, fine, subangular blocky structure; friable; a few fine roots; very strongly acid; clear, wavy boundary.

B21tg--15 to 26 inches, light yellowish-brown (2.5Y 6/4) sandy clay loam; prominent mottles of light gray (2.5Y 7/2) and a few, fine, prominent mottles of reddish yellow (5YR 7/8); massive in places; friable; a few fine roots; thin clay films; very strongly acid; gradual, wavy boundary.

B22tg--26 to 40 inches, light yellowish-brown (2.5Y 6/4) sandy clay loam; common, medium, distinct mottles of light gray (2.5Y 7/2) and yellow (2.5Y 7/6); moderate, medium, subangular blocky structure; friable; extremely acid; clear, wavy boundary.

B3g--40 to 50 inches, light-gray (N 7/0) light sandy clay loam; yellow (10YR 7/8) and reddish-yellow (5YR 6/8) mottles; weak, fine, subangular blocky structure; friable; extremely acid; clear, wavy boundary.

C1--50 to 80 inches, light-gray (N 7/0) heavy coarse sandy loam; common, medium, distinct mottles of yellow (10YR 7/8); friable to loose; extremely acid, clear, wavy boundary.

C2--80 to 82 inches +, quartz gravel that is slightly rounded.

The A horizons range from 6 to 16 inches in thickness and are sandy loam, loam, and silt loam in texture. In areas that are not cultivated, the A1

horizon is dark grayish brown or dark gray to dark brown. The B2 horizons are yellowish-brown sandy clay loam that is mottled with gray and yellow at a depth below about 15 inches. The A and B horizons combined generally are about 50 inches thick. Depth to rounded quartz gravel ranges from 36 to 80 inches.

Augusta soils (0 to 2 percent slopes) (Asl).--These are the only Augusta soils mapped in the county. They generally occupy areas between the poorly drained Worsham soils and the better drained Congaree soils on flood plains of the larger streams in the county.

Included with this soil are a few areas of a soil that has a surface layer of silty clay loam and some areas of a soil that has 12 to 18 inches of overwash on the surface. Also included are some areas that have layers of sand in the subsoil and a few small areas of Altavista, Chewacla, and Wehadkee soils.

Augusta soils are suited to a limited number of crops, but they can be used intensively if drainage is provided.

## Buncombe Series

In the Buncombe series are deep, nearly level, sandy soils that are excessively drained. These soils are on first bottoms in long, narrow areas generally adjacent to rivers and other large streams in the flood plains. They are chiefly in the northwestern part of the county along the banks of the Chattahoochee River, but smaller areas are scattered along other rivers and large streams. The alluvium in which the soils formed was derived primarily from areas underlain by granite, gneiss, schist, and other siliceous igneous rocks.

The surface layer of these soils is dark-brown loamy fine sand about 8 inches thick. It is underlain by stratified dark-brown to yellowish-brown loamy sand.

These soils are very strongly acid to extremely acid. Natural fertility and content of organic matter are low. The surface layer is in good tilth and the root zone is deep, but droughtiness is a problem. Infiltration and permeability are rapid.

Buncombe soils occur with the Chewacla, Congaree, and Wehadkee soils. They are similar to the Congaree soils in color but are coarser textured throughout. They are better drained than the Chewacla and Wehadkee soils and also are sandier.

About 40 percent of the acreage of these soils is cultivated or pastured, and the rest is wooded or is idle. In the wooded areas yellow-poplar, sycamore, sweetgum, beech, and loblolly pine are the chief trees.

Representative profile of Buncombe loamy fine sand under loblolly pine and broomsedge (2 1/2 miles southwest of Five Forks, 75 feet west of Yellow River, and 25 feet south of Five Forks Road):

Ap--0 to 8 inches, dark-brown (10YR 3/3) loamy fine sand; weak, fine, granular structure; friable; many fine roots, and a few fine mica flakes; very strongly acid; clear, wavy boundary.

A12--8 to 12 inches, dark-brown (10YR 3/3) fine sandy loam; weak, fine, granular structure; friable; a few fine roots and mica flakes; very strongly acid; abrupt, smooth boundary.

C1--12 to 52 inches, yellowish-brown (10YR 5/4) loamy fine sand; structureless; very friable; contains a few thin layers of sandy loam; a few fine mica flakes; very strongly acid; clear, wavy boundary.

C2--52 to 74 inches, yellowish-brown (10YR 5/6) loamy fine sand; structureless; a few fine mica flakes; very strongly acid.

The Ap horizon ranges from dark brown or dark gray to dark reddish brown. Its texture is dominantly loamy fine sand, but in places it is coarse sandy loam. The C horizons consist of dark-brown to yellowish-brown loamy fine sand and strata of sandy loam. The thickness of the sandy alluvium ranges from about 50 inches to more than 75 inches.

Buncombe loamy fine sand (0 to 2 percent slopes) (Bfs).--This is the only Buncombe soil mapped in the county. Its profile is the one described as representative for the series. The surface layer is dark-brown to dark reddish-brown loamy fine sand to coarse sandy loam. The underlying material is loamy fine sand that varies in color. The areas are long and narrow and occupy from 2 to 5 acres along the Chattahoochee and Yellow Rivers and other large rivers and creeks.

This soil is in good tilth. Infiltration is rapid, and runoff is slow. The water table generally is at a depth of more than 60 inches.

Included with this soil are a few small areas of a soil that has a surface layer of loam and a few small areas of a soil that is similar to the Congaree soils.

Buncombe loamy fine sand is suited to most crops grown locally. Yields are fair if good management is used. Most of this soil has been cultivated at some time but now is wooded.

## Cecil Series

The Cecil series consists of deep, well-drained soils formed in material weathered from granite, gneiss, and mica schist. These soils are on broad to narrow ridgetops and long, strongly sloping hillsides. The areas are large and are scattered throughout the county.

In the less eroded areas, the surface layer is light yellowish-brown to dark yellowish-brown sandy loam and gravelly sandy loam, but in the more eroded areas, the surface layer is reddish-brown to red clay loam. The upper part of the subsoil in all of the soils is red sandy clay to a depth of 15 to 25 inches. Below is sandy clay 6 to 10 inches thick that is splotched with reddish yellow, brownish yellow, and yellowish red. This layer is underlain by red clay loam 10 to 20 inches thick that contains many fine mica flakes, which also are

present in the C horizon. Depth to partly weathered parent material is 40 to 60 inches, and depth to hard rock commonly is more than 10 feet.

The natural fertility and content of organic matter in these soils are low. Permeability is moderate, and the available water capacity is medium.

Cecil soils occur with Pacolet, Appling, Madison, Gwinnett, Louisburg, and Davidson soils. They are deeper than the Pacolet and have a redder subsoil than the Appling. They contain less mica, especially in the surface layer and the upper part of the subsoil, than the Madison soils; have a less red subsoil and are deeper than the Gwinnett soils; and are deeper, contain more clay, and have more distinct horizons than the Louisburg soils. Their surface layer is not so brown as that of the Davidson soils, and their subsoil is less red.

The native vegetation was chiefly white oak, post oak, red oak, and hickory, but dogwood, sourwood, sweetgum, yellow-poplar, and shortleaf pine grew in some places. About half of the acreage is now cultivated or is used as pasture. Some areas formerly cultivated now have a cover of shortleaf, loblolly, and Virginia pines.

Representative profile of Cecil sandy loam, 2 to 6 percent slopes, eroded, in a pecan orchard (1 1/2 miles south of Lawrenceville and 1,000 feet west of Georgia Highway No. 124):

Ap--0 to 5 inches, dark yellowish-brown (10YR 3/4) sandy loam; weak, fine, granular structure; very friable; many fine and medium roots; medium acid; abrupt, smooth boundary.

A2--5 to 8 inches, reddish-yellow (7.5YR 6/6) sandy loam; weak, fine, granular structure; very friable; a few fine roots; strongly acid; clear, wavy boundary.

B1--8 to 14 inches, light-red (2.5YR 6/8) light clay loam; weak, fine, granular structure; friable; a few fine roots; very strongly acid; clear, wavy boundary.

B21t--14 to 24 inches, red (2.5YR 4/6) light sandy clay; moderate, medium, subangular blocky structure; firm; a few fine roots; very strongly acid; clear, wavy boundary.

B22t--24 to 34 inches, red (2.5YR 5/8) sandy clay splotched with reddish yellow (5YR 6/8); moderate, medium, angular and subangular blocky structure; firm; red (10R 4/6) clay films on ped faces and a few fine mica flakes; very strongly acid; clear, wavy boundary.

B3t--34 to 52 inches, red (2.5YR 5/8) clay loam; weak, fine, subangular blocky structure; friable; many very fine mica flakes; very strongly acid; clear, wavy boundary.

C--52 to 56 inches +, light-red (2.5YR 6/8) sandy loam; weak, fine, granular structure; very friable; very strongly acid; many very fine mica flakes.

The surface layer is light yellowish-brown to dark yellowish-brown sandy loam or gravelly sandy loam in most places, but in some eroded areas it is yellowish-red to reddish-brown clay loam. The subsoil ranges from red to yellowish red in color and from clay to clay loam in texture. Thickness of the solum ranges from 40 to 52 inches, but it generally is about 48 inches. Depth to hard rock generally is more than 10 feet.

Cecil sandy loam, 2 to 6 percent slopes, eroded (CYB2).--The profile of this soil is the one described as representative for the series (see pl. I). This soil is on broad ridgetops and long, gentle slopes. The areas range from 5 to 50 acres. Tilth generally is good, but in the more eroded areas, it is poor.

Included with this soil are a few small severely eroded areas and other small areas that have gravel scattered on the surface.

This Cecil soil is well suited to all cultivated crops grown locally, and about 55 percent of the acreage is cultivated or is used as pasture. The rest is wooded, is idle, or is used as sites for residences and industries.

Cecil sandy loam, 6 to 10 percent slopes, eroded (CYC2).--This soil is on long, narrow ridgetops and moderately long hillsides in areas of less than 5 to more than 25 acres. The surface layer is 5 to 7 inches thick, but the profile otherwise is similar to the one described as representative for the series. The uppermost 3 to 6 inches of the subsoil is light-red to red sandy clay loam. Below is red, firm sandy clay or clay to a depth of 40 inches. In places the lower part of the subsoil is splotched with reddish yellow.

This soil generally is in good tilth. Runoff is medium, and available water capacity is medium.

Included with this soil are some small areas of a severely eroded soil. Here the surface layer is reddish-brown to yellowish-brown sandy clay loam, tilth is poor, and infiltration is slow.

The slopes and runoff make the hazard of further erosion moderate to severe if this Cecil soil is cultivated. This soil nevertheless can be cultivated safely under good management. It is suited to a wide range of crops, and about 30 percent of the acreage is cultivated or is pastured. The rest is wooded, is left idle, or is used as building sites for residences or industries.

Cecil sandy loam, 10 to 15 percent slopes, eroded (CYD2).--This soil is on moderately long, moderately steep side slopes in areas of 3 to more than 25 acres.

Included with this soil are some small areas of a soil that is severely eroded. Here the surface layer is reddish-brown or yellowish-red sandy clay loam, tilth is poor, and infiltration is slow.

The slopes and moderately rapid runoff make the hazard of further erosion severe if this Cecil soil is cultivated. This soil is poorly suited to frequent cultivation, but it can be cropped occasionally if it is well managed. About 80 percent of the acreage is wooded; the rest is cultivated or pastured, left idle, or used as building sites for residences.

Cecil clay loam, 6 to 10 percent slopes, eroded (CfC2).--This soil is on long, narrow ridgetops and moderately long and short hillsides in areas of 3 to more than 50 acres. The surface layer is reddish-brown to yellowish-red clay loam. It consists of material formerly in the upper part of the subsoil that has been mixed with the remaining original surface layer by plowing. Except for this surface layer, the profile is similar to the one described as representative for the series. In the more eroded areas, the red clay subsoil is at the surface.

Infiltration is slow, and runoff is medium to moderately rapid. Tilth is poor, and the hazard of further erosion is moderate to severe.

Included with this soil are a few areas of a soil that has a surface layer of sandy loam. Also included are some areas of a soil that has a surface layer of gravelly clay loam and a few pebbles scattered throughout the profile.

This Cecil soil can be cultivated occasionally under good management. It is well suited to permanent pasture and to trees. About 70 percent of the acreage is wooded; the rest is cultivated or pastured, left idle, or used as building sites for residences and industries.

Cecil gravelly sandy loam, 2 to 10 percent slopes (CeC).--This soil is on broad, gently sloping ridgetops and moderately long, sloping hillsides. The areas range from 2 to more than 20 acres. The surface layer is gravelly and is 7 to 12 inches thick, but the profile otherwise is similar to the one described as representative for the series. The uppermost 3 to 6 inches of the subsoil is yellowish-red to red sandy clay loam and overlies red, firm sandy clay to clay. At a depth of about 24 inches is a layer about 8 inches thick that is splotched with reddish yellow. Below this layer is red clay loam that contains many very fine mica flakes.

Included with this soil are some areas of a soil that is severely eroded. In these areas the surface layer is reddish-brown to yellowish-red sandy clay loam.

The gravel and cobblestones in the surface layer of this Cecil soil limit use, but if these are removed, the soil is suited to moderately intensive use. This soil is suited to cultivation under good management, but if it is cultivated, the erosion hazard is slight to moderate. About 65 percent of the acreage is wooded. The rest is cultivated, is idle or pastured, or is used as building sites for residences or industries.

## Chewacla Series

The Chewacla series consists of nearly level, somewhat poorly drained soils formed in alluvium. These soils generally are on broad flood plains along the Yellow River, Suwanee Creek, and other large streams or are along the outer edges of the flood plains of the Chattahoochee River.

The surface layer generally is reddish-brown silt loam, and the subsoil is reddish-brown silty clay loam to light silty clay loam. Depth to hard rock is more than 10 feet in most places.

In these soils natural fertility is low and the content of organic matter is medium. Permeability and infiltration are moderate, and available water capacity is high.

Chewacla soils occur with the Augusta, Buncombe, Congaree, and Wehadkee soils. They are wetter and less sandy throughout the profile than the Buncombe and Congaree soils. They are better drained than the Wehadkee soils, and their profile is less gray.

About 80 percent of the acreage of these soils is used as pasture or woodland, and the rest is cultivated or is left idle. In the wooded areas sweetgum, yellow-poplar, beech, water oak, alder, willow, and other trees that tolerate wetness are the chief plants.

Representative profile of a Chewacla silt loam having slopes of 0 to 2 percent, under various kinds of hardwoods (2 miles north of Duluth, and 1,000 feet south of the place where Suwanee Creek drains into the Chattahoochee River):

O2--1 inch to 0, dark-brown (7.5YR 4/4) silt loam mixed with partly weathered leaf litter and organic matter; very friable; abrupt, smooth boundary.

A1--0 to 6 inches, reddish-brown (5YR 4/4) silt loam; weak, fine and medium, subangular blocky structure; friable; many fine roots; very strongly acid; clear, smooth boundary.

B2--6 to 17 inches, reddish-brown (5YR 4/4) silty clay loam; a few, fine, faint mottles of red and yellowish red; moderate, medium, subangular blocky structure; a few worm casts; very strongly acid; clear, smooth boundary.

B3--17 to 28 inches, reddish-brown (5YR 4/4) light silty clay loam; coarse, medium, distinct mottles of dark reddish gray (5YR 4/2) and grayish brown (10YR 5/2); weak, medium and fine, granular structure; very strongly acid; clear, wavy boundary.

C1--28 to 37 inches, dark-brown (10YR 3/3) silt loam or loam; slightly sticky; very strongly acid; clear, wavy boundary.

C2--37 to 42 inches, brown (10YR 5/3) silt loam; slightly sticky; very strongly acid; clear, wavy boundary.

IIB1tg--42 to 48 inches, brown (10YR 5/3) silty clay loam; moderate, medium, prominent mottles of gray; weak, medium and fine, granular structure; nonsticky; very strongly acid; clear, wavy boundary.

IIB2tg--48 to 52 inches +, dark-brown (7.5YR 4/4) silty clay mottled with gray; weak, medium and fine, subangular blocky structure; very strongly acid.

The surface layer is dark-brown to reddish-brown silt loam 4 to 8 inches thick. The B horizon is brown to reddish-brown silty clay loam to a depth between 28 and 35 inches. Gray mottles are at or below a depth of about 15 inches. The C horizon is brown to dark-brown loam or silt loam.

Chewacla soils, frequently flooded (0 to 2 per cent slopes) (Cfs).--These are the only Chewacla soils mapped in the county. They are on flood plains in areas that are about 100 to 300 feet wide and as much as 1,000 feet long. The areas range from 5 to 50 acres, and they are flooded several times each year for 1 to 4 days.

Most areas of these soils have recent accumulations of reddish-brown silt loam to light silty clay loam on the surface. Stratified sand, about 4 to 10 inches thick, occurs at various depths throughout the weakly developed profile.

These soils are in good tilth, but the root zone is moderately shallow. Runoff is slow. The water table generally is at a depth of more than 22 inches, though during wet seasons it is at the surface or just a few inches below.

Included with these soils are a few areas of Augusta, Congaree, and Worsham soils that are too small to be mapped separately.

These Chewacla soils are suited to a limited number of crops, but they can be used intensively if drainage is provided. About 80 percent of the acreage is wooded or pastured (pl. I). The rest is cultivated or left idle.

## Congaree Series

The Congaree series consists of deep, well-drained soils that formed in alluvium. These soils are on broad first bottoms of the rivers and other large streams in the county and are subject to occasional overflow. They occupy small areas chiefly along the Chattahoochee River and along the first bottoms of the lower reaches of the Yellow and the Alcovy Rivers.

These soils have a surface layer of dark-brown or dark yellowish-brown fine sandy loam, silt loam, or loam. The subsoil is brown to strong brown fine sandy loam or sandy clay loam. It is free of mottles to a depth between 36 and 40 inches. Depth to hard rock commonly is more than 10 feet.

In these soils natural fertility is low and the content of organic matter is medium. Permeability is moderate. The water table generally is at a depth of more than 40 inches. A large acreage along the Chattahoochee River and below Buford Dam is flooded less than once in 10 years, but all other areas are flooded frequently.

Congaree soils occur with the Buncombe, Chewacla, and Wehadkee soils. They are not so sandy as the Buncombe soils and are better drained than the Chewacla and Wehadkee.

The vegetation on the Congaree soils is chiefly sweetgum, elm, willow, alder, water oak, beech, yellow-poplar, and loblolly pine. About 85 percent of the acreage is cultivated or pastured, and the rest is left idle or is wooded.

Representative profile of a Congaree fine sandy loam on 0 to 2 percent slopes, in a field of browntop millet (1 1/2 miles west of Suwanee, and 300 feet east of the Chattahoochee River):

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

B1--8 to 40 inches, dark-brown to brown (7.5YR 4/4) fine sandy loam; weak, medium, subangular blocky structure; friable; common very fine mica flakes; many fine roots; strongly acid; clear, wavy boundary.

B2--40 to 52 inches +, dark-brown to brown (7.5YR 4/4) sandy clay loam; weak, medium, subangular blocky structure; friable; a few very fine mica flakes; very strongly acid.

The surface layer is predominantly fine sandy loam, but in places it is loam or silt loam. It ranges from dark brown to dark yellowish brown in color. The subsoil is chiefly brown sandy clay loam, but some areas contain intermittently stratified loamy sand a few inches thick. In places gray mottles are at a depth below 36 inches.

Congaree loam (0 to 2 percent slopes) (Cus).--This soil is on long, broad first bottoms in areas of 5 to 20 acres. The largest acreage is the better drained part of the flood plains along the Chattahoochee River.

The surface layer ranges from loam to silt loam, and in places the profile is better developed, but the profile of this soil otherwise is similar to the one described as representative for the series. This soil generally is in good tilth and has a deep root zone. The available water capacity is medium to high.

Included with this soil are a few areas of Altavista, Buncombe, and Chewacla soils that are too small to be mapped separately.

This Congaree soil is suited to truck crops and to many other crops. It can be cultivated intensively, and yields are moderate to high if good management is used. About 75 percent of the acreage is cultivated or pastured; the rest is wooded or idle.

Congaree soils, frequently flooded (0 to 2 percent slopes) (Cos).--These soils generally occupy areas that are 50 to 100 feet wide and 1,000 to 5,000 feet long. They are on flood plains in areas 2 to 10 acres in size. These soils consist of thick deposits of mixed alluvium made up generally of stratified sand and silt. They vary widely in color and texture within a short distance, and mottles are common at a depth below 36 inches.

Tilth is good in these soils. Runoff is slow, and the available water capacity is high.

Congaree soils are suited to a wide range of crops, and they can be used intensively even though flooding is a slight to moderate hazard in winter and spring. Crops on these soils respond well to good management, and most of the cultivated acreage has been cropped mainly to corn.

About 45 percent of the acreage is wooded or

pastured, and the rest is cultivated or is idle. In the wooded areas the trees are chiefly sweetgum, yellow-poplar, and gum, but pines grow in a few places. In areas where the canopy is sparse, the undergrowth is dense. In some areas in the southeastern part of the county along Big Haynes Creek, the underlying substrata are a good source of industrial sand.

Congaree soils, local alluvium (0 to 6 percent slopes) (Cng).--These soils generally are in depressions near the heads of drainageways and along small streams. The areas range from 1 to 5 acres. These soils consist of deep, well-drained alluvium washed from Appling, Cecil, Gwinnett, Madison, and other adjacent soils in the uplands.

The texture and color of these soils vary greatly within a short distance. Depth to hard rock is 8 to 25 feet, but it commonly is less than 15 feet. In most places slopes are 2 to 4 percent, though they range from 0 to 6 percent.

Natural fertility in these soils is low, and the content of organic matter is medium. Permeability and infiltration are moderate, runoff is medium to slow, and available water capacity is high.

These soils are suited to a wide range of crops and can be used intensively. Crops on these soils respond to good management, and most of the acreage has been cropped mainly to cotton and corn. In the wooded areas the trees are chiefly white oak, red oak, and post oak, though shortleaf pine and loblolly pine grow in some places.

## Davidson Series

The Davidson series consists of deep, well-drained soils formed in material from diorite and similar rocks. These soils are in the uplands on broad, gently sloping ridgetops and on short, steep slopes along drainageways. They occupy small areas, chiefly in the central part of the county and southwest of Lawrenceville.

In the less eroded areas, the surface layer is dark reddish-brown loam, but in the more eroded areas, it is red to dusky-red clay loam. The subsoil is dark-red to dusky-red, firm clay to clay loam.

The natural fertility and content of organic matter are low in these soils. Tilth is good only within a narrow range of moisture content. Permeability is moderate, and available water capacity is medium. The erosion hazard is slight to moderate in cultivated areas.

Davidson soils occur with Cecil, Gwinnett, and Madison soils. They have a browner surface layer than Cecil and Madison soils, and their subsoil is a darker red. Their A and B horizons combined are thicker than those in Gwinnett soils, and depth to hard rock is greater.

About 60 percent of the acreage of these soils is cultivated or pastured. The vegetation in wooded areas is chiefly white oak, post oak, red oak hickory, sassafras, and shortleaf and loblolly pines. In abandoned fields shortleaf and loblolly pines now grow.

Representative profile of Davidson loam, 2 to 6 percent slopes, eroded, under young pines (one-fourth mile southwest of Central Gwinnett High School and 500 feet west of Georgia Highway No. 29):

Ap--0 to 6 inches, dark reddish-brown (2.5YR 3/4) loam; weak, fine, granular structure; friable; many fine and medium roots; strongly acid; abrupt, smooth boundary.

B1--6 to 10 inches, dark-red (10R 3/6) clay loam; weak, medium, subangular blocky structure; friable; many fine roots; strongly acid; clear, wavy boundary.

B21t--10 to 38 inches, dark reddish-brown (2.5YR 3/4) clay; moderate, medium, angular and subangular blocky structure; friable to firm; a few clay films on some peds; a few fine roots; very strongly acid; gradual, wavy boundary.

B22t--38 to 52 inches +, dark-red (2.5YR 3/6) clay; moderate, medium, angular and subangular blocky structure; friable to firm; very strongly acid.

The surface layer ranges from clay loam to loam. It is dark reddish brown or dark brown to dusky red. The subsoil is chiefly clay, but it ranges to heavy clay loam and from dark red to dusky red in color. The solum is more than 40 inches thick. Depth to hard rock generally is more than 10 feet.

Davidson loam, 2 to 6 percent slopes, eroded (DgB2).--This soil occupies broad, gently sloping ridgetops in areas of 5 to 25 acres. Its profile is the one described as representative for the series. This soil generally is in good tilth and has a deep root zone.

Included with this soil are a few small severely eroded areas that have a surface layer of clay loam to clay.

This Davidson soil is suited to a wide range of crops, and it can be cultivated moderately intensively if it is well managed. About 60 percent of the acreage is cultivated or pastured. The rest is wooded, is left idle, or is used as building sites for residences or industries.

Davidson loam, 6 to 10 percent slopes, eroded (DgC2).--This soil is on long sloping hillsides in areas of 5 to 20 acres. The surface layer is dark reddish-brown loam 5 to 7 inches thick and the subsoil is dark-red clay, but the profile of this soil otherwise is similar to the one described as representative for the series.

Tilth generally is good in this soil, and the root zone generally is deep. Some areas are severely eroded, however, and in these the surface layer is clay and water infiltrates slowly into the soil.

The slopes make runoff moderately rapid if this Davidson soil is cultivated, and the erosion hazard

therefore is moderate to severe. Nevertheless, if this soil is well managed, it is suitable for cultivation and for moderately intensive use. A wide range of crops can be grown. About 60 percent of the acreage is cultivated or pastured; the rest is wooded, is left idle, or is used as building sites for residences or industries.

Davidson clay loam, 2 to 6 percent slopes, eroded (DhB2).--This soil is on broad, gently sloping ridgetops in areas of 5 to 50 acres. The surface layer is reddish-brown to dark-red clay loam 3 to 5 inches thick, but the profile otherwise is similar to the one described as representative for the series. The present surface layer consists of material from the upper part of the subsoil that has been mixed with remnants of the original surface layer by plowing. Tilth is poor.

Included with this soil are small areas of a soil that has weathered rock fragments on the surface and scattered throughout the soil. Also included are small areas of Cecil, Winnett, Madison, and Pacolet soils.

The slopes and slow infiltration make runoff medium to moderately rapid on this Davidson soil. The hazard of further erosion therefore is moderate to severe if this soil is cultivated. If this soil is well managed, however, it is suited to a fairly wide range of crops. About half of the acreage is cultivated or pastured; the rest is used as building sites for residences or industries.

Davidson clay loam, 6 to 10 percent slopes, eroded (DhC2).--This soil is on long, sloping hillsides adjacent to narrow ridgetops in areas of 5 to 50 acres. The surface layer is reddish-brown to dark-red clay loam, but the profile of this soil otherwise is similar to the one described as representative for the series. Tilth is poor.

Included with this soil are small areas of a soil that has partly weathered rock fragments on the surface and scattered throughout the soil. Also included are small areas of Cecil, Gwinnett, Madison, and Pacolet soils.

The slopes and slow infiltration make runoff moderately rapid on this soil. The hazard of further erosion therefore is severe if this soil is cultivated. If this soil is well managed, however, it can be cultivated occasionally. It is well suited to permanent pasture and to pine trees. About 45 percent of the acreage is cultivated or pastured; the rest is wooded or is used as building sites for residences or industries.

Davidson clay loam, 10 to 15 percent slopes, eroded (DhD2).--This soil is on moderately steep, long side slopes in areas of 5 to 35 acres. The surface layer is reddish-brown to dark-red clay loam 3 to 5 inches thick, but the profile of this soil otherwise is similar to the one described as representative for the series. The present surface layer consists of material from the upper part of the subsoil that has been mixed with the remaining original surface layer by plowing. Below, the material is dark-red to dusky-red clay to a depth of more than 40 inches. Tilth is poor. A few shallow gullies occur in some places.

Included with this soil are small areas of a soil that has partly weathered rock fragments on the surface and scattered throughout the soil. Also included are small areas of Cecil, Gwinnett, Madison, and Pacolet soils and small areas of Davidson loam.

The strong slopes and slow infiltration make runoff rapid on this Davidson soil. The hazard of further erosion therefore is severe if the soil is cultivated. If this soil is well managed, however, it can be cultivated occasionally. It is well suited to permanent pasture and to pine trees. About 75 percent of the acreage is wooded; the rest is idle, is pastured or cultivated, or is used as building sites for residences.

## Durham Series

Soils of the Durham series are deep and well drained. They formed in material weathered from granite and coarse-grained gneiss. These soils are in the uplands, generally on broad, level ridgetops and in slight depressions. The largest areas are near Grayson and Snellville, but small areas are scattered throughout the county.

The surface layer is dominantly dark grayish-brown or yellowish-brown to brown sandy loam, though it ranges to coarse sandy loam. Below is a thin layer of light olive-brown and yellowish-brown coarse sandy loam 4 to 6 inches thick. The subsoil is light olive-brown or yellowish-brown to brownish-yellow sandy clay loam that commonly is mottled at a depth of about 32 inches. Depth to hard rock generally is more than 6 feet.

The natural fertility and content of organic matter in these soils are low. Permeability is moderate and available water capacity is medium.

Durham soils occur with the Appling, Louisburg, and Worsham soils. They are browner than the Appling soils and their subsoil is less mottled. They are deeper and have more distinct horizons than the Louisburg soils and are better drained than the Worsham.

Hickory, dogwood, sweetgum, blackgum, loblolly pine, shortleaf pine, white oak, red oak, and yellow-poplar are the chief kinds of trees on the Durham soils. About 75 percent of the acreage is pastured or cultivated; the rest is idle, is wooded, or is used for purposes other than farming.

Representative profile of Durham sandy loam, 2 to 6 percent slopes, in an old cotton field (one-fourth mile southwest of Ebenezer Church and 1 1/2 miles east of Oak Grove School):

Ap--0 to 8 inches, dark grayish-brown (2.5Y 4/2) sandy loam; weak, fine, granular structure; very friable; many fine roots; a few fine quartz crystals; strongly acid; abrupt, smooth boundary.

A2--8 to 12 inches, light olive-brown (2.5Y 5/4) and yellowish-brown (10YR 5/6) coarse sandy loam; weak, fine, granular structure; very friable; many fine roots; a few fine quartz

crystals; a few worm casts of dark grayish brown (2.5Y 4/2); strongly acid; clear, smooth boundary.

B1--12 to 17 inches, yellowish-brown (10YR 5/6) light sandy clay loam; weak, medium, subangular blocky structure; friable; many fine roots; a few fine quartz crystals; strongly acid; clear, smooth boundary.

B21t--17 to 32 inches, light olive-brown (2.5Y 5/4) sandy clay loam; moderate, medium and fine, angular and subangular blocky structure; friable; a few fine roots; a few quartz crystals; strongly acid; clear, wavy boundary.

B22t--32 to 44 inches, brownish-yellow (10YR 6/6) light sandy clay loam; common, medium, prominent mottles of yellow (2.5Y 7/6), strong brown (7.5YR 5/6), and red (2.5YR 4/6); moderate, medium, angular and subangular blocky structure; friable; a few fine roots; a few fine quartz crystals and quartz pebbles; very strongly acid; clear, wavy boundary.

B3--44 to 52 inches, mottled brownish-yellow (10YR 6/6), yellow (2.5Y 7/6), and yellowish-red (5YR 5/8) sandy clay loam; moderate, medium, angular and subangular blocky structure; friable; a few strong-brown (7.5YR 5/6) clay films on ped faces; a few fine quartz crystals and quartz pebbles; very strongly acid; clear, wavy boundary.

C--52 to 90 inches +, mottled yellowish-red (5YR 5/8), reddish-yellow (7.5YR 7/8), yellow (10YR 7/8), and white (N 8/0) sandy loam; structureless; very friable; many mica flakes; feels slightly greasy; a few fine quartz crystals and quartz pebbles; very strongly acid.

The Ap horizon is dark grayish-brown or yellowish-brown to brown sandy loam to coarse sandy loam. The combined thickness of the A horizons ranges between 8 and 14 inches. The Bt horizons are yellowish-brown or brownish-yellow to light olive-brown sandy clay loam. Red, yellow, strong-brown, and white mottles are at a depth below 30 inches. The C horizon is mottled yellowish-red, yellow, brownish-yellow, strong-brown, and white sandy loam to sandy clay loam. The solum ranges from 40 to 52 inches in thickness.

Durham sandy loam, 2 to 6 percent slopes (DiB).--This is the only Durham soil mapped in the county. Its profile is the one described as representative for the series. This soil generally is in good tilth and has a deep root zone. Runoff is medium to slow.

Included with this soil are a few areas of a soil that has a surface layer of fine sandy loam or very sandy loam in which there are many quartz pebbles. Also included are areas of Appling and Worsham soils and of Durham sandy loam on slopes of less than 2 percent. All areas of these included soils are too small to be mapped separately.

This Durham soil is well suited to intensive use, and erosion is slight if the soil is cultivated. Most of the acreage is cultivated or is used as pasture. Much of the rest is wooded, is left idle, or is used as building sites for residences or industries. This soil also is a source of topsoil of fair quality. It is well suited as subbase material for roads and is frequently used for this purpose.

## Gullied Land

Gullied land (Gul) consists of an intricate pattern of narrow ridges separated by shallow to deep gullies that have steep side slopes. The areas occupy only a few acres in some places but are as large as 10 to 20 acres in others. They are adjacent to areas of Davidson, Gwinnett, Madison, and Pacolet soils.

In most places the gullies have cut into the underlying weathered mica, schist, granite, or gneiss. The soil material on the ridges between the gullies generally is sandy clay loam or clay loam, but it is sandy loam in a few places in the more gently sloping areas. In some places all of the original surface layer and subsoil have been removed by erosion, and plant growth is sparse.

The soil material in Gullied land is very low in content of organic matter and supply of available plant nutrients and is strongly acid to extremely acid. Runoff is very rapid, and the available water capacity is low.

Gullied land is not suited to cultivation. It is better suited to pine trees than to other uses, but good management is required to establish a good stand of pines (pl. I).

## Gwinnett Series

In the Gwinnett Series are moderately deep, well-drained soils formed in material weathered from rocks that contain dark-colored minerals such as biotite, hornblende, and pyroxene. These soils are on ridgetops in broad, smooth areas and narrow, gently sloping areas or are on long slopes on hillsides that have short, steep side slopes along drainageways. The areas are large and are chiefly in the central part of the county and southwest of Lawrenceville.

In the less eroded areas, these soils have a surface layer of reddish-brown to dusky-red loam to sandy loam. In the more eroded areas, the surface layer is dark-red clay loam to sandy clay loam. The subsoil is dark-red to red, firm clay or clay loam. Depth to hard rock commonly is more than 6 feet.

These soils are low in natural fertility and in content of organic matter. Permeability is moderate, and the available water capacity is medium.

Gwinnett soils occur with Cecil, Davidson, Madison, Musella, Pacolet, Red Bay, and Wickham soils. They have a redder surface layer and a

darker red subsoil than the Cecil, Madison, Pacolet, and Wickham soils, but they have less mica throughout the profile than the Madison soils. They are thinner than the Davidson soils, and they generally have fewer cobblestones in the surface layer, a thicker subsoil, and greater depth to hard rock than the Musella soils. Gwinnett soils contain more clay and are less friable than Red Bay soils.

About 35 percent of the acreage of these soils is cultivated or pastured. The vegetation in the wooded areas is chiefly white oak, post oak, and hickory trees and sassafras sprouts, though yellow-poplar and pine grow in places. In abandoned fields shortleaf and loblolly pines now grow.

Representative profile of Gwinnett loam, 2 to 6 percent slopes, eroded, in an unimproved pasture where there are a few loblolly pines (2 1/2 miles west-northwest of Dacula, about 1,000 feet southeast of Hurricane Shoals Road, and 100 feet west of Rabbit Road):

Ap--0 to 7 inches, dusky-red (10R 3/4) loam; weak, medium, subangular blocky structure; friable; many fine roots; about 3 percent, by volume, is fine gravel; a few cobblestones and larger stones; strongly acid; clear, smooth boundary.

B21t--7 to 23 inches, dark-red (10R 3/6) clay; moderate, medium, subangular blocky structure; slightly firm; about 2 percent, by volume, is quartz gravel and weathered mafic gneiss; some small worm holes that have thin clay films around the holes; very strongly acid; gradual, irregular boundary.

B22t--23 to 35 inches, dark-red (10R 3/6) clay; moderate, medium, subangular blocky structure; friable; about 5 percent, by volume, is weathered rock fragments; thin clay films on ped faces; very strongly acid; clear, wavy boundary.

B&C--35 to 43 inches, dark-red (10R 3/6) to weak-red (10R 4/4) clay loam and weathered yellowish-brown (10YR 5/6) rock, which makes up about 40 percent of the horizon, by volume; moderate, medium, subangular blocky structure; friable; very strongly acid.

R--43 to 45 inches +, weathered fractured rock.

The surface layer ranges from loam to clay loam in texture and from reddish brown to dusky red in color. The subsoil is mainly clay, though it ranges to clay loam. Its color ranges from dark red to red. The solum ranges from 20 to 40 inches in thickness, but it generally is about 36 inches thick. Depth to hard rock generally is more than 6 feet, but commonly fractured and broken rock is at a depth of 4 to 6 feet.

Gwinnett loam, 2 to 6 percent slopes, eroded (GgB2).--This soil is in broad, smooth areas or in narrow areas on ridgetops and on gently sloping hillsides. The areas occupy less than 5 to more than 25 acres. The profile of this soil is the one described as representative of the series.

This soil has a moderately deep root zone. It is in good tilth within only a narrow range, which depends on the content of moisture and supply of organic matter. The hazard of further erosion is slight to moderate if this soil is cultivated.

Included with this soil are a few areas of a soil that has a surface layer 4 to 6 inches thicker than the surface layer of this soil. Also included are a few areas that are severely eroded, and other areas that have diorite and hornblende gneiss fragments and boulders on the surface and scattered throughout the profile. In other included small areas, the subsoil contains mica flakes and feels greasy.

This Gwinnett soil is well suited to moderately intensive use. About 55 percent of the acreage is cultivated or pastured, is in woods, or is idle. The rest is used as building sites for residences and industries.

Gwinnett loam, 6 to 10 percent slopes, eroded (GgC2).--This soil is on narrow ridgetops and on the upper part of moderately long, gentle slopes. The areas occupy 5 to 35 acres.

This soil has a moderately deep root zone. It is in good tilth within only a narrow range, which depends on the content of moisture and supply of organic matter. The available water capacity is medium, and the hazard of further erosion is moderate to severe.

Included with this soil are a few small areas of a severely eroded soil that has a surface layer of dark reddish-brown to dark-red clay loam. A few other included areas have fragments of diorite and hornblende gneiss scattered on the surface and throughout the profile. Also included are some areas of soil having a subsoil that contains a small amount of mica.

This Gwinnett soil is suited to wheat, alfalfa, peaches, and most other crops commonly grown in the county. About 50 percent of the acreage is wooded; the rest is cultivated or pastured, is left idle, or is used as building sites for residences or industries.

Gwinnett loam, 10 to 25 percent slopes, eroded (GgE2).--This soil occupies short and long slopes that are moderately steep to steep. The areas range from 5 to 50 acres. The A and B horizons combined range from 26 to 40 inches in thickness, but the profile of this soil otherwise is similar to the one described as representative of the series. Runoff is more rapid than on less steep Gwinnett soils, and the hazard of further erosion is severe if this soil is cultivated.

Included with this soil are a few small areas of a severely eroded soil that has a surface layer of dark reddish-brown to dark-red clay loam. Also included are some small areas of a soil that has many mica flakes throughout the profile and small areas that have a gravelly surface layer.

This Gwinnett soil is better suited to trees or pasture or other perennial vegetation than to other

uses. Most of the acreage has been cultivated at some time, but about 85 percent of the acreage is now in trees or pasture or is idle. Some areas are used as building sites for residences.

Gwinnett clay loam, 2 to 6 percent slopes, eroded (GeB2).--This soil is on broad, gently sloping ridgetops in areas that occupy less than 5 to more than 25 acres. The A and B horizons combined are 20 to 36 inches thick, but the profile of this soil otherwise is similar to the profile described as representative of the series. The present surface layer is reddish-brown to dark-red clay loam and consists of material from the upper part of the subsoil that has been mixed with the remaining surface layer by plowing. In small severely eroded areas, red or dark-red clayey material formerly in the subsoil is exposed.

Included with this soil are small areas that have partly weathered fragments of diorite and hornblende gneiss on the surface and scattered throughout the profile and some areas of a soil that has many mica flakes throughout the profile. Also included are areas of Cecil, Davidson, Musella and Pacolet soils that are too small to be mapped separately.

Because of the slopes and slow infiltration, runoff is medium to moderately rapid on this Gwinnett soil. The hazard of further erosion is moderate to severe, and the soil also is in poor tilth. Nevertheless, if this soil is well managed, it is suited to a wide range of crops.

Gwinnett clay loam, 6 to 10 percent slopes, eroded (GeC2).--This soil is on narrow ridgetops and on the upper part of moderately long, gently sloping to strongly sloping hillsides. The areas occupy 5 to 50 acres. This soil has a surface layer of reddish-brown to dark-red clay loam, which consists of material from the upper part of the subsoil that has been mixed with the remaining surface layer by plowing, but its profile otherwise is similar to the one described as representative of the series. In small severely eroded areas, red or dark-red clayey material formerly in the subsoil is exposed. The A and B horizons combined are 20 to 37 inches thick. In a few places shallow gullies have formed.

Included with this soil are small areas of a soil that has partly weathered fragments of diorite and hornblende gneiss on the surface and scattered throughout the profile and some areas of a soil that has many mica flakes throughout the profile. Also included are areas of Cecil, Davidson, Musella, and Pacolet soils that are too small to be mapped separately.

The slopes and slow infiltration make runoff moderately rapid on this Gwinnett soil. Consequently, the hazard of further erosion is severe in cultivated areas. The soil also is in poor tilth. Nevertheless, if this soil is well managed, it can be cultivated occasionally. It is well suited to permanent pasture and to pine trees. About 40 percent of the acreage is cultivated or pastured; the rest is wooded, is idle, or is used as building sites for residences or industries. A site suitable for an industrial plant, on which a building for new industry is being constructed, is shown in plate II.

Gwinnett clay loam, 10 to 25 percent slopes, eroded (GeE2).--This soil is on moderately steep, long and short slopes on hillsides in areas that range from 5 to 75 acres in size. The surface layer is reddish-brown to dark-red clay loam, which consists of material from the upper part of the subsoil that has been mixed with the remaining surface layer by plowing, but the profile otherwise is similar to the representative profile described for the series. The A and B horizons combined generally are 4 to 8 inches thinner than in Gwinnett loam, 10 to 25 percent slopes, eroded. In the more eroded areas, red or dark-red clayey material formerly in the subsoil is exposed. In places a few shallow gullies have formed.

Included with this soil are small areas of a soil that has partly weathered rock fragments on the surface and scattered throughout the profile and some areas of a soil that contains mica flakes. Also included are areas of Cecil, Davidson, Musella, and Pacolet soils that are too small to be mapped separately.

The slopes and slow infiltration make runoff on this Gwinnett soil rapid, and the hazard of further erosion is severe. This soil also is in poor tilth. It is not suited to cultivation and is better suited to permanent pasture and to pine trees. About 85 percent of the acreage is wooded or idle; the rest is cultivated, is pastured, or is used as building sites for residences.

## Helena Series

The Helena series consists of moderately deep, very gently sloping to sloping, somewhat poorly drained to moderately well drained soils. These soils formed in mixed material weathered from such rocks as granite or granite gneiss cut by small dykes of gabbro and diorite or mixed with hornblende schist or hornblende gneiss. They are chiefly in the uplands around the heads of drainageways, in slight depressions, and at the base of slopes. The individual areas range from 2 to 20 acres.

These soils have a surface layer of dark grayish-brown to dark-brown fine sandy loam, loam, and sandy loam. The subsoil is yellowish-brown to olive-gray clay loam to clay and commonly is mottled with light red and light gray in the uppermost 10 inches. Depth to hard rock generally is 3 to 6 feet.

The natural fertility and content of organic matter in these soils are low. Permeability and runoff are moderately slow.

Helena soils occur with the Iredell, Louisburg, Wilkes, and Worsham soils. They are not so plastic as the Iredell soils. Their profile is better developed than that of the Louisburg and Wilkes soils, and they are deeper to parent material. Helena soils have a darker colored surface layer

than the Worsham soils, and their subsoil is more clayey.

About 55 percent of the acreage of these soils is wooded or pastured; the rest is cultivated or is idle. Water oak, yellow-poplar, alder, sweetgum, and blackgum are the chief trees in wooded areas.

Representative profile of Helena sandy loam, 2 to 6 percent slopes, under pines and hardwoods; (1 1/2 miles north of Lilburn, 1,000 feet north of the crossing of Hillcrest Road and Dickens Road, and 300 feet west of Hillcrest Road):

A1--0 to 3 inches, dark grayish-brown (2.5Y 4/2) sandy loam; moderate, medium, granular structure; very friable; many fine and medium roots; strongly acid; clear, smooth boundary.

A2--3 to 6 inches, light olive-brown (2.5Y 5/4) heavy sandy loam; moderate, medium, granular structure; very friable; slightly sticky when wet; a few fine roots; some old worm channels filled with dark-brown loamy material; strongly acid; clear, smooth boundary.

B21t--6 to 15 inches, yellowish-brown (10YR 5/6) clay loam; common, distinct mottles of olive-yellow; (2.5Y 6/8) moderate, medium, subangular blocky structure; firm, sticky, black specks and thin, strong-brown (7.5YR 5/8) clay films on ped faces and in cracks; very strongly acid; clear, wavy boundary

B22t--15 to 23 inches, yellowish-brown (10YR 5/6) sandy clay; common, medium, prominent mottles of light red (2.5YR 6/8) and light gray (10YR 7/1); moderate, medium, subangular blocky structure; firm, sticky lumps or pockets of clay; very strongly acid; clear, wavy boundary.

B23t--23 to 32 inches, olive-gray (5Y 5/2) clay; common, medium, distinct mottles of yellowish brown (10YR 5/6); weak, medium, subangular blocky structure; very plastic; a few soft manganese concretions.

B3&C--32 to 36 inches, olive-gray (5Y 5/2) sandy clay loam; massive; slightly plastic; many black mineral particles; very strongly acid.

R--36 inches, loose, fractured hard rock; not penetrated by soil auger.

The surface layer is dark grayish brown or very dark grayish brown to dark brown. Its texture is sandy loam in most places, but in some areas it is fine sandy loam or loam. The A horizon ranges between 4 and 8 inches in thickness. The B2 horizon is yellowish-brown to olive-gray plastic clay mottled with light gray and light red. The solum ranges from 26 to 35 inches in thickness.

Helena sandy loam, 2 to 6 percent slopes (HYB).--This is the only Helena soil mapped in the county. In places the surface layer is silt loam covered by 10 to 14 inches of reddish-brown overwash, but the profile of this soil otherwise is similar to the one described as representative for the series. Depth to mottling generally is 10 to 20 inches.

The surface layer of this soil is in good tilth. Infiltration is moderate, and available water capacity is medium. The root zone is moderately deep to shallow, depending on variation in depth to the clayey subsoil and underlying rock. Depth to the water table generally is more than 15 inches.

Included with this soil are some areas of Iredell and Wilkes soils that are too small to be mapped separately.

This Helena soil is suited to only a few cultivated crops, but the crops respond fairly well if fertilizer is applied and other good management is used. Most of the acreage has been cultivated at some time, but now more than half of it is wooded or pastured.

## Iredell Series

The Iredell series consists of moderately deep, moderately well drained to somewhat poorly drained soils that are very slowly permeable. These soils formed in material weathered from diorite, gabbro, diabase, hornblende schist, and similar kinds of rocks. They are in the uplands in the central and northeastern parts of the county on narrow ridgetops and short steep slopes.

These soils generally have a surface layer of dark-brown to very dark grayish-brown cobbly fine sandy loam. The subsoil is yellowish-brown, heavy, plastic clay mottled with strong brown, red, and gray. Many cobblestones and a few larger stones are on the surface and scattered throughout the profile. Depth to partly weathered parent material is about 24 to 30 inches, and depth to hard rock commonly is less than 4 feet.

The natural fertility and content of organic matter in these soils are low. The cobblestones and larger stones in and on these soils make use of farm machinery impractical.

Iredell soils occur with the Wilkes, Gwinnett, Helena, and Louisa soils. Their subsoil is more clayey than that in the Wilkes, Gwinnett, and Louisa soils, more plastic than that in the Helena soils, and lighter colored than that in the Gwinnett soils. Iredell soils lack the schist fragments that are typical of the Louisa soils.

The present vegetation on the Iredell soils is chiefly white oak, post oak, hickory, and sassafras trees, but shortleaf and loblolly pines grow in places.

In this county Iredell soils occur closely with the Wilkes soils and are mapped only in a complex with those soils. A description of the Wilkes soils is provided under the Wilkes series.

Representative profile of an Iredell cobbly fine sandy loam on 6 to 10 percent slopes, under various kinds of hardwoods (1 1/2 miles north of Lilburn and 500 feet north of the intersection of Burns Drive and Dickens Road):

A1--0 to 3 inches, very dark grayish-brown (10YR 3/2) cobbly fine sandy loam; weak, fine, granular structure; very friable;

about 5 percent, by volume, is small brown concretions; many fine and medium roots; slightly acid; abrupt, smooth boundary.

A2--3 to 7 inches, dark-brown (10YR 3/3) gravelly fine sandy loam, weak, fine, granular structure; friable; about 5 percent, by volume, is small brown concretions; many fine and medium roots; medium acid; clear, wavy boundary.

A3--7 to 10 inches, light olive-brown (2.5Y 5/4) gravelly sandy loam; weak, fine, granular structure; friable; about 5 percent, by volume, is small brown concretions; many fine and medium roots; strongly acid; abrupt, wavy boundary.

B21t--10 to 19 inches, yellowish-brown (10YR 5/6) clay; common, fine, prominent mottles of red (2.5YR 4/8) and strong brown (7.5YR 5/6); moderate, medium, subangular blocky structure; very firm and plastic when wet; clay films on ped faces; a few fine quartz fragments; strongly acid; clear, wavy boundary.

B22t--19 to 25 inches, yellowish-brown (10YR 5/6) clay; common, fine, distinct mottles of gray (10YR 6/1); massive; plastic when wet; clay films on ped faces; a few fine quartz fragments; medium acid; gradual, wavy boundary.

B3t--25 to 28 inches, yellowish-brown (10YR 5/8) clay mixed with partly weathered saprolite (disintegrated rock); common, fine, distinct mottles of light brownish gray (2.5Y 6/2) and gray (N 6/0); massive; plastic when wet; slightly acid; clear, wavy boundary.

C1--28 to 32 inches, partly weathered, greenish-gray saprolite and yellowish-brown streaks of massive clay.

C2--32 to 36 inches, partly weathered mafic rock.

R--36 inches +, hard diorite.

In texture the surface layer is predominantly cobbly fine sandy loam, but in some areas it ranges to cobbly loam. The B horizon contains more than 50 percent clay. A few iron and manganese concretions occur throughout the solum. The thickness of the solum ranges from 25 to 36 inches. The shrink-swell potential is very high.

## Louisa Series

In the Louisa series are shallow, somewhat excessively drained soils formed in material weathered from mica schist and mica gneiss. These soils are in the uplands. Some of the areas are on narrow, gently sloping ridgetops and others are on hillsides along some of the drainageways on escarpments with moderately long and sloping and short and steep slopes. The areas are small and occur throughout the county, but the largest ones are in the northwestern part.

The surface layer of these soils is yellowish-brown to dark grayish-brown gravelly sandy loam. It overlies yellowish-red to red gravelly fine sandy loam or discontinuous gravelly sandy clay loam that has a high content of fine mica flakes. The underlying mica schist and mica gneiss commonly are weathered to a depth of many feet.

In these soils natural fertility and content of organic matter are low. Permeability is moderately rapid, and available water capacity is low.

Louisa soils occur with Iredell, Louisburg, Madison, and Wilkes soils. They are not so clayey or plastic as Iredell soils, and they are shallower and have less distinct horizons than Madison soils. Louisa soils contain more mica than the Louisburg and Wilkes soils and are finer textured throughout.

The vegetation on these soils is chiefly white oak, post oak, red oak, hickory, dogwood, and sweetgum, but loblolly and shortleaf pines grow in some places. Much of the acreage is wooded, but some of it is pastured, cultivated, or idle.

Representative profile of Louisa gravelly sandy loam, 6 to 15 percent slopes, under pines (3 miles north of the Gwinnett County courthouse and 1,000 feet east of Georgia Highway No. 20):

Ap--0 to 6 inches, yellowish-brown (10YR 5/4) gravelly sandy loam; weak, fine, granular structure; very friable; many fine roots and schist fragments; strongly acid; abrupt, smooth boundary.

Bt--6 to 15 inches, red (2.5YR 4/6) gravelly light sandy clay loam; weak, fine, granular structure; friable; about 75 percent, by volume, is schist fragments; strongly acid; clear, wavy boundary.

C1--15 to 32 inches, yellowish-red (5YR 4/8) partly weathered schist fragments; strongly acid; gradual, wavy boundary.

C2--32 to 52 inches, reddish-brown (2.5YR 4/4) partly weathered, highly micaceous schist fragments intermixed with reddish-gray schist fragments.

The surface layer ranges from gravelly sandy loam to gravelly fine sandy loam and is yellowish brown to dark grayish brown. It is 3 to 6 inches thick. The Bt horizon is discontinuous, ranges from gravelly sandy loam to gravelly sandy clay loam, and is yellowish red to red. Depth to weathered mica schist ranges from 6 to 18 inches, and depth to hard rock generally is more than 5 feet.

Louisa gravelly sandy loam, 6 to 15 percent slopes (LkD).--This soil is on narrow ridgetops and moderately long side slopes in areas of 5 to 20 acres. Its profile is the one described as representative for the series. The surface layer generally is in good tilth, but the root zone is shallow.

Included with this soil are areas of a soil that has a surface layer of fine sandy loam and in places weathered mica schist at the surface. Also included are areas of a soil that has a subsoil of red or yellowish-red, micaceous sandy clay loam or clay loam, 10 to 24 inches thick, which makes up from about 25 to 30 percent of the acreage of this mapping unit. Small areas of Louisburg and Madison soil also are included. All of these included

soils are too small to be mapped separately.

Because this Louisa soil is shallow to underlying rock fragments, runoff is rapid on areas left bare and the erosion hazard is severe. Crops on this soil respond well if fertilizer is applied, but yields of the crops commonly grown are low to moderate. About 75 percent of the acreage is wooded or pastured; the rest is cultivated, left idle, or used as building sites for residences.

Louisa gravelly sandy loam, 15 to 45 percent slopes (LkF).--This soil is on short, steep side slopes in areas of 5 to 35 acres. The root zone is very shallow.

Included with this soil are a few areas of a soil that has slopes that range from 45 to 60 percent. Also included are some areas of a soil that has a surface layer of fine sandy loam and a few rock outcrops. Areas of Louisburg and Madison soils also are included. All of these included soils are too small to be mapped separately.

This Louisa soil is better suited to perennial vegetation than to cultivated crops. The hazard of erosion is severe if this soil is cultivated, and crop yields are low. Most of the acreage is wooded, but some is pastured, cultivated, or idle.

## Louisburg Series

The Louisburg series consists of shallow to moderately deep, well-drained to excessively drained soils. These soils formed chiefly in material weathered from granite and gneiss, but in some places this material was derived partly from diorite, micaceous quartz, and mica schist. Louisburg soils are in the uplands on narrow ridgetops and on moderately long to short, very steep hillsides. The largest areas are in the eastern half of the county, but smaller areas occur throughout the county.

These soils have a surface layer of grayish-brown to light olive-brown loamy sand or stony loamy sand underlain by light yellowish-brown to yellowish-brown sandy loam. Below, in some areas, is a thin layer of yellowish-red to yellowish-brown sandy clay loam that has a few mottles of reddish yellow to red immediately above partly decomposed rock. The partly decomposed layer of rock is white, light gray, and light yellowish brown and is 3 to 10 inches thick. Depth to hard rock varies but generally ranges from 18 to 48 inches.

The natural fertility is low, and the supply of organic matter generally also is low. Permeability is moderately rapid to rapid, and available water capacity is low.

Louisburg soils occur with the Cecil, Durham, Helena, Pacolet, and Wedowee soils, and in some places they are associated with the Louisa soils. They are shallower to hard rock than the Cecil, Durham, Pacolet, and Wedowee soils and lack the well-defined horizons of those soils. They are sandier and have more rock outcrops and large stones on the surface than the Louisa soils. Louisburg soils also contain less mica than the Louisa soils and lack the red color typical of those soils.

About 85 percent of the acreage of these soils is wooded or pastured; the rest is cultivated or idle.

Representative profile of Louisburg loamy sand, 10 to 25 percent slopes, under loblolly pines (4 miles south of Dacula and 100 feet south of Brooks Road):

Ap--0 to 6 inches, light olive-brown (2.5Y 5/4) and yellowish-brown (10YR 5/4) loamy sand; weak, fine, granular structure; very friable; many fine and medium roots; very strongly acid; clear, wavy boundary.

B2--6 to 13 inches, yellowish-brown (10YR 5/6) sandy loam; weak to moderate, fine, granular structure; loose; many fine and medium roots; very strongly acid; abrupt, smooth boundary.

B&C--13 to 29 inches, pale-yellow (5Y 8/4) sandy loam and partly weathered granite rock; strongly acid; abrupt, wavy boundary.

R--29 to 31 inches, light-gray (5Y 7/1), hard granite.

The surface layer ranges from loamy sand to coarse sandy loam in texture, and from grayish brown or yellowish brown to olive brown in color. The subsoil is predominantly sandy loam to coarse sandy loam, but in places thin, discontinuous layers of sandy clay loam and a few pockets of sandy clay occur. Depth to hard rock ranges from 18 to 48 inches.

Louisburg loamy sand, 2 to 10 percent slopes (LnC).--This soil is on narrow ridgetops and moderately sloping hillsides in areas of 5 to 10 acres. The A horizon is 4 to 6 inches thicker, but the profile of this soil otherwise is similar to the one described as representative for the series. Fractured rock is exposed or is within 24 inches of the surface in 20 to 25 percent of the acreage. In many places the subsoil in as much as 30 percent of the area is sandy clay loam about 4 to 6 inches thick. In other places the subsoil is sandy clay loam as much as 2 feet thick. In a few small areas hard rock and a few pebbles and boulders are scattered on the surface.

The root zone in this soil is shallow. Infiltration is rapid, available water capacity is low, and runoff is medium.

Included with this soil are some areas of Durham, Pacolet, and Wedowee soils that are too small to be mapped separately.

The shallow root zone and small amount of water available for plants limit productivity of this Louisburg soil. About 65 percent of the acreage is wooded or pastured; the rest is cultivated, is left idle, or is used as building sites for residences and light industries.

Louisburg loamy sand, 10 to 25 percent slopes (LnE).--This soil is on narrow ridgetops and moderately short and short, steep slopes in areas of 5 to 50 acres. The short, steep slopes generally are adjacent to drainageways. Depth to hard rock ranges between 20 and 36 inches, but the profile

of this soil otherwise is similar to the one described as representative for the series.

The root zone is shallow in this soil. Infiltration is rapid, and available water capacity is low. Runoff is medium in cultivated areas.

Included with this soil are a few areas of a soil that has fractured rock, boulders, and pebbles scattered on the surface and at a variable depth within the A horizon. Also included are some areas of Cecil, Pacolet, and Wedowee soils. All of these included soils are too small to be mapped separately.

The shallow root zone and small amount of water available for plants limit productivity of this Louisburg soil. About 85 percent of the acreage is wooded; the rest is pastured, is cultivated or left idle, or is used as building sites for residences.

Louisburg stony loamy sand, 6 to 15 percent slopes (LDD).--This soil is on narrow, sloping ridgetops and on moderately short hillsides in areas of 5 to 20 acres. Depth to hard rock generally is 24 inches, but the profile of this soil otherwise is similar to the one described as representative for the series. More stones are also on the surface of this soil.

This soil is in poor tilth and has a shallow root zone. Infiltration is rapid, available water capacity is low, and runoff is medium.

Included with this soil are a few areas of Durham, Pacolet, and Wedowee soils that are too small to be mapped separately.

The poor tilth, shallow root zone, and small amount of water available for plants limit productivity of this soil. About 80 percent of the acreage is wooded; the rest is pastured, left idle or cultivated, or is used as building sites for residences.

Louisburg stony loamy sand, 15 to 45 percent slopes (LDF).--This soil is on short, steep and very steep slopes adjacent to drainageways in areas of 5 to 10 acres. Depth to hard rock generally is about 22 inches, but the profile of this soil otherwise is similar to the one described as representative for the series. More stones are also on the surface of this soil.

Tilth is poor in this soil, and the root zone is shallow. Infiltration and runoff are rapid, and available water capacity is low.

Included with this soil are a few areas of Louisa, Pacolet, and Wedowee soils that are too small to be mapped separately.

The poor tilth, shallow root zone, and small amount of water available to plants limit productivity of this Louisburg soil. About 95 percent of the acreage is wooded; the rest is pastured, cultivated, or idle.

## Made Land

Made land (Mae) consists mostly of cuts and fills in areas being prepared for shopping centers and as building sites for industries and for housing developments (pl. II). Most of the areas are along Interstate Highway No. 85, but a few are scattered throughout the county.

All of the soil material has been disturbed or removed from many areas of this land type. In many places the cuts are deep and are into the weathered mica schist, granite, or gneiss. In other places the soil material is sandy clay loam or clay loam. The filled areas generally are made up of a mixture of sand, silt, clay, and boulders removed from new cuts, though in a few places the boulders are lacking.

The soil material is acid. The content of organic matter and supply of available plant nutrients are very low. Topsoil therefore must be added before sod and shrubs can be established.

Made land is not used for farming. Erosion is a hazard, but it can be controlled by establishing grasses, legumes, vines, woody plants, and other vegetation.

## Madison Series

In the Madison series are moderately deep to deep, well-drained soils formed in material weathered from micaceous quartz, mica schist, and granite gneiss. These soils are in the uplands on somewhat broad ridgetops, on long, moderately sloping hillsides, and on short, steep slopes adjacent to drainageways. The areas generally are large and are in the northwestern part of the county.

The surface layer ranges from reddish-brown to yellowish-brown gravelly sandy loam to sandy loam, but in the more eroded areas it is sandy clay loam to clay loam. The subsoil is red clay loam to clay. Depth to weathered parent material generally ranges from 22 to 50 inches, and depth to hard rock generally is more than 10 feet.

Natural fertility and content of organic matter in these soils are low, and permeability and available water capacity are moderate. Except for scattered pieces of gravel, tilth generally is good in the less eroded areas. In the more eroded areas, the surface layer is gravelly and tilth is only fair.

Madison soils occur with the Appling, Cecil, Davidson, Louisa, Gwinnett, Louisburg, and Pacolet soils. They have more mica throughout the profile, and especially in the upper part of the subsoil, than the Appling, Cecil, Davidson, Gwinnett, and Pacolet soils and are deeper and have more distinct horizons than the Louisa and Louisburg soils. Madison soils also are more friable than the Gwinnett soils, and their subsoil is less clayey.

About 75 percent of the acreage of these soils is wooded or pastured, and the rest is cultivated or idle. The chief trees in the wooded areas are white oak, post oak, and red oak, but hickory, dogwood, and shortleaf pine grow in some places.

Representative profile of Madison gravelly sandy loam, 6 to 10 percent slopes, eroded, under young loblolly pines, (one-fourth mile east of Interstate Highway No. 85 and the overpass on Old Peachtree Road and 50 feet north of Old Peachtree Road):

Ap--0 to 6 inches, yellowish-brown (10YR 5/4) gravelly sandy loam, weak, fine, granular structure; friable; a few very fine mica flakes; many flat schist pebbles and a few quartz pebbles; many fine roots; strongly acid to very strongly acid; abrupt, smooth boundary.

B21t--6 to 10 inches, red (2.5YR 5/6) clay loam; moderate, medium, subangular blocky structure; friable; a few fine mica flakes; a few fine clay films on ped faces; very strongly acid; clear, smooth boundary.

B22t--10 to 23 inches, red (2.5YR 5/6) light clay; moderate, medium, angular and subangular blocky structure; friable; many fine mica flakes make the material feel greasy; a few fine clay films on ped faces; extremely acid; clear, wavy boundary.

B3t--23 to 29 inches, red (2.5YR 4/6) sandy clay loam; weak, medium, subangular blocky structure; friable; many fine mica flakes make the material feel greasy; extremely acid; gradual, wavy boundary.

C--29 to 90 inches, highly weathered mica schist; approximately 95 percent is reddish-gray material and 5 percent is brownish-yellow weathered material that is extremely acid.

The surface layer ranges from sandy loam to gravelly sandy loam in the less eroded areas and from clay loam to sandy clay loam in the more eroded areas. It is yellowish brown, yellowish red, or reddish brown. The subsoil is mainly red heavy clay loam but ranges to clay. The solum ranges from 20 to 60 inches in thickness. Depth to hard rock generally is more than 10 feet.

Madison gravelly sandy loam, 2 to 6 percent slopes, eroded (MhB2).--This soil is on moderately broad ridgetops and on narrow saddles between the ridgetops in areas of 5 to 10 acres. The surface layer is about 10 inches thick, but the profile of this soil otherwise is similar to the one described as representative for the series. The A and B horizons combined are between 20 and 40 inches thick. In places many small flat fragments of schist and a few quartz pebbles are in this soil.

The surface layer of this soil generally is in good tilth, and the root zone is moderately deep. Infiltration is moderate, runoff is medium, and the hazard of further erosion is slight to moderate if this soil is cultivated.

Included with this soil are a few areas of Appling, Cecil, and Pacolet soils and a few cobbly areas. Also included are some areas of a soil that has a surface layer of sandy loam or fine sandy loam. All of these included soils are too small to be mapped separately.

This Madison soil is suited to a wide range of crops, and it can be farmed somewhat intensively. Crops on it respond well if fertilizer is applied and if other good management is used. Most of the acreage has been cropped at some time, chiefly to cotton and corn, but about 75 percent of it now is wooded. The rest is cultivated, pastured, left idle, or used as building sites for residences or industries.

Madison gravelly sandy loam, 6 to 10 percent slopes, eroded (MhC2).--This soil is on long, narrow, sloping ridgetops and moderately long, strongly sloping hillsides in areas of 5 to 50 acres. Its profile is the one described as representative for the series. The A and B horizons combined are 20 to 40 inches thick. The surface layer and uppermost part of the subsoil are about 10 to 20 percent schist and quartz gravel, but below, the amount of gravel is less.

Included with this soil are a few areas of Appling, Cecil, and Pacolet soils. Also included are areas of a soil that has a surface layer of sandy loam or fine sandy loam. All areas of these included soils are too small to be mapped separately.

Because of the slopes, runoff is medium if this Madison soil is cultivated. The hazard of further erosion is moderate to severe, but this soil can be cultivated if it is well managed. The generally good tilth and moderately thick root zone make the soil suitable for a wide range of crops. About 75 percent of the acreage is wooded or pastured. The rest is cultivated, left idle, or used as building sites for residences or industries.

Madison sandy clay loam, 2 to 6 percent slopes, eroded (MiB2).--This soil is on narrow ridgetops and long, gently sloping hillsides in areas of 5 to 20 acres. The surface layer is reddish-brown to red sandy clay loam 4 to 6 inches thick, but the profile otherwise is similar to the one described as representative for the series. The A and B horizons combined range from 24 to 50 inches in thickness.

The surface layer of this soil is in fair tilth, and the root zone is deep. Infiltration is slow, and runoff is medium to moderately rapid. The hazard of further erosion is moderate to severe if this soil is cultivated.

This Madison soil is suited to a wide range of crops. Crops on it respond well if fertilizer is applied and if management otherwise is good. Most of the acreage has been cropped at some time, chiefly to cotton and corn. About 55 percent is now wooded or pastured; the rest is cultivated, left idle, or used as building sites for residences or industries.

Madison sandy clay loam, 6 to 10 percent slopes, eroded (MiC2).--This soil is on long, narrow ridgetops and moderately long, strongly sloping hillsides in areas of 5 to 25 acres. The surface layer is reddish-brown to yellowish-red, friable sandy clay loam 3 to 5 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 plowing. The subsoil is red clay loam. The A and B horizons combined are 20 to 40 inches thick. A few areas are severely eroded, and in a few places the soil is cut by shallow gullies.

Included with this soil are a few areas of a soil that has a gravelly surface layer and some areas of a soil that has a surface layer of sandy loam. These included soils are too small to be mapped separately.

If this Madison soil is cultivated, the slopes, sandy surface layer, and slow infiltration make runoff moderately rapid. The hazard of further erosion therefore is severe, but row crops can be grown occasionally under good management. This soil is well suited to permanent pasture and to pine trees. More than 75 percent of the acreage is under second-growth pines, but oaks grow in some places. The rest of the acreage is cultivated, pastured, left idle, or used as building sites for residences or industries.

Madison sandy clay loam, 10 to 15 percent slopes, eroded (MiD2).--This soil is on moderately long, moderately steep side slopes in areas of 5 to 40 acres. The surface layer is reddish-brown to yellowish-red, friable sandy clay loam. It consists of material from the upper part of the subsoil that has been mixed with the remaining original surface layer by plowing. The subsoil is red clay loam. The A and B horizons combined are 20 to 40 inches thick. Tilth generally is poor.

Included with this soil are a few areas of a soil that has a gravelly surface layer and some areas that have a surface layer of sandy loam. Areas of these included soils are too small to be mapped separately.

The somewhat steep slopes and slow infiltration make runoff rapid on this Madison soil. The hazard of further erosion therefore is severe. This soil is suited to permanent pasture and to pine trees. About 70 percent of the acreage is wooded; the rest is cultivated or pastured, left idle, or used as building sites for residences.

Madison sandy clay loam, 15 to 45 percent slopes, eroded (MiF2).--This soil is on short, steep slopes. It generally is adjacent to drainageways in areas of 5 to 15 acres. The surface layer is reddish-brown to yellowish-red, friable sandy clay loam 3 to 5 inches thick. It consists of red clay loam formerly in the upper part of the subsoil that has been mixed with the remaining original surface layer by plowing. The A and B horizons combined are 20 to 40 inches thick. Tilth generally is fair.

Included with this soil are a few areas of a soil that has a surface layer of gravelly sandy loam and some areas of a soil that has a subsoil of micaceous loam. Also included are small areas in which the A and B horizons combined are 40 to 60 inches thick and that generally are in slight depressions and at the base of slopes. All of these included soils are too small to be mapped separately.

The strong slopes and slow infiltration make runoff very rapid and the hazard of further erosion severe on this Madison soil. This soil therefore is not suited to cultivation. It is suited to pine trees. About 90 percent of the acreage is wooded; the rest is cultivated, pastured, or left idle.

## Musella Series

The Musella series consists of shallow to moderately deep, well-drained to somewhat excessively drained soils formed in material weathered from diorite and other similar rocks. These soils are in the uplands on narrow ridgetops and short, strongly sloping to very steep areas adjacent to drainageways. The areas range from 5 to 25 acres, and they are mostly in the central part of the county.

In the less eroded areas, the surface layer is dark reddish-brown or dusky-red stony or cobbly loam. In the more eroded areas, the surface layer is dark-red to red cobbly clay loam or cobbly clay. The subsoil is firm stony or cobbly clay to stony or cobbly clay loam and ranges from dark red to red in color, but in a few areas it is dusky red. Depth to fractured and broken rock ranges between 15 and 36 inches in most places.

These soils generally are in poor tilth. Natural fertility and content of organic matter are low, infiltration is slow, permeability is moderately slow, and available water capacity is low.

Musella soils generally occur with Davidson and Gwinnett soils, but in a few places they occur with Cecil soils. They have a darker surface layer, a darker red subsoil, and thinner A and B horizons than Cecil soils. They are shallower to hard rock than Davidson and Gwinnett Soils, and unlike those soils have a cobbly surface layer.

About 75 percent of the acreage of these soils is wooded or pastured. The rest is cultivated or is left idle.

Representative profile of a Musella cobbly loam on 15 to 25 percent slopes, under pines and hardwoods (about 7.5 miles east-northeast of Lawrenceville on the west side of Hurricane Shoals Road and 100 feet north of the Apalachee River):

A1--0 to 6 inches, dusky-red (2.5YR 3/2) cobbly loam; weak, fine, granular structure; friable; many fine roots; strongly acid; abrupt, smooth boundary.

Bt--6 to 15 inches, red (10R 4/6) clay; moderate, medium, subangular blocky structure; firm; about 2 percent, by volume, is partly weathered mafic rock; very strongly acid; clear, wavy boundary.

C1--15 to 23 inches, strong-brown, soft, weathered mafic rock makes up about 95 percent of this horizon and red, clayey material surrounds the rock fragments; strongly acid; gradual, irregular boundary.

C2--23 to 35 inches, strong-brown, soft, highly weathered schist that contains pockets of red, clayey material; many fine mica flakes; strongly acid.

In the less eroded areas, the surface layer is dusky-red or dark reddish-brown to reddish-brown stony or cobbly loam, but in small more eroded areas, the surface layer is dark-red to red cobbly clay loam. The subsoil ranges from dark red to red and from clay loam to clay and is stony and cobbly. The solum generally is about 18 inches

thick. Depth to broken rock ranges between 15 and 36 inches.

Musella cobbly loam, 6 to 15 percent slopes (MCD).--This soil is on narrow ridgetops and short, sloping hillsides in areas of 5 to 20 acres. The A and B horizons combined are 2 to 4 inches thicker, but the profile otherwise is similar to the one described as representative for the series. In a few areas the surface layer is gravelly or stony loam.

Included with this soil are a few areas of a soil in which the A and B horizons combined are as much as 24 inches thick. Also included are some areas of Wilkes stony sandy loam. These included soils are too small to be mapped separately.

The shallow root zone, poor tilth, and low available water capacity make this Musella soil poorly suited to cultivation. About 70 percent of the acreage is wooded; the rest is cultivated or pastured, is left idle, or is used as building sites for residences.

Musella cobbly loam, 15 to 45 percent slopes (MCF).--This soil is on short, steep slopes and generally is adjacent to drainageways. The areas range from 5 to 25 acres. The profile of this soil is like the one described as representative for the series.

Included with this soil are a few areas of a soil that has a surface layer of gravelly or stony loam and some areas of a soil in which the A and B horizons combined are as thick as 24 inches. Also included are some areas of Gwinnett loam and of Wilkes sandy loam. All of these included soils are too small to be mapped separately.

The steep slopes, shallow root zone, poor tilth, and low available water capacity make this Musella soil better suited to pine trees than to cultivated crops. About 80 percent of the acreage is wooded; the rest is pastured or cultivated, is left idle, or is used as building sites for residences.

## Pacolet Series

In the Pacolet series are moderately deep to deep, well-drained soils formed in material weathered from gneiss, mica schist, and granite. These soils are in the uplands on broad to narrow ridgetops and on moderately long slopes and on short, steep side slopes. The areas are scattered throughout the county.

In the less eroded areas, the surface layer is light yellowish-brown to brown sandy loam 6 to 10 inches thick. The subsoil is red to reddish-brown sandy clay to clay and is 20 to 30 inches thick. In the more eroded areas, the surface layer ranges from yellowish-red to red sandy clay loam. Depth to weathered and broken rock commonly is 3 to 5 feet.

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

Pacolet soils occur with Appling, Cecil, Gwinnett, Louisburg, Madison, Red Bay, and Wedowee soils. They have a redder subsoil than Appling and Wedowee soils, and their surface layer contains less mica than that in the Madison and Red Bay soils. Their surface layer and subsoil are less red than those in Gwinnett soils. The A and B horizons combined in the Pacolet soils are thicker than in the Louisburg soils, and the horizons are more distinct, but they are thinner than those in Cecil soils.

The present vegetation on the Pacolet soils is chiefly white oak, post oak, red oak, hickory, and loblolly pine, but dogwood, sourwood, sweetgum, shortleaf pine, and yellow-poplar grow in some areas. About 65 percent of the acreage is cultivated; the rest of the acreage has been planted to loblolly pine or is unimproved woodland.

Representative profile of Pacolet sandy loam, 2 to 6 percent slopes, eroded, in a pasture (7.6 miles northeast of Lawrenceville along Georgia Highway No. 124 and 300 feet southwest of its junction with Georgia Highway No. 324):

Ap--0 to 7 inches, brown (10YR 5/3) sandy loam; weak, fine, granular structure; very friable; many fine roots; a few angular quartzite pebbles; medium acid; clear, smooth boundary.

B1--7 to 10 inches, strong-brown (7.5YR 5/8) light sandy clay loam; weak, fine, subangular blocky structure; friable; many fine roots; a few angular quartzite pebbles; strongly acid; abrupt, smooth boundary.

B2t--10 to 26 inches, red (2.5YR 4/6) clay; moderate, medium, subangular blocky structure; slightly firm; many thick clay films on faces of peds; a few fine roots; a few quartz fragments; very strongly acid; clear, wavy boundary.

B3--26 to 34 inches, red (2.5YR 4/8) sandy clay loam; moderate, medium, subangular blocky structure; friable; a few thin clay films on faces of some peds; a few quartz fragments; very strongly acid; gradual, wavy boundary.

C--34 to 48 inches, light-red (2.5YR 6/8) sandy loam; friable; a few fine mica flakes; very strongly acid.

The surface layer ranges from light yellowish-brown to brown sandy loam, cobbly sandy loam, and sandy clay loam. The more eroded areas are yellowish red to red. The subsoil ranges from yellowish-red to red sandy clay to clay. In places the lower part of the subsoil is mottled with yellowish red and yellowish brown. The solum is 20 to 40 inches thick. Depth to weathered and broken rock commonly is 3 to 5 feet.

Pacolet sandy loam, 2 to 6 percent slopes, eroded (PfB2).--This soil is on broad to narrow ridgetops. Its profile is the one described as representative for the series. This soil has a moderately deep root zone and generally is in good tilth.

Included with this soil are a few areas of a somewhat severely eroded soil that has a surface layer of yellowish-red or red sandy clay loam. Also included are some areas of a soil that has a surface layer of gravelly sandy loam 4 to 8 inches thick and some other areas with a surface layer 4 to 6 inches thicker than that in the profile described as representative for the series. All of these included soils are too small to be mapped separately.

This Pacolet soil can be cultivated if it is well managed, and it is suited to a wide range of crops. If it is cultivated or left bare, the hazard of further erosion is moderate. About 65 percent of the acreage is cultivated or pastured (pl. II). The rest is wooded, left idle, or used as building sites for residences or industries.

Pacolet sandy loam, 6 to 10 percent slopes, eroded (PfC2).--This soil is on moderately long slopes and generally is adjacent to ridgetops. In places the subsoil is slightly mottled with yellowish brown and yellowish red, but the profile otherwise is similar to the one described as representative for the series.

The surface layer of this soil generally is in good tilth. The root zone is moderately deep. Runoff is medium.

Included with this soil are a few areas of a soil that has a surface layer of gravelly sandy loam. Also included are some severely eroded areas, where the surface layer is yellowish-red or red sandy clay loam and tilth is poor.

This Pacolet soil is suited to a wide range of crops, and if it is well managed, it can be cultivated without exceeding allowable soil losses. The hazard of further erosion is moderate if the soil is cultivated. About 45 percent of the acreage is wooded or idle; the rest is cultivated or pastured or is used as building sites for residences or industries.

Pacolet sandy clay loam, 2 to 6 percent slopes, eroded (PgB2).--This soil is on narrow to broad ridgetops. The surface layer is yellowish-red sandy clay loam 3 to 6 inches thick. It consists of material formerly in the upper part of the subsoil that has been mixed with the remaining original surface layer by plowing. In some of the more eroded areas, the red, clayey subsoil is exposed.

Tilth generally is poor in this soil because of the clay content in the surface layer. Runoff is rapid, and the hazard of further erosion is moderate to severe if the soil is left bare.

Included with this soil are a few small slightly eroded areas. Here the surface layer is yellowish-brown to strong-brown sandy loam.

Under good management this Pacolet soil is moderately well suited to crops, and the response of crops is fair to good. This soil is well suited to use as sites for residences and industries. About 45 percent of the acreage is cultivated, pastured, or used as sites for residences or industries; the rest is wooded or idle.

Pacolet sandy clay loam, 6 to 10 percent slopes, eroded (PgC2).--This soil is on broad ridgetops and on moderately long slopes in areas of 5 to 50 acres. The surface layer is yellowish-red to red sandy clay loam 3 to 5 inches thick. It consists of material formerly in the upper part of the subsoil that has been mixed with the remaining original surface layer by plowing. The A and B horizons combined are about 35 inches thick. Tilth generally is poor because of the clayey surface layer.

Included with this soil are some severely eroded areas, and here the red, clayey subsoil is exposed. Also included are some areas of a soil that has a surface layer of yellowish-brown to strong-brown sandy loam. These included soils are too small to be mapped separately.

The slope, texture, slow infiltration, and rapid runoff make the hazard of further erosion severe on this Pacolet soil. If this soil is well managed, however, it can be cultivated occasionally. It is suited to permanent pasture, to pine trees, and to use as sites for residences or industries. About 55 percent of the acreage is wooded; the rest is cultivated or pastured, is idle, or is used as building sites for residences or industries.

Pacolet sandy clay loam, 10 to 15 percent slopes, (PgD2).--This soil is on short to moderately long, moderately sloping hillsides in areas of 5 to 75 acres. The surface layer is yellowish-red to red sandy clay loam 3 to 5 inches thick. It consists of material formerly in the upper part of the subsoil that has been mixed with the remaining original surface layer by plowing. The A and B horizons combined are about 36 inches thick. Tilth generally is poor.

Included with this soil are small areas of a severely eroded soil in which the red, clayey subsoil is exposed. Also included are small areas of a soil that has a surface layer of yellowish-brown to strong-brown sandy loam 6 to 10 inches thick.

The slope, slow infiltration, and rapid runoff make the hazard of further erosion severe on this Pacolet soil. This soil consequently is not suited to cultivation. It is suited to permanent pasture, pine trees, and for use as sites for residences or industries. About 75 percent of the acreage is wooded or is idle; the rest is cultivated, pastured, or used as building sites for residences and industries.

Pacolet sandy clay loam, 15 to 25 percent slopes, eroded (PgE2).--This soil is on moderately steep to steep, short slopes in areas of 3 to 35 acres. The surface layer is yellowish-red to red sandy clay loam 3 to 5 inches thick. It consists of material formerly in the upper part of the subsoil that has been mixed with the remaining original surface layer by plowing. Tilth generally is poor.

Included with this soil are small severely eroded areas of a soil in which the red, clayey subsoil is exposed. Also included are small areas of a soil that has a surface layer of

yellowish-brown to strong-brown sandy loam 4 to 8 inches thick.

The strong slopes, slow infiltration, and very rapid runoff make the erosion hazard severe on this Pacolet soil. This soil therefore is not suited to cultivation, and it especially is not suited to clean-tilled crops. About 80 percent of the acreage is wooded or is idle; the rest is cultivated or pastured or is used as sites for residences.

Pacolet cobbly sandy loam, 15 to 45 percent slopes (PiF).--This soil is on moderately steep to steep, short slopes adjacent to drainageways. The surface layer commonly is yellowish-brown cobbly sandy loam 4 to 5 inches thick. The subsoil is red to yellowish-red clay loam to clay to a depth of about 36 inches, and it generally is mottled with yellowish brown in the lower 4 to 6 inches.

Included with this soil are some small areas of a soil that has a surface layer of stony or gravelly sandy loam. Also included are small areas of Cecil soils.

The cobblestones on the surface, strong slopes, and severe hazard of further erosion make this soil unsuitable for cultivation. It is suited, however, to permanent pasture and to pine trees. About 85 percent of the acreage is wooded; the rest is cultivated or pastured, is left idle, or is used as building sites for residences or industries.

## Red Bay Series

In the Red Bay series are deep, well-drained soils that formed in alluvium. These soils are on terraces; on broad, gently sloping ridgetops; and on short side slopes. They occupy small areas near the Chattahoochee River.

The surface layer is reddish-brown to very dusky red sandy loam to fine sandy loam. The subsoil is dark-red to red sandy clay loam and generally is friable. The transported material in which the soils formed generally is 5 to 10 feet deep. Depth to hard rock is more than 10 feet.

The natural fertility and content of organic matter in these soils are low. Permeability is moderate, and available water capacity is medium.

Red Bay soils occur with Gwinnett, Madison, Pacolet, and Wickham soils. They have a darker colored surface layer than the Pacolet and Wickham soils, and their subsoil generally is darker red. They are thicker than the Gwinnett and Pacolet soils and are deeper to hard rock.

About 90 percent of the acreage of these soils is cultivated or pastured; the rest is idle, is wooded, or is used as building sites for residences.

Representative profile of Red Bay sandy loam, 2 to 6 percent slopes,in a cultivated field (2 miles northwest of Duluth and about one-half mile east of Georgia Highway No. 120):

Ap--0 to 9 inches, very dusky red (2.5YR 2/2) sandy loam; weak, fine, granular structure; loose; a few fine roots; strongly acid; clear, smooth boundary.

B1--9 to 26 inches, dark reddish-brown (2.5YR 3/4) light sandy clay loam; weak, fine and medium, subangular blocky structure; very friable; a few fine roots; very strongly acid; gradual, wavy boundary.

B2t--26 to 52 inches +, red (10R 4/6) to dark-red (2.5YR 3/6) sandy clay loam; weak, medium, subangular blocky structure; friable; very strongly acid.

The surface layer is very dusky red, reddish-brown, dark-brown, or very dark brown sandy loam or fine sandy loam 6 to 10 inches thick. The subsoil is dark-red or dark reddish-brown to red sandy clay loam. Thickness of the solum is predominantly 40 to 60 inches but may range to 70 inches.

Red Bay sandy loam, 2 to 6 percent slopes (RhB).--This is the only Red Bay soil mapped in the county. Its profile is the one described as representative for the series. The areas are 5 to 10 acres in size and are on broad ridgetops and on short hillsides. Generally this soil is within one-half mile of the Chattahoochee River.

Included with this soil are some areas of Pacolet and Wickham soils. Also, about 10 to 15 percent of the acreage consists of an included soil that has a surface layer of fine sandy loam and a slightly coarser textured subsoil than this Red Bay soil. All areas of these included soils are too small to be mapped separately.

The deep root zone, friable texture, good tilth, and gentle slopes make this Red Bay soil suited to most crops grown locally. This soil can be farmed moderately intensively, and crops on it respond well if fertilizer is applied and if other good management is used.

## Rock Land

Rock land (2 to 50 percent slopes)(Roc) consists of areas that have granite at or within a few inches of the surface. From 30 to 40 percent of the acreage consists of pockets of coarse-textured soil material that has little soil development. The areas are small and are mainly in the southeastern part of the county, but some are scattered throughout the county.

Plants in areas of Rock land generally do not grow well, though a few shrubs, grasses, and scrubby trees have survived for years in small pockets of soil material or in crevices between rocks. This land type can be developed to a limited extent for recreational use. It provides little food and cover for wildlife.

## Wedowee Series

The Wedowee series consists of deep, well-drained soils that formed in material weathered from granite, gneiss, and mica schist. These soils are in the uplands on moderately steep to steep side slopes and generally are near drainageways.

They occupy large areas in the southern, eastern, and northeast-central parts of the county, but small areas are widely scattered throughout the rest of the county.

In the less eroded areas, these soils have a surface layer of light yellowish-brown to brown sandy loam. The uppermost 3 to 8 inches of the subsoil is yellowish-brown or strong-brown sandy clay loam. Below is yellowish-red clay loam to sandy clay loam to a depth of about 25 inches. At a depth below 25 inches, is mottled yellowish-red, red, and yellow clay loam to loam. Depth to hard rock generally is more than 5 feet.

The natural fertility and content of organic matter are low in these soils. Permeability is moderate, and internal drainage, runoff, and available water capacity are medium.

These soils occur with the Appling, Louisburg, and Pacolet soils. Their A and B horizons combined are 10 to 20 inches thinner than those in the Appling soils. They also are thinner than those in the Cecil soils. Wedowee soils are less red than the Cecil and Pacolet and have a more clayey subsoil than the Louisburg.

Wedowee soils are well suited to trees. White oak, post oak, red oak, and hickory are the chief trees in the wooded areas, though sweetgum, yellow-poplar, and loblolly pine grow in some places. About 75 percent of the acreage is wooded, and the rest is used as pasture, is cultivated, or left idle.

Representative profile of Wedowee sandy loam, 10 to 25 percent slopes, eroded, under hardwoods (about one-half mile east of the intersection of Interstate Highway No. 85 and Stevens Norcross Road):

A1--0 to 8 inches, brown (10YR 5/3) sandy loam; weak, fine and medium, granular structure; very friable; many fine and medium roots; strongly acid; clear, smooth boundary.

A2--8 to 11 inches, yellowish-brown (10YR 5/6) sandy loam; weak, fine and medium, subangular blocky structure; very friable; many fine and medium roots; very strongly acid; clear, wavy boundary.

B1t--11 to 16 inches, strong-brown (7.5YR 5/8) sandy clay loam; weak, medium, subangular blocky structure; friable; quartz pebbles make up about 1 percent, by volume, of this horizon; many fine and a few medium roots; very strongly acid; gradual, wavy boundary.

B2t--16 to 25 inches, yellowish-red (5YR 5/8) sandy clay; moderate, medium, subangular blocky structure; firm; many mica flakes; a few fine roots; very strongly acid; gradual, wavy boundary.

B3--25 to 35 inches, yellowish-red (5YR 5/8) clay loam; a few, medium, prominent mottles of brownish yellow (10YR 6/6); weak, medium, subangular blocky structure; friable; many mica flakes; a few fine roots; very strongly acid; gradual, wavy boundary.

C--35 to 50 inches +, yellowish-red (5YR 5/8) loam, which has a few, fine, mottles of distinct red (2.5YR 5/8) and contains partly weathered mica gneiss.

The surface layer ranges from light yellowish-brown to brown sandy loam in the less eroded areas, but it is yellowish-brown to light-red sandy clay loam in the more eroded areas. The A horizon ranges from 7 to 13 inches in thickness. The solum generally is about 37 inches thick, but it ranges from 35 to 40 inches in thickness.

Wedowee sandy loam, 10 to 25 percent slopes, eroded (WrE2).--This is the only Wedowee soil mapped in the county. Its profile is the one described as representative for the series. A few small places are more eroded, and here the surface layer is yellowish-brown to light-red sandy clay loam, tilth is poor, and infiltration is slow.

Included with this soil are a few small areas of a soil in which the A and B horizons combined are 40 to 50 inches thick. Also included are small areas of a soil that has enough very fine mica flakes in the subsoil that it feels greasy.

This Wedowee soil is poorly suited to cultivation. The strong slopes and moderately rapid runoff make the hazard of further erosion moderate to severe in areas left bare. Under good management, however, the less sloping areas can be cropped occasionally.

## Wehadkee Series

In the Wehadkee series are moderately deep to deep, poorly drained soils on first bottoms. These soils formed in alluvium washed from areas underlain primarily by granite, gneiss, and other siliceous igneous and metamorphic rocks. They are on broad, moderately long to long flood plains along the rivers and other large streams in the county. Wehadkee soils generally occupy concave areas between soils on the bottoms and in the uplands that are better drained.

These soils have a surface layer of light brownish-gray loam to silt loam. The subsoil generally is gray to dark-gray silty clay loam mottled with dark yellowish brown. Depth to hard rock is more than 10 feet in most places.

The natural fertility and content of organic matter in these soils are low. Permeability is slow. The water table is high and is near the surface during winter.

Wehadkee soils occur with the Buncombe, Chewacla, and Congaree soils on level to nearly level flood plains along the rivers and other large streams, and with the Augusta and Worsham soils on low stream terraces and in the uplands. They are finer textured and wetter than Buncombe soils and grayer and more poorly drained than Chewacla soils. They are more poorly drained than the Augusta soils and have about the same internal drainage as the Worsham, but they lack the distinct B horizon of those soils.

About 90 percent of the acreage of these soils is wooded or pastured, and the rest is cultivated or

idle. The chief plants in the wooded areas are willow, blackgum, alder, yellow-poplar, and other plants that tolerate wetness.

Representative profile of a Wehadkee silt loam on slopes of 0 to 2 percent, under hardwoods (250 feet north of Pate Road and 50 feet east of Haynes Creek):

Ap--0 to 6 inches, light brownish-gray (10YR 6/2) silt loam; many, medium, distinct mottles of dark yellowish brown (10YR 3/4); weak, medium, subangular blocky structure; slightly sticky; many fine and medium roots; very strongly acid; gradual, wavy boundary.

B1g--6 to 30 inches, gray (10YR 6/1) silty clay loam; many, medium, distinct mottles of dark yellowish brown (10YR 3/4); weak, medium, subangular blocky structure; sticky; many fine and medium roots; very strongly acid; gradual, wavy boundary.

B2g--30 to 40 inches, gray (10YR 5/1) heavy silty clay loam; many, fine and medium, distinct mottles of dark yellowish brown (10YR 3/4); weak, medium, subangular blocky structure; sticky; extremely acid; gradual, wavy boundary.

Cg--40 to 52 inches +, dark-gray (10YR 4/1) sandy clay loam; massive; slightly sticky; extremely acid.

The surface layer is light brownish-gray to gray loam and silt loam 4 to 7 inches thick. The subsoil is gray to dark-gray sandy clay loam to silty clay loam. It is stratified and is mottled with shades of brown, yellow, and red. The solum generally is more than 40 inches thick, but it ranges from 30 to 50 inches in thickness. Reaction ranges from strongly acid to extremely acid.

Wehadkee soils, frequently flooded (0 to 2 percent slopes) (WeD).--These are the only Wehadkee soils mapped in the county. They are in poor tilth. Runoff is very slow, and depth to the water table generally is less than 24 inches. During the winter water stays on the surface for more than 10 days at a time.

Included with these soils are some areas of a soil that has a surface layer of silty clay loam, and other areas that have thin layers of sand in the profile at varying depths. Also included are areas of Augusta, Chewacla, and Worsham soils. All of these included soils are too small to be mapped separately.

Wehadkee soils, frequently flooded, are suited to a limited number of crops, but they can be cropped intensively if drainage is provided. Crops on these soils respond fairly well if fertilizer is applied. Most of the acreage is wooded or pastured, and except for a few small cultivated areas, the rest is idle. Some areas are good habitats for waterfowl (pl. III).

## Wickham Series

In the Wickham series are deep, well-drained soils that formed in material washed from soils in the uplands. These soils are on broad, gently sloping ridgetops and moderately long side slopes or are on stream terraces. The areas are small and are chiefly near the larger streams in the county.

In the less eroded areas, the surface layer commonly is dark yellowish-brown sandy loam, and the subsoil is yellowish-red, red, or strong-brown clay loam to sandy clay loam. Mottles occur below a depth of about 36 inches. The surface layer and subsoil are friable. The transported material in which the soils formed is between 4 and 10 feet thick. Depth to hard rock is more than 10 feet.

The natural fertility and content of organic matter in these soils are low. Permeability is moderate, and runoff and available water capacity are medium. The root zone is deep.

Wickham soils occur with Altavista and Augusta soils on nearly level to very gently sloping stream terraces, with Red Bay soils on high terraces, and with Gwinnett soils in the uplands. They are better drained than Altavista and Augusta soils, are more friable and have a less red subsoil than Gwinnett soils, and are not so red as Red Bay soils.

About 75 percent of the acreage of these soils is pastured or cultivated. White oak, post oak, water oak, and hickory are the chief trees in wooded areas, though shortleaf and loblolly pines grow in some places. In abandoned fields, shortleaf and loblolly pines now grow.

Representative profile of Wickham sandy loam, 2 to 6 percent slopes, eroded, in a cultivated field (2 1/2 miles west of Duluth and 700 feet north of McClure Bridge Road):

Ap--0 to 7 inches, dark yellowish-brown (10YR 4/4) sandy loam; weak, fine, granular structure very friable; many fine roots and a few rounded quartz pebbles; very strongly acid; abrupt, smooth boundary.

B21t--7 to 21 inches, yellowish-red (5YR 4/6) sandy clay loam; weak, medium, subangular blocky structure; friable; a few quartz pebbles; a few thin patches of clay films on ped faces; very strongly acid; clear, wavy boundary.

B22t--21 to 34 inches, strong-brown (7.5YR 5/6) heavy clay loam; many, medium, prominent mottles of yellowish red (5YR 4/6) and pale brown (10YR 6/3); moderate, medium, subangular blocky structure; slightly firm; clay films on ped faces; a few mica flakes; very strongly acid; gradual, wavy boundary.

B23t--34 to 62 inches, yellowish-brown (10YR 5/6) clay; common, fine, prominent mottles of red (2.5YR 4/8), a few, fine, prominent mottles of light gray (10YR 7/2), and common, medium, prominent mottles of strong brown (7.5YR 5/6);

moderate, medium, subangular blocky structure; firm; a few fine mica flakes; extremely acid.

Texture of the surface layer is dominantly sandy loam, though in places it is gravelly sandy loam. The color of the surface layer ranges from dark yellowish brown to dark brown, but in small more severely eroded areas it is reddish brown and the texture is clay loam to sandy clay loam. The subsoil is chiefly sandy clay loam in texture, but it ranges to clay in the lower part. Its color is strong brown, yellowish red, or red. Depth to mottling ranges between 21 and 36 inches. The material in which the soil formed generally is 4 to 10 feet thick, but it ranges from 3 to 10 feet in thickness. The solum generally is about 60 inches thick. Depth to hard rock generally is more than 10 feet.

Wickham sandy loam, 2 to 6 percent slopes, eroded (WgB2).--This soil is on broad, gently sloping ridgetops and hillsides in areas of 2 to 10 acres. The A and B horizons combined range between 27 and 60 inches in thickness, but the profile of this soil otherwise is similar to the one described as representative for the series.

Included with this soil are small severely eroded areas, a few small areas that have a dark-red subsoil, and small areas that have a surface layer of gravelly sandy loam.

This Wickham soil is well suited to moderately intensive use, but if it is cultivated, the hazard of further erosion is slight to moderate. About 80 percent of the acreage is cultivated or pastured; the rest is wooded or idle or is used as building sites for residences or industries.

Wickham sandy loam, 6 to 10 percent slopes, eroded (WgC2).--This soil is on narrow ridgetops and sloping to strongly sloping side slopes in areas of less than 5 to more than 10 acres. The surface layer is dark-brown, friable sandy loam 4 to 8 inches thick. Small rills and shallow gullies are common in cultivated fields after a hard rain. In some areas rounded gravel is on the surface. In the more eroded areas, the subsoil is exposed, and in some places the red sandy clay loam subsoil is mottled with yellowish red and yellowish brown. Tilth generally is good.

This soil is well suited to moderately intensive use, though if it is cultivated, the hazard of further erosion is slight to moderate. About 70 percent of the acreage is cultivated or pastured; the rest is wooded or idle or is used as building sites for residences or industries.

## Wilkes Series

The Wilkes series consists of shallow to moderately deep, well-drained to somewhat excessively drained soils formed in material weathered from a mixture of such rocks as hornblende gneiss, granite, and schist. These soils are in the uplands on narrow ridgetops and short, steep side slopes. They occupy small areas and are chiefly in the northeastern part of the county and southwest of Lawrenceville.

These soils commonly have a surface layer of very dark brown cobbly sandy loam and a subsoil of thin, discontinuous, yellowish-brown clay loam. Stones are on the surface and throughout the profile. Depth to the partly weathered parent material is about 12 inches.

The natural fertility and content of organic matter are low in these soils. Permeability is rapid to moderate. The stones in and on these soils make use of farm machinery impractical.

Wilkes soils occur with the Helena, Iredell, Louisa, and Louisburg soils. They are not so clayey as Helena soils and lack the mottled, plastic clay subsoil of the Iredell. They also lack the small schist fragments and fine mica flakes typical of the Louisa soils. Their surface layer is darker brown than that in the Louisburg soils, and their subsoil is finer textured.

The present vegetation on these soils is chiefly white oak, post oak, hickory, and sassafras, though shortleaf and loblolly pines grow in some places in abandoned fields.

In this county Wilkes soils occur closely with the Iredell soils and are mapped only in a complex with those soils. A description of the Iredell soils is given under the Iredell series.

Representative profile of Wilkes cobbly sandy loam in the Wilkes-Iredell cobbly complex, 6 to 15 percent slopes, under various kinds of hardwoods (600 feet north of Burns Drive-In and Dickens Road on a convex slope of 14 percent that faces north):

A1--0 to 3 inches, very dark brown (10YR 2/2) cobbly sandy loam; weak, fine, granular structure; very friable; about 50 percent, by volume, is cobblestones and gravel; many fine and medium roots; about 15 percent, by volume, is fine, rounded brown and black concretions; many worm casts; slightly acid; abrupt, smooth boundary.

A2--3 to 6 inches, very dark grayish-brown cobbly sandy loam; weak, fine, granular structure; friable; the content of coarse fragments, roots, concretions, and worm casts is the same as in the A1 horizon; medium acid; gradual, wavy boundary.

A3--6 to 10 inches, dark yellowish-brown (10YR 4/4) gravelly sandy loam; weak, fine, granular structure; friable; about 50 percent, by volume, is coarse fragments that are mostly gravel but include some cobblestones; the content of roots, concretions, and worm casts is the same as in the A1 horizon; medium acid; clear, wavy boundary.

B1--10 to 17 inches, yellowish-brown (10YR 5/6) light sandy clay loam; weak, fine, granular structure; friable; the content of coarse fragments is less than 50 percent, by volume; many small and medium concretions; medium acid; clear, wavy boundary.

B2--17 to 20 inches, yellowish-brown (10YR 5/6) clay loam; common, fine, prominent mottles of

strong brown (7.5YR 5/6), olive (5Y 4/3), and red (2.5YR 4/6); weak, medium, subangular blocky structure; firm; about 20 percent, by volume, is coarse fragments; about 15 percent, by volume, is concretions; strongly acid; clear, wavy boundary.

C1--20 to 24 inches, about 75 percent, by volume, is gravel, cobblestones, and larger stones and pockets of strong-brown (7.5YR 5/8) sandy clay loam with pale-olive (5Y 6/4) streaks; very strongly acid; gradual, wavy boundary.

C2--24 to 32 inches, a mixture of equal parts of highly weathered yellowish-brown (10YR 5/8) rock and greenish-gray (5GY 6/1) clay; slightly acid; clear, wavy boundary.

C3--32 to 40 inches, greenish-gray saprolite; slightly acid; abrupt, wavy boundary.

R--40 inches +, rock.

The B2 horizon is not continuous horizontally. The clay content in the subsoil ranges from 18 to 35 percent. Depth to hard rock generally is less than 40 inches, but it ranges from 20 to 45 inches.

Wilkes-Iredell cobbly complex, 6 to 15 percent slopes (WHD).--These soils are on narrow, sloping ridgetops and moderately long side slopes in areas of 3 to 25 acres. They are mostly in the northeastern part of the county.

This complex consists of nearly equal parts of cobbly Wilkes and Iredell soils. Wilkes soils have a surface layer of very dark brown or very dark grayish-brown cobbly sandy loam about 7 inches thick. The subsoil is thin, discontinuous sandy loam or clay loam. Depth to partly weathered parent material is about 20 inches, and depth to hard rock commonly is less than 40 inches.

In the Iredell soils the surface layer is dark-brown to very dark grayish-brown cobbly fine sandy loam about 10 inches thick. The subsoil is mottled, yellowish-brown plastic clay, 18 to 20 inches thick, that overlies partly weathered parent material. Depth to hard rock generally is less than 4 feet.

Included with these soils are some small areas of rock outcrops and of Gwinnett and Musella soils. Also included are small areas on slopes of as much as 25 percent.

These Wilkes and Iredell soils are difficult to till because of the many cobblestones in the surface layer, and they are not suited to cultivated crops. They are better suited to pasture and to pine trees. About 75 percent of the acreage is wooded or pastured; the rest of the acreage is idle.

## Worsham Series

The Worsham series consists of deep, poorly drained soils formed in material weathered from light-colored granite and gneiss. These soils are chiefly around the heads of drainageways, in depressions, and at the base of slopes in the lower part of the uplands. The areas are small and are mainly in the southern part of the county.

These soils have a surface layer of grayish-brown to pale-brown sandy loam. The subsoil is mottled gray, brownish yellow, reddish yellow, and yellow sandy clay loam. Depth to hard rock in most places is more than 5 feet.

The natural fertility and content of organic matter are low in these soils. Available water capacity is medium, and runoff and permeability are slow.

Worsham soils occur with Augusta, Durham, and Helena soils, but they are more poorly drained and are grayer than those soils.

About 85 percent of the acreage of the Worsham soils is wooded; the rest is pastured, cultivated, or left idle. Sweetgum, blackgum, white oak, water oak, poplar, alder, willow, shortleaf pine, and loblolly pine are the chief trees in the wooded areas.

Representative profile of Worsham sandy loam, 2 to 6 percent slopes, in a pasture (1 1/2 miles southeast of Grayson and one-fourth mile north of Ozora Road):

Ap--0 to 7 inches, grayish-brown (2.5Y 5/2) sandy loam; weak, fine, granular structure; very friable; a few quartz crystals and many fine roots; strongly acid; abrupt, smooth boundary.

A2--7 to 12 inches, pale-olive (5Y 6/2) sandy loam; weak, fine and medium, subangular blocky structure; very friable; many fine roots; very strongly acid; clear, smooth boundary.

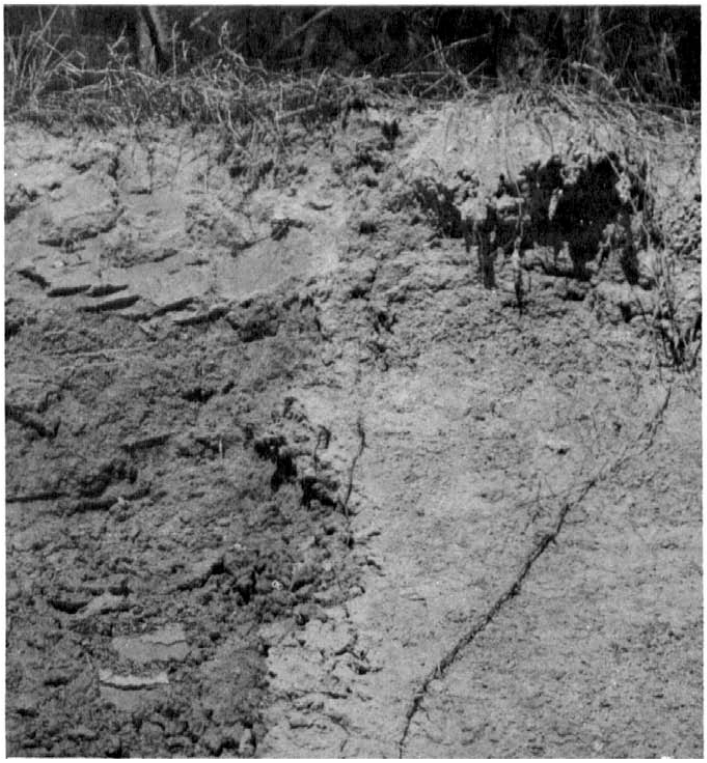
B1t--12 to 18 inches, pale-olive (5Y 6/2) light sandy clay loam; a few, fine, faint mottles of light gray (N 7/0); weak, medium, subangular blocky structure; friable; a few quartz crystals and a few fine roots; very strongly acid; clear, smooth boundary.

B2tg--18 to 33 inches, light olive-gray (5Y 6/2) heavy sandy clay loam; a few, fine, faint mottles of light gray (N 7/0) and common, medium, prominent mottles of brownish yellow (10YR 6/6); moderate, medium, subangular blocky structure; friable; a few quartz crystals; a few clay films; very strongly acid; clear, wavy boundary.

B31tg--33 to 46 inches, light-gray (N 7/0) sandy clay loam; common, medium, prominent mottles of yellow (2.5Y 7/8) and reddish yellow (5YR 6/8); moderate, medium, subangular blocky structure; friable; a few quartz crystals; thin patchy clay films; very strongly acid; clear, wavy boundary.

B32tg--46 to 52 inches +, gray (N 6/0) sandy clay; many, coarse, prominent mottles of brownish yellow (10YR 6/8) and reddish yellow (7.5YR 6/8); moderate, coarse, subangular blocky structure; friable; a few quartz crystals; a few gray clay films on the tops and bottoms of peds; very strongly acid.

The Ap horizon generally is sandy loam, though in places it is silt loam or loam. It ranges from grayish brown to pale brown in color. The subsoil is mainly sandy clay loam but ranges to clay loam.

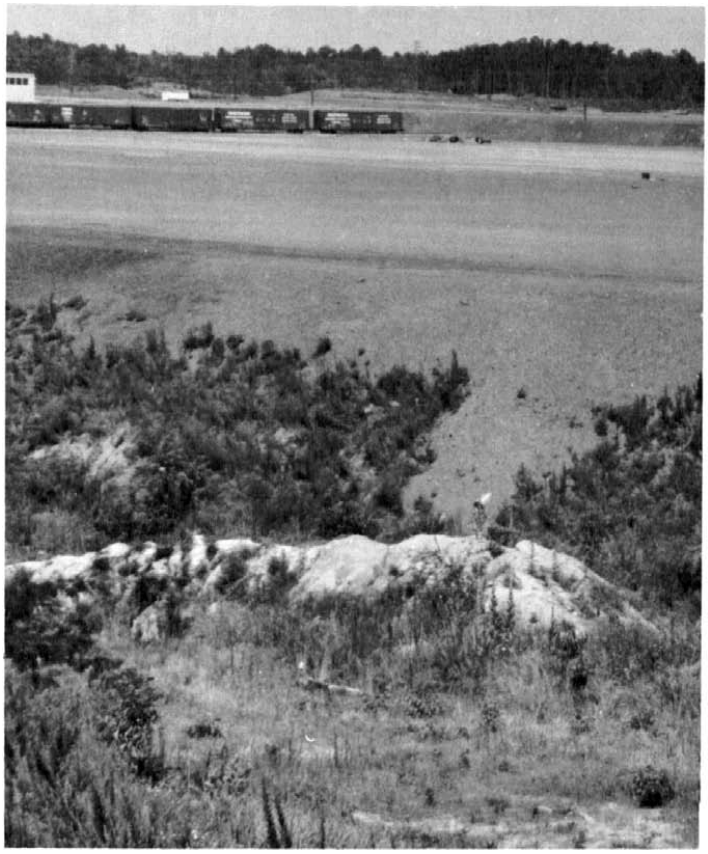


Profile of Cecil sandy loam, 2 to 6 percent slopes, eroded.

Drainage provided for Chewacla soils, frequently flooded, improves the quality of the pasture.

A sucessful stand of pine trees on Gullied land.

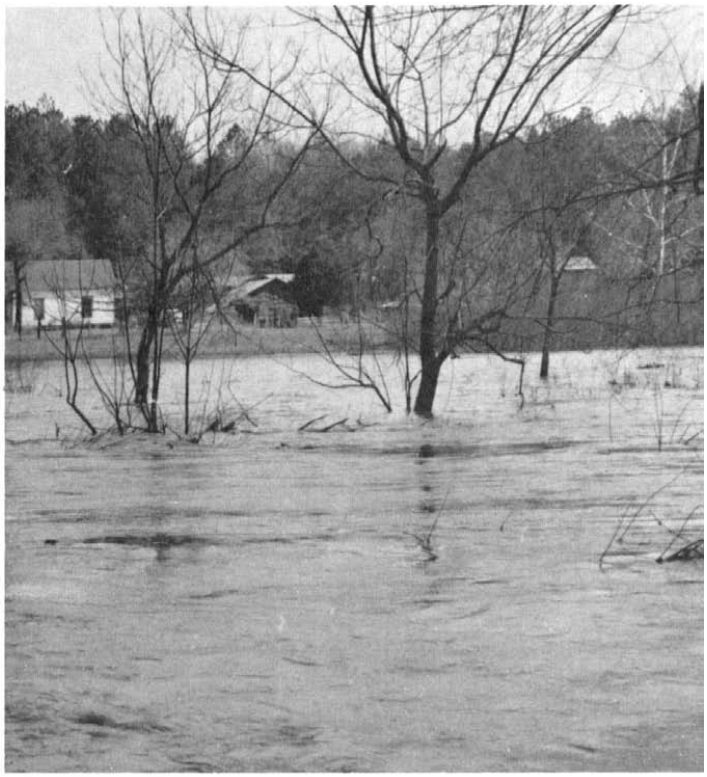
Building for new industry on a Gwinnett soil, one of the soils suitable as a site for industrial plants.



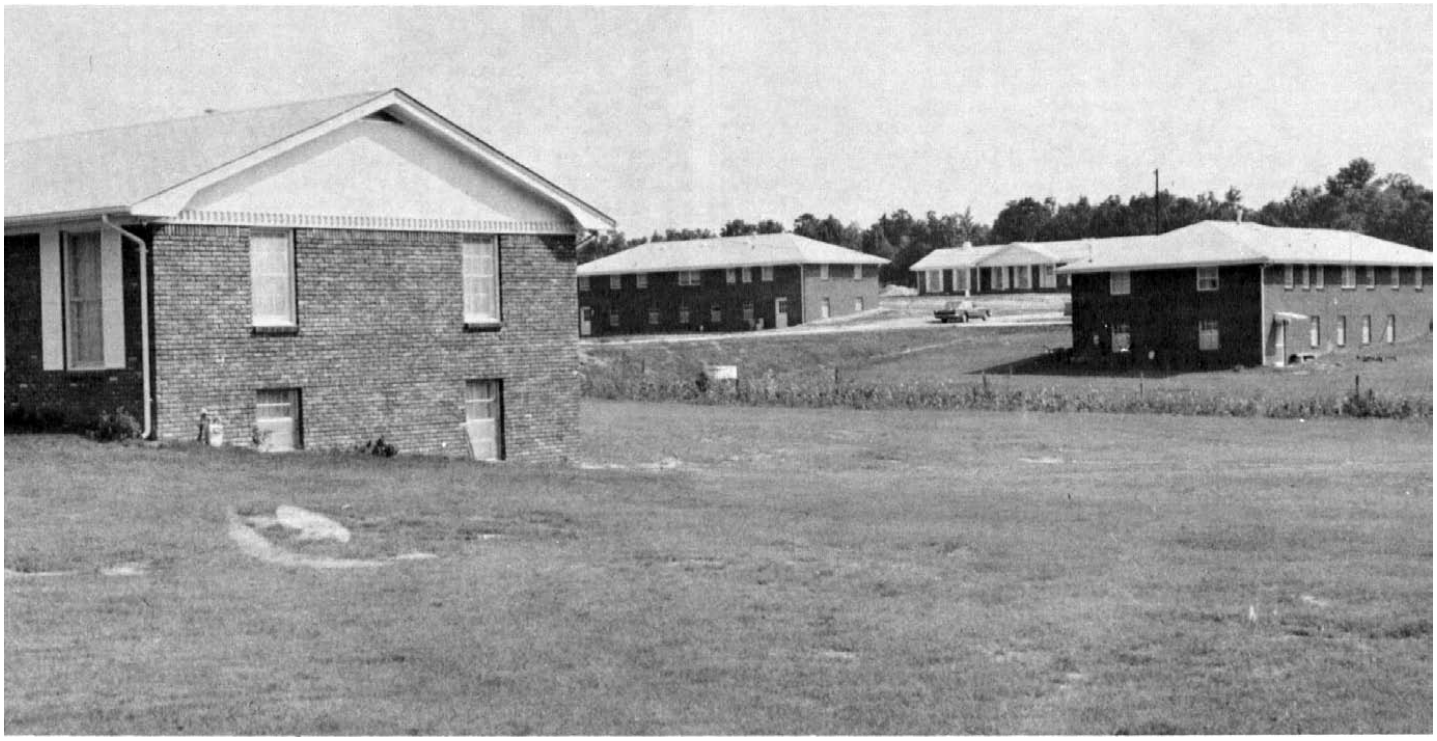
Made land formed by grading and filling for use as sites for industries and for highways.

Pasture of fescue and clover on Pacolet sandy loam, 2 to 6 percent slopes, eroded.

Wehadkee soils, frequently flooded, are good habitats for wildlife.

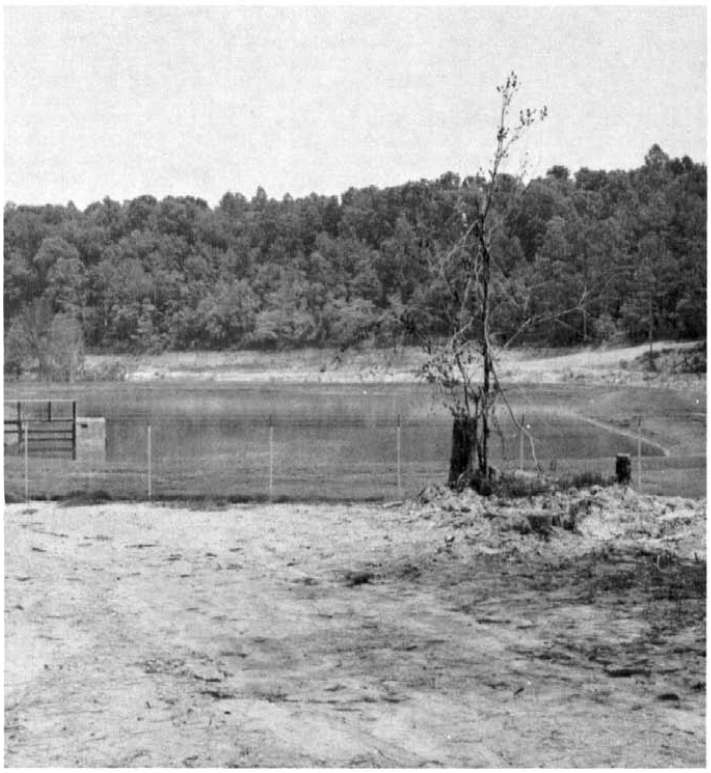


Floodwater from the Yellow River covers an area made up chiefly of Chewacla soils, frequently flooded, and of Worsham sandy loam, 0 to 2 percent slopes, which are subject to very frequent, brief flooding and are therefore severely limited for most nonfarm uses.

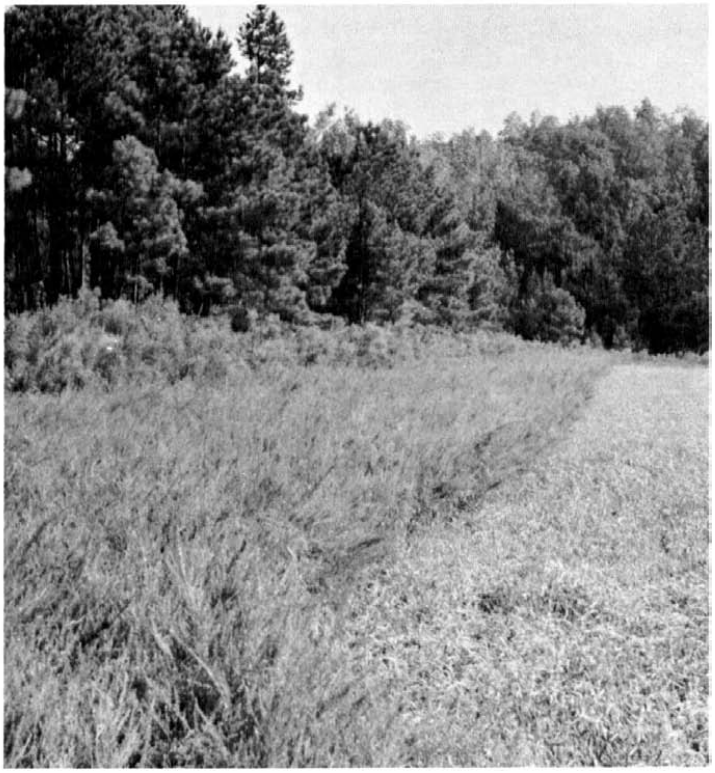


Part of a subdivision on Appling sandy loam, 2 to 6 percent slopes, eroded, one of the soils suitable for residences. The site was under cultivation 2 years before the picture was taken.

Building for light industry on Gwinnett clay loam, 2 to 6 percent slopes, eroded, which has only moderate limitations for such use.



A sewage lagoon in Chewacla soils, frequently flooded, near the base of the uplands, where they are protected from flooding and provide a suitable location for this use.



Field borders of biocolor lespedeza and sericea lespedeza on Wickham sandy loam, 2 to 6 percent slopes, eroded, provide choice food for bobwhites.

It is light gray mottled with yellowish brown, olive brown, and strong brown. Light-gray to white mottles are in the B horizon at a depth of 10 to 12 inches. The solum generally is about 50 inches thick.

Worsham sandy loam, 0 to 2 percent slopes (WkA).--This soil is in level areas and in slight depressions. The areas generally are on the outer edges of large flood plains in areas of 5 to 25 acres. This soil is in fair tilth. The content of organic matter, natural fertility, and supply of available plant nutrients are low. Runoff is very slow, and the areas remain wet for long periods. The water table generally is at a depth of less than 30 inches, and during some months in winter, it stays on the surface for more than 10 days.

Included with this soil are some small areas that have light-red clay loam overwash 6 to 8 inches thick on the surface. Also included are other small areas that have a surface layer of fine sandy loam or silt loam.

This Worsham soil is suited to only a few cultivated crops, but it can be cropped intensively if drainage is provided. About 85 percent of the acreage is wooded; the rest is cultivated or pastured or left idle.

Worsham sandy loam, 2 to 6 percent slopes (WkB).--This soil is chiefly around the heads of drainageways, in depressions, and at the base of slopes on the lower parts of the uplands. The areas are less than 5 acres in size. The profile of this soil is the one described as representative for the series. This soil generally is in poor tilth and has a shallow root zone. The water table generally is at or near the surface for most of the year.

Included with this soil are some areas that have recent deposits of alluvium on them that range from 6 to 10 inches in thickness. Also included are small areas that have a surface layer of fine sandy loam or loam.

This Worsham soil is suited to only a few cultivated crops, and the response of the crops is poor. About 75 percent of the acreage is wooded; the rest is cultivated or pastured or left idle.

## USE AND MANAGEMENT OF THE SOILS

This section describes management of the soils of Gwinnett County for residential, industrial, recreational, and related nonfarm purposes; for engineering; and for woodland. It also discusses management of the soils for cultivated crops and pasture and for wildlife.

### Use of the Soils for Residential, Industrial, Recreational, and Related Nonfarm Purposes

This section was prepared chiefly for planners, developers, landscape architects, builders, zoning officials, realtors, private and potential landowners, and others interested in use of the soils in Gwinnett County for purposes other than farming. Gwinnett County is near Atlanta and is readily accessible to highway systems. Its population is increasing rapidly because the suburbs are steadily expanding into areas formerly used for farming. The demand for housing developments, shopping centers, schools, parks, golf courses, and other developments, is increasing with the population.

In selecting a site for a home, a highway, an industry, recreational use, or other nonfarm purposes, the suitability of the soils in each site for such use must be determined. Some of the more common properties affecting the use of the soils for nonfarm purposes are soil texture, reaction, and depth; shrink-swell potential; steepness of slopes; permeability; depth to hard rock and to the water table; and hazard of flooding. On basis of these and related characteristics, soil scientists and engineers have rated the soils of Gwinnett County for specific nonfarm purposes. The ratings, and the nature of the soil limitations that influenced the ratings, are shown in table 2.

The ratings used are slight, moderate, and severe and they are applied as the soils occur naturally. If the rating is slight, little or no adjustments are needed in use and no limitations are shown. A moderate rating means that some adjustments are needed in use, and severe, that extensive adjustments are needed before the soil is suitable for a specific purpose.

The ratings for hazard of flooding are different from the others. These ratings take into account hazard from stream overflow (pl. III), from runoff, or from seepage. The ratings express frequency of flooding and length of time that water remains on the surface. Very frequent means the hazard is more often than once every year; frequent, once in 1 to 5 years; and infrequent, less than once in 5 to 20 years. Extremely brief floods last less than 2 days; very brief floods, 2 to 7 days; brief floods, from 7 days to 1 month; and long floods, from 1 to 6 months.

In the paragraphs that follow, each nonfarm use is defined and the properties important in rating the limitations of the soils for such purposes are given. The information can be used, along with table 2, with information in other parts of the survey, and with the soil map at the back of the survey as a guide in planning the use of the soils for nonfarm purposes. Before beginning most construction projects, however, an investigation should be made at the site being considered.

For each major nonfarm use, the soil characteristics that determine the ratings slight and severe and the degrees to which these are expressed, are explained in detail. For a rating of moderate,

TABLE 2.--LIMITATIONS OF THE SOILS FOR RESIDENTIAL,

| Soil name and map symbols | Building structures for-- | | Sewage disposal | | Sanitary land fills |
|---|---|---|---|---|---|
| | Residences | Light industries | Septic tank filter fields | Sewage lagoons | |
| Altavista fine sandy loam, 0 to 2 percent slopes (AkA). | Moderate to severe: frequent, extremely brief flooding. | Moderate to severe: frequent, extremely brief flooding. | Moderate to severe: frequent, extremely brief flooding; moderate to slow percolation. | Moderate: frequent, extremely brief flooding. | Moderate to severe: frequent, extremely brief flooding. |
| Appling sandy loam, 2 to 6 percent slopes, eroded (AmB2). | Slight--------- | Moderate: moderate shrink-swell potential. | Moderate: moderate to slow percolation. | Moderate: slopes. | Slight------ |
| Appling sandy loam, 6 to 10 percent slopes, eroded (AmC2). | Slight--------- | Moderate: moderate shrink-swell potential; slopes. | Moderate: moderate to slow percolation. | Severe: slopes. | Slight------ |
| Appling sandy clay loam, 6 to 10 percent slopes, eroded (AnC2). | Slight--------- | Moderate: slopes; moderate shrink-swell potential. | Moderate: moderate to slow percolation. | Severe: slopes. | Slight------ |
| Augusta soils (0 to 2 percent slopes) (Asl). | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding. | Severe: very frequent, brief flooding; high seasonal water table. |
| Buncombe loamy fine sand (0 to 2 percent slopes) (Bfs). | Severe: frequent, extremely brief flooding. | Severe: frequent, extremely brief flooding; moderate bearing capacity 2/ | Severe: frequent, extremely brief flooding. | Severe: rapid permeability. | Severe: frequent, extremely brief flooding. |
| Cecil gravelly sandy loam, 2 to 10 percent slopes (CeC). | Slight--------- | Moderate: slopes; moderate shrink-swell potential. | Moderate: moderate to slow percolation. | Severe: slopes. | Slight------ |

See footnotes at end of table.

INDUSTRIAL, RECREATIONAL, AND RELATED NONFARM USES

| Cemeteries | Recreational facilities | | | | | Trafficways | Suitability for topsoil |
|---|---|---|---|---|---|---|---|
| | Picnic grounds | Campsites and intensive play areas | Recreational buildings | Golf fairways | Paths and trails | | |
| Moderate to severe: frequent, extremely brief flooding. | Moderate: ponding. | Moderate: moderately high water table; frequent, extremely brief flooding. | Moderate to severe: frequent, extremely brief flooding. | Moderate: frequent, extremely brief flooding and ponding. | Moderate: ponding. | Moderate: moderate traffic supporting capacity. | Fair. |
| Slight------ | Slight-------- | Slight---------- 1/ | Slight-------- | Slight-------- | Slight------ | Moderate: moderate traffic supporting capacity. | Fair. |
| Slight------ | Slight-------- | Moderate: slopes. | Slight-------- | Moderate: slopes. | Slight------ | Moderate: moderate traffic supporting capacity. | Fair. |
| Moderate: clayey surface layer. | Slight-------- | Moderate: slopes; clayey surface layer. | Slight-------- | Moderate: slopes. | Moderate: clayey surface layer. | Moderate: moderate traffic supporting capacity. | Poor. |
| Severe: very frequent brief flooding; high seasonal water table. | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding. | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding; high seasonal water table. | Poor. |
| Moderate: frequent, extremely brief flooding. | Moderate: fair trafficability. | Moderate to severe: frequent, extremely brief flooding; sandy surface layer. | Severe: frequent, extremely brief flooding. | Moderate: frequent, extremely brief flooding. | Slight------ | Severe: frequent, extremely brief flooding. | Poor. |
| Slight------ | Slight-------- | Moderate: slopes. | Slight-------- | Moderate: slopes. | Slight------ | Moderate: moderate traffic supporting capacity. | Fair. |

TABLE 2.--LIMITATIONS OF THE SOILS FOR RESIDENTIAL, INDUSTRIAL,

| Soil name and map symbols | Building structures for-- | | Sewage disposal | | Sanitary land fills |
|---|---|---|---|---|---|
| | Residences | Light industries | Septic tank filter fields | Sewage lagoons | |
| Cecil clay loam, 6 to 10 percent slopes, eroded (CfC2). | Slight--------- | Moderate: slopes; moderate shrink-swell potential. | Moderate: moderate to slow percolation. | Severe: slopes. | Slight------ |
| Cecil sandy loam, 2 to 6 percent slopes, eroded (CYB2). | Slight--------- | Moderate: moderate shrink-swell potential. | Moderate: moderate to slow percolation. | Moderate: slopes. | Slight------ |
| Cecil sandy loam, 6 to 10 percent slopes, eroded (CYC2). | Slight--------- | Moderate: moderate shrink-swell potential; slopes. | Moderate: moderate to slow percolation. | Severe: slopes. | Slight------ |
| Cecil sandy loam, 10 to 15 percent slopes, eroded (CYD2). | Moderate: slopes. | Severe: slopes. | Moderate: slopes. | Moderate: slopes. | Moderate: slopes. |
| Chewacla soils, frequently flooded (0 to 2 percent slopes) (Cfs). | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding. | Severe: very frequent, brief flooding; high seasonal water table. |
| Congaree soils, local alluvium (0 to 2 percent slopes) (Cng). | Severe: frequent, extremely brief flooding. | Severe: frequent, extremely brief flooding. | Severe: frequent, extremely brief flooding. | Severe: frequent, extremely brief flooding. | Severe: frequent, extremely brief flooding. |
| Congaree soils, frequently flooded (0 to 2 percent slopes) (Cos). | Severe: frequent, extremely brief flooding. | Severe: frequent, extremely brief flooding. | Severe: frequent, extremely brief flooding. | Severe: frequent, extremely brief flooding. | Severe: frequent, extremely brief flooding. |
| Congaree loam (0 to 2 percent slopes) (Cus). | Severe: frequent, brief flooding. | Severe: frequent, brief flooding. | Severe: frequent, brief flooding. | Severe: frequent, brief flooding. | Severe: frequent, brief flooding. |

See footnotes at end of table.

| Cemeteries | Recreational facilities | | | | | Trafficways | Suitability for topsoil |
|---|---|---|---|---|---|---|---|
| | Picnic grounds | Campsites and intensive play areas | Recreational buildings | Golf fairways | Paths and trails | | |
| Moderate: clayey surface layer. | Slight-------- | Moderate: slopes; clayey surface layer. | Slight-------- | Moderate: slopes. | Moderate: clayey surface layer. | Moderate: moderate traffic supporting capacity. | Poor. |
| Slight------ | Slight-------- | Slight----------1/ | Slight-------- | Slight-------- | Slight------ | Moderate: moderate traffic supporting capacity. | Fair. |
| Slight------ | Slight-------- | Moderate: slopes. | Slight-------- | Moderate: slopes. | Slight------ | Moderate: moderate traffic supporting capacity. | Fair. |
| Moderate: slopes. | Moderate: slopes. | Severe: slopes-- | Moderate: slopes. | Moderate: slopes. | Slight------ | Moderate: slopes; moderate traffic supporting capacity. | Fair. |
| Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding. | Severe: very frequent brief flooding; high seasonal water table. | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding; high seasonal water table. | Poor. |
| Moderate: frequent, extremely brief flooding. | Moderate: frequent, extremely brief flooding. | Severe: frequent, extremely brief flooding. | Severe: frequent, extremely brief flooding. | Moderate: frequent, extremely brief flooding. | Moderate: frequent, extremely brief flooding. | Severe: frequent, extremely brief flooding. | Good. |
| Moderate: frequent, extremely brief flooding. | Moderate: frequent, extremely brief flooding. | Severe: frequent, extremely brief flooding. | Severe: frequent, extremely brief flooding. | Moderate: frequent, extremely brief flooding. | Moderate: frequent, extremely brief flooding. | Severe: frequent, extremely brief flooding. | Good. |
| Moderate: frequent, brief flooding. | Moderate: frequent, brief flooding. | Severe: frequent, brief flooding. | Severe: frequent, brief flooding. | Moderate: frequent, brief flooding. | Moderate: frequent, brief flooding. | Severe: frequent, brief flooding. | Good. |

TABLE 2.--LIMITATIONS OF THE SOILS FOR RESIDENTIAL, INDUSTRIAL,

| Soil name and map symbols | Building structures for-- | | Sewage disposal | | Sanitary land fills |
|---|---|---|---|---|---|
| | Residences | Light industries | Septic tank filter fields | Sewage lagoons | |
| Davidson loam, 2 to 6 percent slopes, eroded (DgB2). | Slight--------- | Moderate: moderate shrink-swell potential. | Slight-------- | Moderate: slopes. | Slight------ |
| Davidson loam, 6 to 10 percent slopes, eroded (DgC2). | Slight--------- | Moderate: moderate shrink-swell potential; slopes. | Slight-------- | Severe: slopes. | Slight------ |
| Davidson clay loam, 2 to 6 percent slopes, eroded (DhB2). | Slight--------- | Moderate: moderate shrink-swell potential. | Slight-------- | Moderate: slopes. | Moderate: clayey surface layer. |
| Davidson clay loam, 6 to 10 percent slopes, eroded (DhC2). | Slight--------- | Moderate: moderate shrink-swell potential; slopes. | Slight-------- | Severe: slopes. | Moderate: clayey surface layer. |
| Davidson clay loam, 10 to 15 percent slopes, eroded (DhD2). | Moderate: slopes. | Severe: slopes. | Moderate: slopes. | Severe: slopes. | Moderate: clayey surface layer; slopes. |
| Durham sandy loam, 2 to 6 percent slopes (DiB). | Slight--------- | Moderate: moderate shrink-swell potential. | Moderate: moderate to slow percolation. | Moderate: slopes. | Slight------ |
| Gwinnett clay loam, 2 to 6 percent slopes, eroded (GeB2). | Slight--------- | Moderate: moderate shrink-swell potential. | Moderate: moderate to slow percolation. | Moderate: slopes. | Slight------ |
| Gwinnett clay loam, 6 to 10 percent slopes, eroded (GeC2). | Slight--------- | Moderate: slopes; moderate shrink-swell potential. | Moderate: moderate to slow percolation. | Severe: slopes. | Slight------ |
| Gwinnett clay loam, 10 to 25 percent slopes, eroded (GeE2). | Moderate: slopes. | Severe: slopes. | Severe: slopes. | Severe: slopes. | Severe: slopes. |

See footnotes at end of table.

| Cemeteries | Recreational facilities | | | | | Trafficways | Suitability for topsoil |
|---|---|---|---|---|---|---|---|
| | Picnic grounds | Campsites and intensive play areas | Recreational buildings | Golf fairways | Paths and trails | | |
| Slight------ | Moderate: fair trafficability. | Slight: slopes-- | Slight-------- | Slight-------- | Slight------ | Moderate: moderate traffic supporting capacity. | Fair. |
| Slight------ | Moderate: fair trafficability. | Moderate: slopes. | Slight-------- | Moderate: slopes. | Slight------ | Moderate: moderate traffic supporting capacity. | Fair. |
| Moderate: clayey surface layer. | Moderate: clayey surface layer. | Severe to moderate: clayey surface layer. | Slight-------- | Moderate: clayey surface layer. | Moderate: clayey surface layer. | Moderate: moderate traffic supporting capacity. | Poor. |
| Moderate: clayey surface layer. | Moderate: clayey surface layer. | Severe to moderate: clayey surface layer; slopes. | Slight-------- | Moderate: clayey surface layer; slopes. | Moderate: clayey surface layer. | Moderate: moderate traffic supporting capacity. | Poor. |
| Moderate: clayey surface layer; slopes. | Moderate: clayey surface layer; slopes. | Severe: clayey surface layer; slopes. | Moderate: slopes. | Moderate: clayey surface layer; slopes. | Moderate: clayey surface layer. | Moderate: moderate traffic supporting capacity; slopes. | Poor. |
| Slight------ | Slight-------- | Slight---------- 1/ | Slight-------- | Slight-------- | Slight------ | Moderate: moderate traffic supporting capacity. | Fair. |
| Slight------ | Slight-------- | Slight---------- 1/ | Slight-------- | Slight to moderate; clayey surface layer. | Moderate: clayey surface layer. | Moderate: moderate traffic supporting capacity and erosion hazard. | Poor. |
| Moderate: clayey surface layer. | Slight-------- | Moderate: slopes; clayey surface layer. | Slight-------- | Moderate: slopes. | Moderate: clayey surface layer. | Moderate: moderate traffic supporting capacity. | Poor. |
| Severe: slopes. | Moderate: slopes. | Severe: slopes-- | Severe: slopes. | Severe: slopes. | Moderate: clayey surface layer. | Moderate: moderate traffic supporting capacity; erodibility; slopes. | Poor. |

TABLE 2.--LIMITATIONS OF THE SOILS FOR RESIDENTIAL, INDUSTRIAL,

| Soil name and map symbols | Building structures for-- | | Sewage disposal | | Sanitary land fills |
|---|---|---|---|---|---|
| | Residences | Light industries | Septic tank filter fields | Sewage lagoons | |
| Gwinnett loam, 2 to 6 percent slopes, eroded (GgB2). | Slight--------- | Moderate: moderate shrink-swell potential. | Moderate: moderate to slow percolation. | Moderate: slopes. | Slight------- |
| Gwinnett loam, 6 to 10 percent slopes, eroded (GgC2). | Slight--------- | Moderate: moderate shrink-swell potential; slopes. | Moderate: moderate to slow percolation. | Severe: slopes. | Slight------- |
| Gwinnett loam, 10 to 25 percent slopes, eroded (GgE2). | Moderate: slopes. | Severe: slopes. | Severe: slopes. | Severe: slopes. | Severe: slopes. |
| Gullied land (10 to 25 percent slopes) (Gul). | Severe: severe erosion. | Severe: severe erosion; slopes. | Severe: slow percolation; slopes. | Severe: slopes. | Moderate: slopes. |
| Helena sandy loam, 2 to 6 percent slopes (HYB). | Severe: moderate to high shrink-swell potential. | Severe: moderate to high shrink-swell potential. | Severe: slow percolation. | Moderate: slopes. | Moderate: clayey subsoil. |
| Louisa gravelly sandy loam, 6 to 15 percent slopes (LkD). | Moderate: shallowness to rock. | Moderate: rock. | Severe: rock-- | Severe: seepage; slopes. | Moderate: rock. |
| Louisa gravelly sandy loam, 15 to 45 percent slopes (LkF). | Severe: shallowness to rock; slopes. | Severe: rock; slopes. | Severe: rock; slopes. | Severe: rapid permeability; slopes. | Severe: rock; slopes. |
| Louisburg stony loamy sand, 6 to 15 percent slopes (LDD). | Severe: shallowness to hard rock. | Severe: slopes. | Severe: rock-- | Severe: seepage; slopes. | Severe: rock; slopes. |
| Louisburg stony loamy sand, 15 to 45 percent slopes (LDF). | Severe: shallowness to rock; slopes. | Severe: rock; slopes. | Severe: rock; slopes. | Severe: rapid permeability; slopes. | Severe: rock; slopes. |
| Louisburg loamy sand, 2 to 10 percent slopes (LnC). | Moderate: shallowness to rock. | Moderate: rock; slopes. | Severe: rock-- | Severe: seepage; slopes. | Moderate: rock. |
| Louisburg loamy sand, 10 to 25 percent slopes (LnE). | Severe: shallowness to rock; slopes. | Severe: slopes. | Severe: rock-- | Severe: seepage; slopes. | Severe: rock; slopes. |

See footnotes at end of table.

| Cemeteries | Recreational facilities | | | | | Trafficways | Suitability for topsoil |
|---|---|---|---|---|---|---|---|
| | Picnic grounds | Campsites and intensive play areas | Recreational buildings | Golf fairways | Paths and trails | | |
| Slight------ | Slight-------- | Slight[1/]---------- | Slight-------- | Slight-------- | Slight------ | Moderate: moderate traffic supporting capacity. | Fair. |
| Slight------ | Slight-------- | Moderate: slopes. | Slight-------- | Moderate: slopes. | Slight------ | Moderate: moderate traffic supporting capacity. | Fair. |
| Severe: slopes. | Moderate: slopes. | Severe: slopes-- | Severe: slopes. | Severe: slopes. | Moderate: slopes. | Severe: moderate traffic supporting capacity; slopes. | Fair. |
| Severe: poor trafficability; slopes. | Severe: severe erosion. | Severe: severe erosion; slopes. | Severe: severe erosion; slopes. | Severe: severe erosion; slopes. | Moderate: severe erosion; slopes. | Severe: severe erosion. | Poor. |
| Moderate: clayey subsoil. | Moderate: ponding. | Moderate: ponding. | Severe: ponding. | Moderate: ponding. | Moderate: ponding. | Severe: moderate to high shrink-swell potential. | Fair. |
| Moderate: rock; slopes. | Slight to moderate; slopes. | Severe: rock; slopes. | Moderate: slopes. | Moderate: slopes. | Slight------ | Moderate: rock; slopes. | Poor. |
| Severe: rock; slopes. | Severe: fair trafficability; slopes. | Severe: rock; slopes. | Severe: slopes. | Severe: slopes. | Moderate: slopes. | Severe: rock; slopes. | Poor. |
| Severe: rock; slopes. | Severe: poor trafficability; slopes. | Severe: rock; slopes. | Severe: rock; slopes. | Severe: rock; slopes. | Moderate: slopes. | Severe: rock; slopes. | Fair to poor. |
| Severe: rock; slopes. | Severe: moderate trafficability; slopes. | Severe: rock; slopes. | Severe: slopes. | Severe: slopes. | Moderate: slopes. | Severe: rock; slopes. | Poor. |
| Moderate: rock. | Slight-------- | Moderate to severe: rock; slopes. | Moderate: rock; slopes. | Moderate: slopes. | Slight------ | Moderate: rock. | Fair. |
| Severe: rock; slopes. | Severe: poor trafficability; slopes. | Severe: rock; slopes. | Severe: rock; slopes. | Severe: rock; slopes. | Moderate: slopes. | Severe: rock; slopes. | Fair to poor. |

267-726 O - 67 - 4

TABLE 2.--LIMITATIONS OF THE SOILS FOR RESIDENTIAL, INDUSTRIAL,

| Soil name and map symbols | Building structures for-- | | Sewage disposal | | Sanitary land fills |
|---|---|---|---|---|---|
| | Residences | Light industries | Septic tank filter fields | Sewage lagoons | |
| Made land (Mae) | Slight | Slight to moderate; moderate bearing capacity 2/. | Not applicable. | Not applicable. | Slight |
| Madison gravelly sandy loam, 2 to 6 percent slopes, eroded (MhB2). | Slight | Moderate: moderate shrink-swell potential. | Moderate: moderate to slow percolation. | Moderate: slopes. | Slight |
| Madison gravelly sandy loam, 6 to 10 percent slopes, eroded (MhC2). | Slight | Moderate: moderate shrink-swell potential. | Moderate: moderate to slow percolation. | Severe: slopes. | Slight |
| Madison sandy clay loam, 2 to 6 percent slopes, eroded (MiB2). | Slight | Moderate: moderate shrink-swell potential. | Moderate: moderate to slow percolation. | Moderate: slopes. | Slight |
| Madison sandy clay loam, 6 to 10 percent slopes, eroded (MiC2). | Slight | Moderate: moderate shrink-swell potential; slopes. | Moderate: moderate to slow percolation. | Severe: slopes. | Slight |
| Madison sandy clay loam, 10 to 15 percent slopes, eroded (MiD2). | Moderate: slopes. | Severe: slopes. | Moderate: moderate to slow percolation; slopes. | Severe: slopes. | Moderate: slopes. |
| Madison sandy clay loam, 15 to 45 percent slopes, eroded (MiF2). | Severe: slopes | Severe: slopes. | Severe: slopes. | Severe: slopes. | Severe: slopes. |
| Musella cobbly loam, 6 to 15 percent slopes (MCD). | Severe: shallowness to broken rock; some slopes more than 10 percent. | Severe: rock; slopes. | Severe: rock; slopes. | Severe: seepage; slopes. | Severe: cobblestones; slopes. |
| Musella cobbly loam, 15 to 45 percent slopes (MCF). | Severe: shallowness to rock; slopes. | Severe: rock; slopes. | Severe: rock; slopes. | Severe: seepage; slopes. | Severe: cobblestones; slopes. |

See footnotes at end of table.

| Cemeteries | Recreational facilities | | | | | Trafficways | Suitability for topsoil |
|---|---|---|---|---|---|---|---|
| | Picnic grounds | Campsites and intensive play areas | Recreational buildings | Golf fairways | Paths and trails | | |
| Moderate: clayey surface layer. | Moderate: clayey surface layer. | Moderate: clayey surface layer. | Slight-------- | Not applicable. | Moderate: clayey surface layer. | Severe: low traffic supporting capacity. | Poor. |
| Slight------ | Slight-------- | Slight----------1/ | Slight-------- | Slight-------- | Slight------ | Moderate: moderate traffic supporting capacity. | Fair. |
| Slight------ | Slight-------- | Moderate: slopes. | Slight-------- | Moderate: slopes. | Slight------ | Moderate: moderate traffic supporting capacity. | Fair. |
| Slight------ | Slight-------- | Slight----------1/ | Slight-------- | Slight to moderate: clayey surface layer. | Moderate: clayey surface layer. | Moderate: moderate traffic supporting capacity and erosion hazard. | Poor. |
| Moderate: clayey surface layer. | Slight-------- | Moderate: clayey surface layer; slopes. | Slight-------- | Moderate: slopes. | Moderate: clayey surface layer. | Moderate: moderate traffic supporting capacity. | Poor. |
| Moderate: slopes. | Moderate: slopes. | Severe: slopes-- | Moderate: slopes. | Moderate: slopes. | Moderate: clayey surface layer. | Moderate: slopes. | Poor. |
| Severe: slopes. | Moderate to severe: slopes. | Severe: slopes-- | Severe: slopes. | Severe: slopes. | Moderate to severe: slopes. | Severe: moderate traffic supporting capacity; slopes. | Poor. |
| Severe: cobblestones; slopes. | Moderate to severe: cobblestones; slopes. | Severe: cobblestones; slopes. | Severe: rock; slopes. | Severe: cobblestones; slopes. | Moderate: cobblestones. | Moderate to severe: rock; slopes. | Poor. |
| Severe: cobblestones; slopes. | Moderate to severe: cobblestones; slopes. | Severe: cobblestones; slopes. | Severe: rock; slopes. | Severe: cobblestones; slopes. | Moderate to severe: cobblestones; slopes. | Moderate to severe: rock; slopes. | Poor. |

TABLE 2.--LIMITATIONS OF THE SOILS FOR RESIDENTIAL, INDUSTRIAL,

| Soil name and map symbols | Building structures for-- | | Sewage disposal | | Sanitary land fills |
|---|---|---|---|---|---|
| | Residences | Light industries | Septic tank filter fields | Sewage lagoons | |
| Pacolet sandy loam, 2 to 6 percent slopes, eroded (PfB2). | Slight--------- | Moderate: moderate shrink-swell potential. | Moderate: moderate to slow percolation. | Moderate: slopes. | Slight------- |
| Pacolet sandy loam, 6 to 10 percent slopes, eroded (PfC2). | Slight--------- | Moderate: moderate shrink-swell potential; slopes. | Moderate: moderate to slow percolation. | Severe: slopes. | Slight------- |
| Pacolet sandy clay loam, 2 to 6 percent slopes, eroded (PgB2). | Slight--------- | Moderate: moderate shrink-swell potential. | Moderate: moderate to slow percolation. | Moderate: slopes. | Slight------- |
| Pacolet sandy clay loam, 6 to 10 percent slopes, eroded (PgC2). | Slight--------- | Moderate: slopes; moderate shrink-swell potential. | Moderate: moderate to slow percolation. | Severe: slopes. | Slight------- |
| Pacolet sandy clay loam, 10 to 15 percent slopes, eroded (PgD2). | Moderate: slopes. | Severe: slopes. | Moderate: moderate to slow percolation; slopes. | Severe: slopes. | Moderate: slopes. |
| Pacolet sandy clay loam, 15 to 25 percent slopes, eroded (PgE2). | Moderate: slopes. | Severe: slopes. | Severe: slopes. | Severe: slopes. | Severe: slopes. |
| Pacolet cobbly sandy loam, 15 to 45 percent slopes (PiF). | Severe: cobblestones; slopes. | Severe: slopes. | Severe: slopes. | Severe: slopes. | Severe: slopes. |
| Red Bay sandy loam, 2 to 6 percent slopes (RhB). | Slight--------- | Moderate: moderate shrink-swell potential. | Slight-------- | Moderate: slopes. | Slight------- |
| Rock land (2 to 50 percent slopes) (Roc). | Severe: rock--- | Severe: rock-- | Severe: rock-- | Severe: rock. | Severe: rock. |

See footnotes at end of table.

RECREATIONAL, AND RELATED NONFARM USES--Continued

| Cemeteries | Recreational facilities | | | | | Trafficways | Suitability for topsoil |
|---|---|---|---|---|---|---|---|
| | Picnic grounds | Campsites and intensive play areas | Recreational buildings | Golf fairways | Paths and trails | | |
| Slight------ | Slight-------- | Slight 1/---------- | Slight-------- | Slight-------- | Slight------ | Moderate: moderate traffic supporting capacity. | Fair. |
| Slight------ | Slight-------- | Moderate: slopes. | Slight-------- | Moderate: slopes. | Slight------ | Moderate: moderate traffic supporting capacity. | Fair. |
| Slight------ | Slight-------- | Slight 1/---------- | Slight-------- | Slight to moderate: clayey surface layer. | Moderate: clayey surface layer. | Moderate: moderate traffic supporting capacity and erosion hazard. | Poor. |
| Moderate: clayey surface layer. | Slight-------- | Moderate: clayey surface layer; slopes. | Slight-------- | Moderate: slopes. | Moderate: clayey surface layer. | Moderate: moderate traffic supporting capacity. | Poor. |
| Moderate: slopes. | Moderate: slopes. | Severe: slopes-- | Moderate: slopes. | Moderate: slopes. | Moderate: clayey surface layer. | Moderate: slopes. | Poor. |
| Severe: slopes. | Moderate: slopes. | Severe: slopes-- | Severe: slopes. | Severe: slopes. | Moderate: clayey surface layer. | Moderate: moderate traffic supporting capacity; erodibility; slopes. | Poor. |
| Severe: slopes. | Severe: cobblestones; slopes. | Severe: slopes-- | Severe: slopes. | Severe: slopes. | Moderate to severe: slopes. | Severe: moderate traffic supporting capacity; slopes. | Poor. |
| Slight------ | Slight-------- | Slight to moderate: slopes. | Slight-------- | Slight-------- | Slight------ | Moderate: moderate traffic supporting capacity. | Fair. |
| Severe: rock. | Moderate: rock. | Severe: rock---- | Severe: rock-- | Severe: rock--- | Severe: steep slopes. | Severe: rock-- | Poor. |

TABLE 2.--LIMITATIONS OF THE SOILS FOR RESIDENTIAL, INDUSTRIAL,

| Soil name and map symbols | Building structures for-- | | Sewage disposal | | Sanitary land fills |
|---|---|---|---|---|---|
| | Residences | Light industries | Septic tank filter fields | Sewage lagoons | |
| Wedowee sandy loam, 10 to 25 percent slopes, eroded (WrE2). | Moderate: slopes. | Severe: slopes. | Severe: slopes. | Severe: slopes. | Severe: slopes. |
| Wehadkee soils, frequently flooded (0 to 2 percent slopes) (Wed). | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding. | Severe: very frequent, brief flooding; high seasonal water table. |
| Wickham sandy loam, 2 to 6 percent slopes, eroded (WgB2). | Slight--------- | Slight-------- | Slight-------- | Moderate: slopes. | Slight------- |
| Wickham sandy loam, 6 to 10 percent slopes, eroded (WgC2). | Slight--------- | Moderate: slopes. | Slight-------- | Severe: slopes. | Slight------- |
| Wilkes-Iredell cobbly complex, 6 to 15 percent slopes (WHD). | Severe: high shrink-swell potential. | Severe: high shrink-swell potential. | Severe: slow percolation; slopes. | Severe: slopes. | Severe: rock. |
| Worsham sandy loam, 0 to 2 percent slopes (WkA). | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding. | Severe: very frequent, brief flooding; high seasonal water table. |
| Worsham sandy loam, 2 to 6 percent slopes (WkB). | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding. | Severe: very frequent, brief flooding; high seasonal water table. |

1/ Moderate limitations as an intensive play area because slopes are greater than 2 percent.

| Cemeteries | Recreational facilities | | | | | Trafficways | Suitability for topsoil |
|---|---|---|---|---|---|---|---|
| | Picnic grounds | Campsites and intensive play areas | Recreational buildings | Golf fairways | Paths and trails | | |
| Severe: slopes more than 15 percent. | Moderate: slopes. | Severe: slopes-- | Severe: slopes. | Severe: slopes. | Moderate: slopes. | Severe: moderate traffic supporting capacity; slopes. | Fair. |
| Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding. | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding; high seasonal water table. | Poor. |
| Slight------ | Slight-------- | Slight[1/]---------- | Slight-------- | Slight-------- | Slight------ | Slight-------- | Fair. |
| Slight------ | Slight-------- | Moderate: slopes. | Slight-------- | Moderate: slopes. | Slight------ | Slight-------- | Fair. |
| Severe: rock; slopes. | Moderate: cobblestones; slopes. | Moderate: cobblestones; slopes. | Moderate: rock; slopes. | Moderate: cobblestones; slopes. | Slight to moderate: cobblestones. | Severe: low traffic supporting capacity. | Poor. |
| Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding. | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding; high seasonal water table. | Poor. |
| Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding. | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding; high seasonal water table. | Severe: very frequent, brief flooding; high seasonal water table. | Poor. |

[2/] In considering the ratings for bearing capacity, engineers and others should not apply specific values to the estimates given here.

these same soil characteristics apply, but to an intermediate degree not easy to define briefly. For this reason, ratings of moderate are not defined in this section. The reader can obtain a better concept of the soil limitations for a rating of moderate by reading the detailed description of the specific mapping unit.

Building sites for residences.--These areas are used for homes (pl. III). The ratings and limitations in table 2 are for houses that are no more than three stories high. The soil properties most important in rating the soils are bearing capacity, shrink-swell potential, depth to seasonally high water table, flooding, slopes, and depth to hard rock. The kind of sewage system is not a part of the evaluation for residences.

Soils that have slight limitations for use as building sites for residences have slopes of less than 10 percent, are well drained or moderately well drained, and are free of flooding. They also are more than 36 inches deep to hard rock, have low or moderate shrink-swell potential, and are relatively free of stones and other coarse fragments. Soils that have severe limitations for this use have slopes of more than 25 percent, are cobbly or stony, are less than 20 inches to hard rock, are wet, or are subject to flooding.

Building structures for light industries.--These structures are used for stores, offices, and small industries (pl.IV). They are not more than three stories high. The soil properties important in rating the soils for this use are slopes, depth to the water table and to hard rock, flooding, and shrink-swell potential. It is assumed that sewage disposal facilities are available, and these are not considered in the rating.

Soils that have slight limitations for light industries have slopes of less than 6 percent, low shrink-swell potential, and are free of flooding. The water table is at a depth of 30 inches more than 6 months of the year and never rises to less than 15 inches below the surface. On the other hand, soils that have severe limitations for this use are subject to flooding, are wet, have high shrink-swell potential, have slopes of more than 10 percent, or have low bearing capacity.

Septic tank filter fields.--The term "septic tank filter field" (16) refers to a sewage system in which waste is distributed to a central tank and the effluent from the tank is dispersed over a fairly large area of filter field lines buried in the soil. The soil properties most important in rating the soils for the proper operation of such a system are shrink-swell potential, depth to the seasonally high water table and to hard rock, flooding, slopes, and the percolation rate.

In general, soils that have a percolation rate faster than 45 minutes per inch, the water table at a depth of more than 60 inches, slopes of less than 10 percent, hard rock at a depth of more than 50 inches, and are free of flooding, have slight limitations for use as septic tank filter fields. In contrast, soils that have a percolation rate slower than 75 minutes per inch, the water table at a depth of less than 60 inches throughout the year, hard rock at a depth of less than 36 inches, slopes of more than 15 percent, or are subject to flooding, have severe limitations for such use.

Sewage lagoons.--A sewage lagoon (5) consists of an impounded area and a dam (pl. IV). The chief requirements of a soil for use as a floor for the basin of a lagoon are (1) effective sealing against seepage, (2) an even, fairly level surface, and (3) little or no content of organic matter. The soil properties most important in rating the soils for this use are permeability, the suitability of the soil as a site for a reservoir, the suitability of the material at the site for a dam, depth to hard rock, slopes, content of organic matter, and content of coarse fragments more than 6 inches in diameter. A sewage lagoon should be planned so that not less than 2 feet and no more than 5 feet of liquid is within the lagoon.

In soils that have slight limitations for use as a sewage lagoon, permeability is less than 0.8 inch per hour, depth to hard rock is more than 60 inches, slopes are less than 2 percent, and coarse fragments are less than 6 inches in diameter. Soils that have severe limitations for this use, however, have slopes of more than 7 percent, have permeability greater than 2.5 inches per hour, are less than 36 inches to hard rock, or contain coarse fragments larger than 6 inches in diameter that cover more than 15 percent of the surface area.

Sanitary land fills.--A sanitary land fill is an area used to dispose of household trash and garbage by burying it in the soil. The soil properties most important in constructing and operating such a system are slopes, soil texture, depth to hard rock and the water table, and hazard of flooding.

Soils that have slopes of less than 10 percent, are friable, are more than 10 feet to hard rock and the water table, and are not subject to flooding have slight limitations for sanitary land fills. Soils that have severe limitations for this use have slopes of more than 15 percent, are coarse textured, are less than 5 feet to hard rock, have a water table within 48 inches of the surface more than 9 months of the year, or are flooded frequently. Depth to hard rock and the flooding hazard are the major limitations to use of soils for sanitary land fills in Gwinnett County.

Cemetery sites.--These areas are used for underground burial and range from one-half to more than 10 acres. The small sites are near country churches, but large memorial parks and other cemeteries are likely to be centrally located. The soil properties most important in rating the soils for such use are slopes, texture, stoniness, depth to hard rock and the water table, and the flooding hazard.

In general, soils have slight limitations for use as cemetery sites if they have slopes of less than 10 percent, are friable, are free of stones, are more than 6 feet deep to hard rock and the water table, and are free of flooding. In contrast,

soils that contain many stones, have slopes of more than 15 percent, are less than 48 inches deep to hard rock, are flooded frequently, or have the water table at a depth no greater than 15 inches for more than 9 months of the year have severe limitations for this use.

Recreational facilities.--Among the recreational facilities (17) considered in table 2 are picnic grounds, campsites and intensive play areas, recreational buildings, golf fairways, and paths and trails. Soil properties most important for such uses are wetness and depth to the water table, the hazard of flooding, slopes, depth to hard rock, permeability, and stones, rocks, and other coarse fragments.

Picnic grounds are areas that are suitable for pleasure outings at which a meal is eaten outdoors. Such facilities as tables and fireplaces generally are furnished. The chief requirement is good trafficability, and it is assumed that little site preparation is needed.

Soils that have slight limitations for use as picnic grounds are well drained, free of flooding during the season of use, have slopes of less than 10 percent, and have good trafficability. Soils that have severe limitations for this use are wet, are subject to flooding during the season of use, have slopes of more than 25 percent, or have poor trafficability because of stones on the surface.

Campsites and intensive play areas have similar limitations in use. Campsites are areas suitable for tents and small camp trailers and for outdoor dining for periods of about 3 to 14 days. Intensive play areas are used for playgrounds and for baseball, football, tennis, badminton, and other organized games. Both kinds of areas are used frequently and intensively and should withstand heavy foot traffic.

Campsites require little site preparation other than in areas used for tents or for parking. The soils must be able to support heavy traffic by vehicles, as well as people. Soils that have slight limitations for this use are well drained, are free of flooding, and have rapid to moderate permeability. They also have slopes of less than 6 percent, a friable surface layer, and less than 15 percent coarse fragments larger than 10 inches on the surface. In contrast soils that have severe limitations for campsites are wet or water stands in ponds on the surface during periods of use. Flooding also is a hazard, slopes are more than 10 percent, and the surface layer is loose and sandy, is plastic, or is 50 percent or more coarse fragments.

The requirements for intensive play areas are similar to those for campsites. If the rating in table 2 is severe, limitations for the two uses are similar. Soils that have slight limitations for intensive play areas, however, also should have slopes of not more than 2 percent, the surface should be free of coarse fragments, and hard rock should be at a depth of 3 feet or more.

Recreational buildings are those that are constructed for use as seasonal and year-round cottages, washrooms and bathhouses, picnic shelters, and service buildings. The ratings given in table 2 are for buildings served by a public or community sewage system; soil limitations affecting suitability for septic tank filter fields were not considered in these ratings. The soil properties most important in rating the soils for use as recreational buildings are wetness, flooding, slopes, the content of rocks and stones, and depth to hard rock.

Soils that are well drained, are not subject to flooding, have slopes of less than 8 percent, are free of stones, rocks, and other coarse fragments, and are deeper than 5 feet to hard rock have slight limitations for recreational buildings. On the other hand, soils that are subject to flooding, are wet, have slopes of more than 15 percent, or are less than 3 feet deep to hard rock have severe limitations for such use.

The ratings of the soils for golf fairways in table 2 refer to fairways only because most golf greens are manmade. Soils that have slight limitations for golf fairways are not flooded more often than once in 5 to 20 years, have slopes of less than 6 percent, have rapid or moderate permeability, and have a surface soil not so loose, clayey, or stony that it prevents good trafficability. Soils that have severe limitations for such use are subject to flooding, have slopes of more than 15 percent, are wet, or have poor trafficability.

Paths and trails are areas used for cross-country hiking, bridle paths, and other nonintensive use. The areas are assumed to be for use as they occur in nature and need little soil excavation.

Soils have slight limitations for paths and trails if they are well drained, have a seasonal water table at a depth below about 3 feet, and are free of flooding. They also must have slopes of less than 15 percent, and the surface layer should not be so sticky, loose, or stony as to prevent good trafficability. In contrast, soils have severe limitations for this use if they are flooded during periods of use, have slopes of more than 25 percent, are wet, or have a surface layer that limits foot traffic.

Trafficways.--This term refers to low-cost roads and residential streets that require limited cut and fill and subgrade preparation. The properties most important in rating the soils for trafficways are slopes, depth to hard rock and the water table, flooding and erosion hazards, and traffic supporting capacity.

Soils that have slight limitations for trafficways are well drained, have slopes of less than 10 percent, are not subject to flooding or are flooded infrequently, have good traffic supporting capacity, and are more than 36 inches deep to hard rock. Also, the seasonal water table is at a depth of more than 30 inches for more than 9 months a year, and the water table never rises to less than 15 inches from the surface. Soils have severe limitations for trafficways where slopes are more than 25 percent, are wet, or have poor traffic supporting capacity.

Topsoil.--This is soil material suitable for use on areas where vegetation is to be established and maintained. Properties important in rating soil material for this use are productivity, content of coarse fragments, and depth of the material at the

source of supply. The ratings used are good, fair, and poor.

Soils that are a good source of topsoil are productive, lack coarse fragments, are friable, and are more than 20 inches deep at the source of supply. Soils that are poor for this use are low in productivity; are more than 20 percent cobblestones, larger stones, rocks, and other coarse fragments; are in poor tilth; or are less than 6 inches deep at the source of supply.

## Engineering Uses of the Soils[2]

This section describes the properties of the soils that are important to engineering. Soils are natural materials that differ greatly in properties from one location to the next and even within the same area. Soil properties are of special interest to engineers because they affect the construction and maintenance of roads, airports, pipelines, foundations, structures for controlling erosion, facilities for storing and transporting water, systems for draining and irrigating soils, and leaching fields for sewage tanks. The properties most important to the engineer are permeability, shear strength, compaction characteristics, shrink-swell characteristics, soil drainage, grain size, plasticity, and soil reaction, or pH. Topography and depth to water table, to bedrock, or to sand and gravel are also important.

This survey contains information about the soils of Gwinnett County that will be helpful to engineers. Special emphasis has been placed on the engineering properties as related to agriculture, and particularly those that affect irrigation, farm ponds, and structures to control and conserve soil and water. The information in this report can be used to--

1. Make soil and land use studies that will aid in selecting and developing sites for industrial, business, residential, and recreational uses.
2. Make preliminary estimates of the engineering properties of soils for use in planning of agricultural drainage systems, farm ponds, irrigation systems, terraces and diversions, waterways, and other structures for conserving soil and water.
3. Make preliminary evaluations of soil and ground conditions that will aid in selecting locations for highways, airports, pipelines, cables, and sewage disposal fields and in planning detailed surveys of the soils at selected locations.
4. Locate probable sources of sand and other material for use in construction.
5. Correlate performance of engineering structures with the soil mapping units and thus develop information that will be useful in designing and maintaining certain engineering practices and structures.
6. Determine the suitability of soils for movement of vehicles and construction equipment.
7. Supplement the information obtained from other published maps, reports, and aerial photographs for the purpose of making reports that can be used readily by engineers.
8. Develop other preliminary estimates for construction purposes pertinent to the particular area.

Used with the soil map to identify the soils, the engineering interpretations in this section are useful for many purposes. It should be emphasized, however, that these interpretations may not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads or where the excavations are deeper than the depth of layers here reported. Nevertheless, even in such situations, the soil map is useful for planning more detailed field investigations and for suggesting the kinds of problems that can be expected.

In Gwinnett County the soils in most construction sites vary greatly within the depth of the proposed excavation and within fairly short distances. The maps, soil descriptions, and other data in this survey should be used in planning detailed investigations necessary at the construction site. Then only a minimum number of soil samples are needed for laboratory testing. After the soils have been tested and their behavior in place has been observed under varying conditions, the engineer should be able to judge the properties of the individual soil units at other sites throughout the county.

Information of value in planning engineering work is given throughout the text, particularly in the sections "Descriptions of the Soils" and "Formation and Classification of Soils."

Some of the terms used by the soil scientist may be unfamiliar to the engineer, and some words--for example, soil, clay, silt, and sand--have special meanings in soil science. These and other special terms that are used are defined in the Glossary at the back of this survey. Most of the information about engineering is given in tables 3, 4, and 5.

### Engineering Classification Systems

Agricultural scientists of the United States Department of Agriculture classify soils according to texture. In some ways this system of naming textural classes is comparable to the two systems used by engineers for classifying soils; that is, the system of the American Association of Highway Officials (AASHO) and the Unified system.

Most highway engineers classify soils in accordance with the classification developed by the American Association of State Highway Officials (2). In this system soil materials are classified in

---

2 ALBERT E. JENKINS, agriculture engineer, Soil Conservation Service, assisted in the preparation of this section.

seven principal groups. The groups range from A-1 (gravelly soils of high bearing capacity, the best soils for subgrade) to A-7 (clay soils having low strength when wet, the poorest soils for subgrade). Within each group the relative engineering value of the soil material is indicated by a group index number. Group index numbers range from 0 for the best material to 20 for the poorest. The group index number is shown in parentheses after the soil group symbol in table 3.

Some engineers prefer to use the Unified soil classification system (18). In this system soil materials are identified as coarse grained, eight classes; fine grained, six classes; and highly organic. Some soil materials have characteristics that are borderline between the major classes and are given a borderline classification, such as MH-CH. The last column of table 3 gives the classification of the tested soils of the county, according to the Unified system.

## Engineering Test Data

Soil samples from five soil profiles representing two series were tested in accordance with standard procedures to help evaluate the soils for engineering purposes (table 3). The samples for each series were from different locations and were taken at a depth of 106 inches or less. The data therefore may not be adequate for estimating the properties of soils in deeper cuts. These samples were tested for moisture density relationships, volume change, grain-size distribution, liquid limit, and plasticity index.

In the moisture density, or compaction test, a sample of the soil material is compacted several times with a constant compactive effort, each time at a successively higher moisture content. The density of the compacted material increases as the moisture content increases until the optimum moisture content is reached. After that the density decreases with increase in moisture content. The highest density obtained in the compaction test is termed "maximum dry density." Moisture-density data are important in construction, for as a rule, optimum stability is obtained if the soil is compacted to about the maximum dry density when it is at approximately the optimum moisture content.

The volume changes listed in table 3 indicate the amount of shrinkage and swelling in samples prepared at optimum moisture content and then subjected to drying and wetting. The sum of these two values gives the total volume change that can occur in a particular soil.

The results of the mechanical analysis, obtained by combined sieve and hydrometer methods, may be used to determine the relative proportions of the different size particles that make up the soil sample. The percentage of fine-grained material, obtained by the hydrometer method, which generally is used by engineers, should not be used in determining textural classes of soils.

The tests to determine liquid limit and plastic limit measure the effect of water on consistence of the soil material. As the moisture content of a clayey soil increases from a very dry state, the material changes from a semisolid to a plastic state. As the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from a semisolid to a plastic state. The liquid limit is the moisture content at which the soil material passes from a plastic to a liquid state. The plasticity index is the numerical difference between liquid limit and plastic limit. It indicates the range in moisture content within which a soil material is in a plastic condition.

## Estimated Properties of the Soils

Table 4 lists the soils and land types of the county and the map symbols for each mapping unit and gives estimates of some properties significant to engineering. It also gives the textural classification of the U.S. Department of Agriculture and estimates of the Unified classification and of the classification used by the American Association of State Highway Engineers. In addition estimates of the grain-size distribution, permeability, available water capacity, reaction, and shrink-swell potential are given. The estimates are based partly on test data in table 3 and on examinations made in the field and partly on experience with soils within the county or with similar soils from adjoining counties. The estimates are based on more than one sample, and some variation from the recorded values can therefore be expected.

More information on the range of properties of the soils can be obtained from the section "Descriptions of the Soils." The depth from the surface shown in table 4 generally is the depth given for horizons of the profiles described in the section "Descriptions of the Soils."

In the column showing permeability, the rate at which water moves downward through undisturbed soil material is estimated. The estimates are based on undisturbed cores of saturated soils.

The available water capacity, given in inches per inch of soil, refers to the approximate amount of capillary water in the soil when the soil is wet to field capacity. When the soil is air dry, this same amount of water will wet the soil to a depth of 1 inch without deeper percolation.

Reaction gives the intensity of the acidity or alkalinity of the soil, expressed in pH value. A pH notation of 7.0 is neutral. A lower value indicates acidity, and a higher value indicates alkalinity.

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

**TABLE 3.--ENGINEERING**

[Tests performed by the State Highway Department of Georgia in cooperation
accordance with standard procedures of the American Association of State

| Soil name and location of sample | Parent material | Georgia report No. S65-Ga-67 | Depth | Horizon | Moisture density 1/ | | Volume change 2/ | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Maximum dry density | Optimum moisture | Shrinkage | Swelling | Total volume change |
| | | | In. | | Lb. per cu. ft. | Pct. | Pct. | Pct. | Pct. |
| Appling sandy clay loam: | | | | | | | | | |
| 1¼ miles E. of Buford Rock quarry and ½ mile W. of Sardis Church. (Modal) | Granite and gneiss. | 4-3 | 9-28 | B2t | 94 | 24 | 8.8 | 6.9 | 15.7 |
| | | 4-5 | 44-64 | C | 98 | 22 | 5.2 | 9.8 | 15.0 |
| ¼ mile SE. of the junction of U.S. Highway 23 and Beaver Ruin Road and 1/8 mile NE. of the city limits of Norcross along Beaver Ruin Road. (Finer textured than modal) | Granite and gneiss. | 5-3 | 8-36 | B2t | 92 | 25 | 12.3 | 8.5 | 20.8 |
| | | 5-5 | 55-82 | C | 109 | 16 | 4.8 | 7.6 | 12.4 |
| 1 mile NW. of Grayson and 200 feet SW. of Georgia Highway 20. (Coarser textured than modal) | Granite and gneiss. | 6-4 | 22-36 | B22t | 103 | 18 | 5.4 | 6.7 | 12.1 |
| | | 6-6 | 45-76 | C | 104 | 18 | 2.5 | 20.9 | 23.4 |
| Durham sandy loam: | | | | | | | | | |
| ¼ mile SW. of Ebenezer Church and 1½ miles east of Oak Grove School. (Modal) | Granite and gneiss. | 1-1 | 0-8 | Ap | 117 | 12 | 1.4 | 8.3 | 9.7 |
| | | 1-4 | 17-32 | B2t | 113 | 16 | 5.5 | 6.8 | 12.3 |
| | | 1-7 | 59-90 | IIC | 105 | 16 | 3.9 | 12.8 | 16.7 |
| 1¼ miles SSE. of Grayson, 3/4 mile N. of U.S. Highway 78, and 1 mile SW. of Georgia Highway 20. (Coarser textured than modal) | Granite and gneiss. | 3-1 | 0-9 | Ap | 121 | 11 | 1.1 | 9.8 | 10.9 |
| | | 3-4 | 19-35 | B2t | 117 | 13 | 3.1 | 7.4 | 10.5 |
| | | 3-6 | 42-65 | C | 105 | 16 | 3.1 | 8.5 | 11.6 |

1/ Based on AASHO Designation: T 99-57, Method A (2).

2/ Based on "A System of Soil Classification" by W. F. Abercrombie (1).

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

**TEST DATA**

with the U.S. Department of Commerce, Bureau of Public Roads (BPR), in Highway Officials (AASHO) (2), except as stated in footnote 2]

| Mechanical analysis 3/ | | | | | | | | | Liquid limit | Plasticity index | Classification | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Percentage passing sieve-- | | | | | Percentage smaller than-- | | | | | | | |
| 3/8-in. | No. 4 (4.7 mm.) | No. 10 (2.0 mm.) | No. 40 (0.42 mm.) | No. 200 (0.074 mm.) | 0.05 mm. | 0.02 mm. | 0.005 mm. | 0.002 mm. | | | AASHO | Unified 4/ |
| | | | | | | | | | Pct. | | | |
| 100 | 99 | 99 | 94 | 66 | 64 | 62 | 58 | 52 | 47 | 16 | A-7-5(15)-- | ML. |
| --- | 100 | 99 | 82 | 42 | 40 | 32 | 23 | 20 | 5/ NP | NP | A-4(1)----- | SM. |
| --- | 100 | 99 | 93 | 72 | 70 | 65 | 57 | 52 | 55 | 26 | A-7-6(17)-- | MH-CH. |
| 6/ 98 | 96 | 94 | 92 | 27 | 27 | 22 | 17 | 16 | NP | NP | A-2-4(0)--- | SM. |
| --- | 100 | 99 | 82 | 57 | 56 | 51 | 38 | 34 | 41 | 19 | A-7-6(8)--- | CL. |
| --- | --- | 100 | 84 | 50 | 48 | 40 | 24 | 18 | NP | NP | A-4(3)----- | SM. |
| --- | 100 | 98 | 70 | 36 | 34 | 39 | 16 | 10 | NP | NP | A-4(0)----- | SM. |
| 100 | 99 | 98 | 69 | 44 | 44 | 41 | 35 | 31 | 33 | 15 | A-6(3)----- | SC. |
| 100 | 99 | 99 | 73 | 44 | 43 | 35 | 26 | 22 | NP | NP | A-4(2)----- | SM. |
| --- | 100 | 98 | 65 | 34 | 33 | 27 | 12 | 7 | NP | NP | A-2-4(0)--- | SM. |
| --- | 100 | 98 | 69 | 42 | 41 | 37 | 28 | 24 | 27 | 12 | A-6(3)----- | SC. |
| 100 | 99 | 89 | 56 | 32 | 31 | 26 | 20 | 18 | 41 | 16 | A-2-7(1)--- | SM-SC. |

4/ Based on the Unified Soil Classification System, Tech. Memo. No. 3-357 (18). SCS and BPR have agreed to consider that all soils having plasticity indexes within two points from A-line are to be given a borderline classification. Examples of borderline classifications obtained by this use are MH-CH and SM-SC.

5/ Nonplastic.

6/ 100 percent passing 3/4-inch sieve.

| Soil name | Depth to hard rock | Depth to seasonally high water table | Depth from surface | Classification | | |
|---|---|---|---|---|---|---|
| | | | | USDA texture | Unified | AASHO |
| | Feet | Inches | Inches | | | |
| Altavista (AkA) | >5 | 20-26 | 0-6 | Fine sandy loam-- | SM-------- | A-2-------- |
| | | | 6-37 | Sandy clay loam-- | CL, ML---- | A-6-------- |
| | | | 37-52 | Sandy clay------- | CL-------- | A-6, A-7--- |
| Appling (AmB2, AmC2, AnC2) | >8 | >50 | 0-10 | Sandy loam------- | SM-------- | A-2-------- |
| | | | 10-24 | Sandy clay loam-- | ML-CL----- | A-6-------- |
| | | | 24-42 | Sandy clay------- | MH-CH, CL. | A-7-------- |
| | | | 42-52 | Sandy clay loam-- | SM, SC---- | A-2, A-4, A-6. |
| Augusta (As1) | >10 | 15-36 | 0-8 | Fine sandy loam-- | SM-------- | A-2, A-4--- |
| | | | 8-50 | Sandy clay loam-- | ML, CL---- | A-6, A-4--- |
| | | | 50-80 | Sandy loam------- | SM-------- | A-2, A-4--- |
| Buncombe (Bfs) | >6 | >60 | 0-12 | Loamy fine sand-- | SM-------- | A-2-------- |
| | | | 12-74 | Loamy fine sand-- | SM-------- | A-2-------- |
| Cecil (CeC, CfC2, CYB2, CYC2, CYD2). | >10 | >60 | 0-8 | Sandy loam------- | SM-------- | A-2-------- |
| | | | 8-34 | Sandy clay------- | MH-CH, ML-CL, CL. | A-7, A-6--- |
| | | | 34-52 | Clay loam-------- | CL-------- | A-6-------- |
| | | | 52-56 | Sandy loam------- | SM-------- | A-4, A-2--- |
| Chewacla (Cfs) | >10 | 0-24 | 0-6 | Silt loam-------- | ML, SM---- | A-4-------- |
| | | | 6-28 | Silty clay loam-- | ML, CL---- | A-4, A-6--- |
| | | | 28-42 | Silt loam-------- | ML-------- | A-4-------- |
| Congaree (Cng, Cos, Cus) | >10 | 36-40 | 0-8 | Silt loam-------- | ML-------- | A-4-------- |
| | | | 8-40 | Fine sandy loam-- | ML, SM---- | A-4, A-2--- |
| | | | 40-52 | Sandy clay loam-- | CL-------- | A-6-------- |
| Davidson (DgB2, DgC2, DhB2, DhC2, DhD2). | >10 | >60 | 0-6 | Loam------------- | ML, CL---- | A-4-------- |
| | | | 6-52 | Clay loam or clay. | MH, CH, CL. | A-7-------- |
| Durham (DiB) | >6 | >36 | 0-12 | Sandy loam------- | SM-------- | A-2, A-4--- |
| | | | 12-44 | Sandy clay loam or sandy clay. | SC, CL---- | A-6-------- |
| | | | 44-59 | Sandy clay loam-- | SM, SC, CL. | A-4, A-6--- |
| Gullied land (Gul).[1/] | | | | | | |
| Gwinnett (GeB2, GeC2, GeE2, GgB2, GgC2, GgE2). | >6 | >60 | 0-7 | Loam------------- | SM-------- | A-2, A-4--- |
| | | | 7-35 | Clay------------- | MH, CH---- | A-7-------- |
| | | | 35-43 | Clay loam-------- | CL-------- | A-6, A-4--- |
| | | | 43 | Fractured rock. | | |
| Helena (HYB) | 3-6 | 15-25 | 0-6 | Sandy loam------- | SM-------- | A-2, A-4--- |
| | | | 6-15 | Clay loam-------- | CL-------- | A-7, A-6--- |
| | | | 15-32 | Clay------------- | CL, CH, MH. | A-7-------- |

See footnote at end of table.

PROPERTIES OF THE SOILS

| Percentage passing sieve-- | | | Permeability | Available water capacity | Reaction | Shrink-swell potential |
|---|---|---|---|---|---|---|
| No. 4 | No. 10 | No. 200 | | | | |
| | | | Inches per hour | Inches per inch of depth | pH | |
| 95-100 | 95-100 | 10-30 | 2.0-6.3 | 0.12 | 5.6-6.0 | Low. |
| 95-100 | 95-100 | 50-60 | 0.2-0.6 | .15 | 4.5-5.5 | Moderate. |
| 95-100 | 95-100 | 55-75 | 0.2-0.6 | .10 | 4.5-5.0 | Low to moderate. |
| 95-100 | 95-100 | 20-35 | 2.0-6.3 | .12 | 4.5-5.0 | Low. |
| 90-100 | 98-100 | 50-60 | 0.8-2.5 | .14 | 4.5-5.0 | Moderate. |
| 95-100 | 95-100 | 60-75 | 0.2-0.8 | .13 | 4.5-5.0 | Moderate. |
| 95-100 | 95-100 | 27-50 | 0.6-2.0 | .11 | 4.0-4.5 | Low to moderate. |
| 95-100 | 95-100 | 25-40 | 2.5-5.0 | .12 | 4.5-5.0 | Low. |
| 95-100 | 95-100 | 50-65 | 0.2-0.6 | .14 | 4.5-5.0 | Moderate. |
| 95-100 | 95-100 | 30-50 | 0.6-2.0 | .14 | 4.5-5.0 | Low. |
| 100 | 98-100 | 20-30 | 5.0-10.0 | .08 | 4.5-5.0 | Low. |
| 100 | 100 | 10-30 | 5.0-10.0 | .08 | 4.5-5.0 | Low. |
| 84-95 | 75-95 | 20-30 | 2.0-6.3 | .13 | 5.1-5.5 | Low. |
| 95-100 | 90-98 | 55-70 | 0.8-2.5 | .13 | 4.5-5.5 | Moderate. |
| 75-95 | 85-95 | 50-70 | 0.8-2.5 | .13 | 4.5-5.5 | Moderate. |
| 70-85 | 70-85 | 40-50 | 2.0-6.0 | .12 | 4.5-5.5 | Low. |
| 100 | 95-100 | 45-55 | 0.6-2.0 | .17 | 4.5-5.0 | Low. |
| 100 | 95-100 | 50-65 | 0.6-2.0 | .14 | 4.5-5.0 | Moderate. |
| 100 | 95-100 | 50-70 | 0.6-2.5 | .14 | 4.5-5.0 | Low. |
| 95-100 | 95-100 | 50-60 | 0.63-2.0 | .16 | 5.1-5.5 | Low. |
| 95-100 | 98-100 | 30-55 | 0.63-2.0 | .15 | 5.1-5.5 | Low. |
| 95-100 | 95-100 | 50-60 | 0.63-2.0 | .13 | 5.1-5.5 | Moderate. |
| 95-100 | 95-100 | 50-65 | 2.5-5.0 | .10 | 4.5-5.0 | Low to moderate. |
| 100 | 95-100 | 65-85 | 0.8-2.5 | .10 | 4.5-5.0 | Moderate. |
| 95-100 | 95-100 | 20-40 | 2.0-6.0 | .12 | 5.6-6.0 | Low. |
| 100 | 100 | 40-60 | 0.8-2.5 | .13 | 4.5-6.0 | Moderate. |
| 100 | 100 | 40-55 | 2.5-5.0 | .12 | 4.5-5.0 | Moderate to low. |
| 95-100 | 85-100 | 20-40 | 2.5-5.0 | .13 | 5.1-5.5 | Low. |
| 95-100 | 95-100 | 83-90 | 0.8-2.5 | .13 | 5.1-5.5 | Moderate. |
| 95-100 | 95-100 | 55-75 | 0.8-2.5 | .13 | 5.1-5.5 | Moderate to low. |
| 95-100 | 95-100 | 25-50 | 2.0-6.3 | .10 | 5.1-5.5 | Low. |
| 95-100 | 95-100 | 50-70 | 0.2-0.63 | .13 | 5.1-5.5 | Moderate to high. |
| 95-100 | 95-100 | 65-85 | 0.2-0.6 | .12 | 4.5-5.5 | Moderate to high. |

| Soil name | Depth to hard rock | Depth to seasonally high water table | Depth from surface | Classification | | |
|---|---|---|---|---|---|---|
| | | | | USDA texture | Unified | AASHO |
| | Feet | Inches | Inches | | | |
| Iredell (mapped only in a complex with the Wilkes soils). | <4 | 20-25 | 0-10 | Cobbly fine sandy loam. | SM------- | A-2, A-4-- |
| | | | 10-28 | Clay------------ | CH------- | A-7------- |
| Louisa (LkD, LkF) ---------- | >5 | >60 | 0-6 | Gravelly sandy loam. | SM------- | A-4------- |
| | | | 6-52 | Gravelly sandy clay loam. | SC, ML--- | A-4------- |
| Louisburg (LDD, LDF, LnC, LnE). | 1½-4 | >60 | 0-6 | Loamy sand------ | GM, SM--- | A-2------- |
| | | | 6-13 | Sandy loam------ | SC, SM--- | A-4------- |
| | | | 13-29 | Weathered rock. | | |
| | | | 29 | Granite and gneiss bedrock. | | |
| Made land (Mae).[1/] | | | | | | |
| Madison (MhB2, MhC2, MiB2, MiC2, MiD2, MiF2). | >10 | >60 | 0-6 | Gravelly sandy loam. | SM, SC--- | A-2, A-4-- |
| | | | 6-10 | Clay loam------- | SC, CL--- | A-6------- |
| | | | 10-23 | Sandy clay------ | CH, MH--- | A-7------- |
| | | | 23-29 | Sandy clay loam. | ML, SM--- | A-4, A-6-- |
| | | | 29-90 | Weathered mica schist. | | |
| Musella (MCD, MCF) ---------- | >8 | >60 | 0-6 | Cobbly loam----- | SM------- | A-2, A-4-- |
| | | | 6-15 | Clay------------ | CH, MH, CL. | A-7, A-6-- |
| | | | 15-60 | Broken rock. | | |
| Pacolet (PfB2, PfC2, PgB2, PgC2, PgD2, PgE2, PiF). | >6 | >60 | 0-8 | Sandy loam------ | SM------- | A-4------- |
| | | | 8-26 | Clay------------ | MH, CH--- | A-7, A-6-- |
| | | | 26-34 | Sandy clay loam. | CL, ML--- | A-6, A-4-- |
| | | | 34-48 | Sandy loam------ | SM------- | A-4------- |
| Red Bay (RhB)---------- | >10 | >60 | 0-9 | Sandy loam------ | SM------- | A-4------- |
| | | | 9-52 | Sandy clay loam. | CL------- | A-6------- |
| Rock land (Roc).[1/] | | | | | | |

See footnote at end of table.

| Percentage passing sieve-- | | | Permeability | Available water capacity | Reaction | Shrink-swell potential |
|---|---|---|---|---|---|---|
| No. 4 | No. 10 | No. 200 | | | | |
| | | | Inches per hour | Inches per inch of depth | pH | |
| 60-80 | 50-60 | 25-50 | 2.0-6.3 | 0.15 | 5.1-5.5 | Low. |
| 70-90 | 60-70 | 60-70 | 0.2 | .15 | 5.1-5.5 | Very high. |
| 90-100 | 75-95 | 35-45 | 2.5-5.0 | .08 | 4.5-5.0 | Low. |
| 80-95 | 60-85 | 40-55 | 2.5-5.0 | .08 | 4.5-5.0 | Low. |
| 50-100 | 35-95 | 10-30 | 5.0-10.0 | .08 | 5.1-5.5 | Low. |
| 95-100 | 95-100 | 40-50 | 2.0-6.3 | .075 | 5.1-5.5 | Low. |
| 90-100 | 85-100 | 25-50 | 2.5-5.0 | .13 | 5.1-5.5 | Low. |
| 95-100 | 90-100 | 40-60 | 0.6-2.0 | .13 | 5.1-5.5 | Moderate. |
| 95-100 | 85-100 | 70-80 | 0.6-2.0 | .11 | 5.1-5.5 | Moderate. |
| 95-100 | 95-100 | 40-60 | 2.0-6.0 | .10 | 5.1-5.5 | Low. |
| 80-85 | 60-70 | 30-40 | 0.8-2.5 | .15 | 5.1-5.5 | Low. |
| 70-85 | 70-85 | 60-70 | 0.8-2.5 | .13 | 5.1-5.5 | Moderate. |
| 90-100 | 80-95 | 35-50 | 2.5-5.0 | .13 | 5.1-5.5 | Low. |
| 95-100 | 90-100 | 55-75 | 0.8-2.5 | .13 | 5.1-5.5 | Moderate. |
| 95-100 | 90-100 | 50-70 | 0.8-2.5 | .13 | 5.1-5.5 | Moderate. |
| 95-100 | 90-100 | 40-50 | 2.0-6.0 | .10 | 5.1-5.5 | Low. |
| 95-100 | 95-100 | 35-50 | 2.0-6.3 | .10 | 5.6-6.0 | Low. |
| 95-100 | 95-100 | 50-65 | 0.2-2.0 | .13 | 5.1-5.5 | Moderate to low. |

| Soil name | Depth to hard rock | Depth to seasonally high water table | Depth from surface | Classification | | |
|---|---|---|---|---|---|---|
| | | | | USDA texture | Unified | AASHO |
| | Feet | Inches | Inches | | | |
| Wedowee (WrE2) | >5 | >60 | 0-11 | Sandy loam | SM | A-2 |
| | | | 11-16 | Sandy clay loam. | CL | A-6 |
| | | | 16-25 | Sandy clay | MH, CL, SC. | A-7 |
| | | | 25-35 | Clay loam | CL, SC | A-6, A-7 |
| | | | 35-50 | Loam | ML | A-4, A-6 |
| Wehadkee (Wed) | >10 | 0-15 | 0-6 | Silt loam | ML | A-4 |
| | | | 6-40 | Silty clay loam | ML, CL | A-6, A-7 |
| Wickham (WgB2, WgC2) | >10 | 35 | 0-7 | Sandy loam | SM | A-2 |
| | | | 7-21 | Clay loam | CL | A-6 |
| | | | 21-62 | Clay loam to clay. | CL, CH | A-7 |
| Wilkes (WHD) (For properties of the Iredell soil in this unit, refer to the Iredell series.) | < 3½ | 30-45 | 0-14 | Gravelly sandy loam. | SM | A-2, A-4 |
| | | | 14-20 | Sandy loam | SM, SC | A-2, A-4 |
| | | | 20-40 | Cobblestones and larger stones mixed with sandy clay loam. | | |
| Worsham (WkA, WkB) | >5 | 0-15 | 0-8 | Sandy loam | SM | A-2, A-4 |
| | | | 8-40 | Sandy clay loam | SC, CL | A-6 |

1/ Too variable to be rated; onsite investigation needed.

OF THE SOILS--Continued

| Percentage passing sieve-- | | | Permeability | Available water capacity | Reaction | Shrink-swell potential |
|---|---|---|---|---|---|---|
| No. 4 | No. 10 | No. 200 | | | | |
| | | | Inches per hour | Inches per inch of depth | pH | |
| 95-100 | 95-100 | 20-35 | 2.0-6.0 | 0.12 | 4.5-5.0 | Low. |
| 98-100 | 98-100 | 50-65 | 0.6-2.5 | .11 | 4.5-5.0 | Moderate. |
| 95-100 | 95-100 | 40-60 | 0.6-2.5 | .11 | 4.0-4.5 | Moderate. |
| 95-100 | 95-100 | 40-65 | 0.6-2.5 | .10 | 4.5-5.0 | Moderate. |
| 95-100 | 95-100 | 50-60 | 2.0-6.0 | .12 | 4.5-5.5 | Low to moderate. |
| 100 | 100 | 60-75 | 0.6-2.0 | .11 | 4.5-6.0 | Moderate to low. |
| 100 | 100 | 80-90 | 0.6-2.0 | .12 | 4.5-5.0 | Moderate. |
| 95-100 | 95-100 | 25-30 | 2.5-6.0 | .13 | 4.5-5.0 | Low. |
| 95-100 | 95-100 | 50-60 | 0.8-2.5 | .13 | 4.5-5.0 | Moderate. |
| 95-100 | 95-100 | 50-70 | 0.6-2.5 | .10 | 4.5-5.5 | Moderate. |
| 85-95 | 70-85 | 20-40 | 0.63-6.3 | .05 | 5.1-5.5 | Low. |
| 80-90 | 70-80 | 20-40 | 2.0-6.3 | .08 | 5.1-5.5 | Low. |
| 100 | 95-100 | 20-45 | 0.8-2.5 | .11 | 4.5-5.0 | Low. |
| 100 | 100 | 45-70 | 0.2-0.6 | .12 | 4.5-5.0 | Moderate to high. |

| Soil series and map symbol | Suitability as source of road fill | Soil features affecting-- | |
|---|---|---|---|
| | | Highway location | Dikes or levees |
| Altavista (AkA)---------- | Fair---------- | Seasonal high water table; drainage required in places. | Moderate permeability; good construction material. |
| Appling (AmB2, AmC2, AnC2)----- | Fair---------- | Shallow to rock in places, otherwise suitable. | Moderate shrink-swell potential. |
| Augusta (Asl)---------- | Poor---------- | Seasonal high water table. | Moderate shrink-swell potential. |
| Buncombe (Bfs)---------- | Good, but subject to flooding in places. | Moderate strength and stability; subject to occasional flooding. | Moderate strength; rapid permeability and seepage. |
| Cecil (CeC, CfC2, CYB2, CYC2, CYD2). | Fair---------- | Slopes erode easily in deep cuts. | Moderate shrink-swell potential. |
| Chewacla (Cfs)---------- | Poor to fair; moderate stability. | Seasonal high water table; subject to flooding. | Moderate strength and stability; high water table. |
| Congaree (Cng, Cos, Cus)------- | Fair---------- | Subject to occasional flooding; drainage required in places. | Moderate strength and stability. |
| Davidson (DgB2, DgC2, DhB2, DhC2, DhD2). | Fair to poor-------- | Slopes erode easily in deep cuts; plastic subsoil; moderate shrink-swell potential. | Moderate strength and stability; moderate shrink-swell potential. |
| Durham (DiB)---------- | Good in surface layer; fair below. | Soil properties generally good. | Moderate strength and stability. |
| Gwinnett (GeB2, GeC2, GeE2, GgB2, GgC2, GgE2). | Fair---------- | Slopes erode easily in deep cuts; shallow to bedrock in places. | Moderate strength and stability; moderate shrink-swell potential. |
| Gullied land (Gul).[1/] | | | |

See footnote at end of table

| Soil features affecting--Continued | | | | | |
|---|---|---|---|---|---|
| Farm ponds | | Agricultural drainage | Irrigation | Terraces and diversions | Waterways |
| Reservoir area | Embankment | | | | |
| Soil properties are favorable. | Moderate strength and stability. | Drainage not needed. | Moderate to slow permeability. | Soil properties are favorable. | Soil properties are favorable. |
| Soil properties are favorable. | Moderate strength and stability; moderate shrink-swell potential. | Drainage not needed. | Generally slow intake rate. | Soil properties are favorable on slopes of less than 10 percent. | Erodible. |
| Soil properties are favorable. | Moderate shrink-swell potential. | Needs surface and subsurface drainage. | Slow intake rate. | Terraces not needed. | Seasonal high water table. |
| Rapid permeability and seepage. | Moderate strength and stability. | Protection from flooding needed. | Low available water capacity. | Not needed------ | Not needed. |
| Soil properties are favorable. | Moderate strength and stability; impervious when compacted. | Drainage not needed. | Slow intake rate. | Soil properties are favorable on slopes of less than 10 percent. | Moderately to highly erodible. |
| Soil properties are favorable. | Moderate strength and stability. | Needs surface and subsurface drainage. | Poor drainage; seasonal high water table. | Terraces not needed. | Seasonal high water table. |
| Soil properties are favorable. | Moderate strength and stability. | Slow permeability; subsurface drainage needed. | Slow intake rate; drainage needed. | Normally not needed. | Not applicable. |
| Soil properties are favorable. | Moderate strength and stability; moderate shrink-swell potential. | Drainage not needed. | Slow intake rate. | Soil properties favorable on slopes of less than 10 percent. | Highly erodible. |
| Soil properties are favorable. | Moderate strength and stability. | Drainage not needed. | Soil properties are favorable. | Soil properties are favorable. | Soil properties are favorable. |
| Soil properties are favorable. | Moderate strength and stability; moderate shrink-swell potential. | Drainage not needed. | Slow intake rate. | Soil properties are favorable on areas that have slopes of less than 10 percent. | Highly erodible. |

| Soil series and map symbol | Suitability as source of road fill | Soil features affecting-- | |
|---|---|---|---|
| | | Highway location | Dikes or levees |
| Helena (HYB) | Poor; plastic subsoil. | Highly plastic subsoil; moderate to high shrink-swell potential. | Moderate to high shrink-swell potential; highly erodible. |
| Iredell (Mapped only in a complex with Wilkes soils). | Poor; variable material; highly plastic. | Highly plastic material; very high shrink-swell potential. | Very high shrink-swell potential; low strength and stability. |
| Louisa (LkD, LkF) | Fair | Slopes erode easily; moderate strength and stability. | Moderate strength and stability; low shrink-swell potential. |
| Louisburg (LDD, LDF, LnC, LnE). | Good, except where shallow to rock. | Shallow to rock, but otherwise suitable. | Moderate strength and stability; rapid permeability and seepage. |
| Made land (Mae).[1/] | | | |
| Madison (MhB2, MhC2, MiB2, MiC2, MiD2, MiF2). | Fair | Moderate strength and stability. | Moderate strength and stability. |
| Musella (MCD, MCF) | Poor; plastic and shallow to rock. | Shallow to rock | Moderate strength and stability; shallow to rock. |
| Pacolet (PfB2, PfC2, PgB2, PgC2, PgD2, PgE2, PiF). | Fair | Moderate shrink-swell potential. | Moderate strength and stability; moderate shrink-swell potential. |
| Red Bay (RhB) | Good to fair | Soil properties favorable; moderate to low shrink-swell potential. | Moderate strength and stability. |
| Rock land (Roc).[1/] | | | |
| Wedowee (WrE2) | Fair to good | Steep slopes | Moderate strength and stability. |

See footnote at end of table.

| Soil features affecting--Continued | | | | | |
|---|---|---|---|---|---|
| Farm ponds | | Agricultural drainage | Irrigation | Terraces and diversions | Waterways |
| Reservoir area | Embankment | | | | |
| Soil properties are favorable. | Moderate to high shrink-swell potential; highly erodible. | Slow permeability-- | Slow intake rate. | Highly erodible- | Highly erodible. |
| Soil properties are favorable. | Very high shrink-swell potential; low strength and stability. | Very slow permeability. | Very slow intake rate. | Highly erodible; difficult to work. | Highly erodible; difficult to work. |
| Seepage occurs in places. | Moderate strength and stability. | Drainage not needed. | Low water-holding capacity. | Terraces not suitable, because of steep slopes. | Highly erodible; steep slopes. |
| Rapid permeability and seepage. | Moderate strength and stability; rapid permeability and seepage. | Drainage not needed. | Low water-holding capacity. | Not suitable on steep slopes or in stony, shallow areas. | Shallow to rock; stony throughout the profile in places. |
| Soil properties are favorable. | Moderate strength and stability. | Drainage not needed. | Slow intake rate. | Soil properties are favorable on slopes of less than 10 percent. | Highly erodible. |
| Soil properties are favorable. | Moderate strength and stability; shallow to rock. | Drainage not needed. | Slow intake rate. | Shallow to rock; moderately erodible. | Shallow to rock; moderately erodible. |
| Soil properties are favorable. | Moderate strength and stability; moderate shrink-swell potential. | Drainage not needed. | Slow intake rate. | Not suitable on steep slopes; highly erodible. | Highly erodible. |
| Soil properties are favorable. | Moderate to low shrink-swell potential; moderate strength and stability. | Slow permeability-- | Slow intake rate. | Highly erodible- | Highly erodible. |
| Soil properties are favorable; steep slopes. | Moderate strength and stability. | Drainage not needed. | Not feasible, because of steep slopes. | Not feasible, because of steep slopes. | Highly erodible; steep slopes. |

| Soil series and map symbol | Suitability as source of road fill | Soil features affecting-- | |
|---|---|---|---|
| | | Highway location | Dikes or levees |
| Wehadkee (Wed) | Poor | High water table; subject to flooding; moderate shrink-swell potential. | Low strength and stability; moderate shrink-swell characteristics. |
| Wickham (WgB2, WgC2) | Fair to good | High shear strength and stability. | High strength and stability. |
| Wilkes (WHD) | Poor; shallow to rock. | Material is variable and shallow to rock. | Variable strength and stability; high seepage rate. |
| Worsham (WkA, WkB) | Poor | High water table; moderate shrink-swell potential. | Moderate shrink-swell potential; low strength and stability. |

1/ Too variable to be rated; onsite investigation needed.

| Soil features affecting--Continued | | | | | |
|---|---|---|---|---|---|
| Farm ponds | | Agricultural drainage | Irrigation | Terraces and diversions | Waterways |
| Reservoir area | Embankment | | | | |
| Soil properties are favorable. | Low strength and stability; moderate shrink-swell characteristics. | Slow permeability; high water table. | Poor drainage; slow intake rate. | Terraces not needed. | Poor drainage. |
| Soil properties are favorable. | High strength and stability. | Drainage not needed. | Soil properties are favorable. | Soil properties are favorable. | Soil properties are favorable. |
| Excess seepage--- | Material is variable and shallow to rock. | Drainage not needed. | High intake rate. | Stony and shallow to rock. | Shallow to rock; difficult to establish vegetation. |
| Soil properties are favorable. | Moderate shrink-swell potential; low strength and stability. | Slow permeability; subsurface drainage difficult. | Not feasible--- | Not feasible---- | Not feasible. |

## Engineering Interpretations

Table 5 lists suitability ratings for the soils of the county as a source of road fill and gives features that affect work on highways and on structures that conserve soil and water. These features generally are not apparent to the engineer unless he has access to the results of a field investigation. They are, however, significant in construction.

Ratings of the suitability of the soils as a source of sand and gravel are not shown in the table. The source of sand within the county is somewhat limited. Pumping stations along the Chattahoochee River, which borders the county on the northwest, provide sand that is somewhat poorly graded and is not entirely suitable for industrial use. A slightly better grade of sand can be obtained from various places along Haynes Creek and the Yellow River. Another source of sand is the deep substrata underlying the Congaree soils, frequently flooded, in areas along Big Haynes Creek in the southeastern part of the county.

Crushed stone and rock are produced by two stone quarries in the county. In addition, the many rock outcrops in the county are possible sources for dense rock products of high quality.

The suitability of the soil material for road fill depends on the texture and plasticity of the soil material, its water content and compaction characteristics, the hazard of erosion, and presence of rock within the normal depth of the road excavation. Highly plastic soil materials that have a high content of water generally are unsuitable for road fill. The same features that apply to road fill generally apply to highway location, but also considered are the presence of a high water table and the flooding hazard.

Features of the soils considered in constructing dikes and levees are depth to rock, permeability, stability, and shrink-swell potential. In selecting sites for reservoirs for farm ponds, the underlying subsoil should be investigated for permeability and seepage. The rock formations underlying the soils in Gwinnett County are such that a relatively water-tight embankment foundation can be secured if a core trench is cut into weathered rock and backfilled with impervious material. The alluvium overlying the bedrock is deep enough to make this practice economically feasible.

In rating materials for embankments for farm ponds, features to be considered are the strength and stability of the soil and its compaction characteristics and permeability. A thorough investigation of the site is necessary, so that the soils available in the area can be used effectively and a stable, impervious structure can be made.

Lack of suitable outlets is the most limiting factor affecting agricultural drainage in the county. A program to provide outlets for small drainage systems within the county is now in effect.

Features that would adversely affect a soil for irrigation are low available water capacity and slow infiltration and permeability. Irrigation is not widely practiced within the county, however, because few cash crops are grown.

Some difficulties encountered in constructing terraces, diversions, and waterways are caused by the thickness of the surface layer, a shallow root zone, steep slopes, and erodibility. Other difficulties are caused by slow infiltration and permeability and the poor workability of certain plastic soils when wet.

## Use of the Soils for Woodland[3]

Gwinnett County originally was covered chiefly by hardwoods, though mixed stands of hardwoods and pines occupied some areas. The stands consisted of upland oaks and hickory, of yellow-poplar mixed with shortleaf pine, or of Virginia pine. By 1900 most of the original timber had been cut and much of the woodland had reseeded naturally to pines and hardwoods. The second-growth pines were cut heavily in the 1930's and 1940's, and the second-growth hardwoods of high grade growing on the bottom lands were also cut heavily.

About 65 percent of the county, or 182,900 acres, is now in woodland (15). Most of the woodland is in private ownership, though some is used for nonfarm purposes or for industrial developments.

Most of the soils in the county are well suited to trees. Pulpwood, lumber, and veneer are the principal wood products, and they are second to agricultural products in the economy of the county. Markets for the principal wood products are adequate, but a more stable market is needed for low-grade hardwoods. More economical methods of removing underbrush on sloping soils are also needed, so that pines can regenerate naturally.

### Woodland Suitability Groups

Management of woodland can be planned more effectively if soils are grouped according to those characteristics that affect tree growth and the management of the stands (8). For this reason the soils of Gwinnett County have been placed in eight woodland suitability groups. Each group consists of soils that have about the same suitability for trees, require about the same management, and have about the same potential productivity.

In the discussion of each woodland suitability group, the productivity of the soils in each group for trees and the limitations of the soils for such use are given. More detailed information about the soils is given in the section, "Descriptions of the Soils." The "Guide to Mapping Units" at the back of the survey lists all the soils in the county and gives the woodland suitability group for each. The terms used in the discussion of each group and the chief limitations are explained in the paragraphs that follow.

Productivity is expressed as site index, which is the average height, in feet, that the dominant and codominant trees of a given species, growing on a specified soil, will reach in 50 years. In the discussion of each woodland suitability group, the average site index for the principal kinds of trees on the soils of that group is given. Also given is the average annual growth per acre in cords. The average site indexes given are based on measurements of trees of different species and on unpublished and published records (9, 10, 11). The site index for any one soil in the group therefore may differ somewhat from the average.

Plant competition refers to undesirable brush, trees, or other plants that invade a site disturbed by fire, cutting, grazing, or other means. The invading plants compete with the desirable trees and hinder their establishment and growth.

Competition is slight if the unwanted plants cause no special problem. It is moderate if the invaders delay but do not prevent the establishment of a normal, fully stocked stand, and moderate if seedbed preparation is not needed and simple methods keep undesirable plants from invading. Competition is severe if trees cannot regenerate naturally. Where competition is severe, the unwanted plants should be destroyed by controlled burning, spraying with chemicals, or girdling, and the site should be carefully prepared for planting.

Equipment limitations are rated according to the degree that drainage, slope, stoniness, soil texture, or other soil characteristics restrict or prohibit the use of ordinary equipment in pruning, thinning, harvesting, and other woodland management. Different soils may require different kinds of equipment or special methods of operation or may be unsuitable for machine use at different seasons.

The limitation is slight if there is no restriction on the type of equipment or on the time of year that the equipment can be used. It is moderate if slopes are moderately steep, if wetness in winter and early in spring restricts the use of heavy equipment, or if tree roots are damaged to some extent by the use of equipment. The limitation is severe if many types of equipment cannot be used, if the period during which equipment cannot be used is more than 3 months in a year, and if the use of equipment severely damages tree roots and the structure and stability of the soil. The limitation is severe on moderately steep and steep, stony and rocky soils. It is also severe, in winter or early in spring, on wet bottom lands and on low terraces.

Seedling mortality refers to the expected loss of seedlings because of unfavorable soil characteristics. Even when healthy seedlings of suitable species are planted correctly or occur naturally in adequate numbers, some will not survive if conditions are unfavorable.

Mortality is slight if not more than 25 percent of the planted seedlings die, or if trees ordinarily regenerate naturally in places where there are enough seeds. It is moderate if 25 to 50 percent of the seedlings die, or if trees do not regenerate naturally in numbers needed for adequate restocking. In some places, replanting to fill open spaces is necessary. Mortality is severe if more than 50 percent of the planted seedlings die, or if trees do not ordinarily reseed naturally in places where there is enough seed. If mortality is severe, it is necessary to plant seedlings where seeds do not grow, to prepare special seedbeds, and to use superior planting techniques.

Erosion hazard is rated according to the risk of erosion on woodland that is well managed and is not

[3] CRAWFORD C. COOPER, management forester, Georgia Forestry Commission, assisted with this subsection.

protected by special practices. Woodland can be protected from erosion by growing suitable kinds of trees, by adjusting the rotation age and cutting cycles, by using special techniques in management, and by carefully constructing and maintaining roads, trails, and landings. The erosion hazard generally is slight on soils that have slopes of 0 to 2 percent, where runoff is slow or very slow. It is moderate where the soil is not protected by adequate vegetation and runoff is not controlled. The hazard of erosion is severe, on steep slopes, where runoff is rapid and infiltration and permeability are slow.

In the paragraphs that follow, the woodland suitability groups in Gwinnett County are discussed. The land types Gullied land, Made land, and Rock land are not included in a woodland suitability group, because trees suitable for commercial use normally do not grow on them.

## Woodland Suitability Group 1

This group consists of deep, friable, well-drained or excessively drained soils. These soils occupy narrow and broad, nearly level flood plains or are in shallow depressions and at the heads of drainageways in the uplands. Slopes range from 0 to 6 percent, and the areas generally range from 2 to 20 acres.

The soils in this group are well suited to all southern pines grown locally, and they are especially well suited to sweetgum and yellow-poplar. The average site index for loblolly pine is 98, and the average yearly growth of this tree is 1.7 cords per acre. Sweetgum and yellow-poplar have an average site index, respectively, of 100 and 107 and an average yearly growth of 1.5 cords per acre. The average site index is 88 for red oak and white oak, and the average yearly growth of these trees is 0.8 cord per acre.

Plant competition from cull trees, underbrush, and vines is the dominant soil-related management problem. The competition is severe after the overstory has been removed. Clearing, harrowing, furrowing, burning, poisoning, and planting generally are needed to control the undesirable plants.

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

## Woodland Suitability Group 2

In this group are moderately deep to deep, well-drained, mostly eroded soils that have a clayey subsoil. These soils are on broad, gently sloping ridgetops and on long to short, moderately sloping to steep side slopes near drainageways in the uplands. Slopes range from 2 to 45 percent, but in most of the acreage slopes are less than 15 percent. Depth to hard rock ranges from less than 6 to more than 10 feet. The available water capacity is medium.

The soils in this group are moderately well suited to most southern pines grown locally and to yellow-poplar. The average site index is 78 for loblolly pine and 67 for shortleaf pine, and the average yearly growth of these trees is 1.3 and 1.4 cords per acre, respectively. Yellow-poplar has an average site index of 84, and an average yearly growth of 1.0 cord per acre. The average site index is 72 for red oak and white oak, and the average yearly growth of these trees is 0.5 cord per acre.

Competition from unwanted trees, shrubs, and vines is moderate. After the canopy is opened, weeding must be done at least once for seedlings to make normal growth. Eliminating or controlling undesirable plants is not always necessary, but it improves growing conditions.

No limitation to the use of equipment is apparent on slopes of less than 15 percent, but the equipment limitation is moderate to severe on slopes of more than 15 percent. A large percentage of seedlings can be expected to survive following planting or natural reseeding. The erosion hazard is slight on slopes of less than 10 percent, moderate on slopes of 10 to 15 percent, and severe on slopes of more than 15 percent. Drought is not a hazard.

## Woodland Suitability Group 3

In this group are deep, moderately well drained or well drained soils. These soils are on broad, nearly level and very gently sloping stream terraces and in gently sloping areas in the uplands. Slopes range from 0 to 10 percent, but in most of the acreage slopes are 2 to 6 percent. Some areas are eroded. Depth to hard rock generally is more than 5 feet. The available water capacity is medium to moderately high.

The soils in this group are well suited to all southern pines grown locally and to yellow-poplar. The average site index is 82 for loblolly pine and 72 for shortleaf pine, and these trees have an average yearly growth of 1.3 and 1.4 cords per acre, respectively. Yellow-poplar has an average site index of 90, and it has an average yearly growth of 1.2 cords per acre. The average site index is 77 for red oak and white oak, and the average yearly growth of these trees is 0.6 cord per acre.

Competition from unwanted trees, shrubs, and vines is moderate to severe on these soils. After an opening is made in the canopy, weeding must be done at least once for seedlings to make normal growth.

## Woodland Suitability Group 4

This group consists of moderately deep to deep, well-drained soils that are eroded. These soils are on narrow, gently sloping ridgetops and on moderately long and gently sloping to short and steep side slopes near drainageways in the uplands. Slopes range from 2 to 45 percent, but in most of the acreage they are 6 to 15 percent. The surface layer is sandy clay loam, clay loam, or loam, and the subsoil is clay loam to clay. Depth to hard rock ranges from 3 to more than 10 feet. The available water capacity is medium.

The soils in this group are moderately well suited to most southern pines grown locally. The average site index is 73 for loblolly pine and 64 for shortleaf pine, and the average yearly growth of these trees is 1.1 cords per acre. Virginia pine has an average site index of 67 and an average yearly growth of 1.2 cords per acre.

Competition from unwanted trees, shrubs, and vines is moderate. After an opening is made in the canopy, weeding must be done at least once for the seedlings to make normal rowth. The equipment limitation is moderate to severe because these soils are slippery for a short period after a heavy rain. Also if equipment is used when the soils are wet, tree roots are likely to be injured and soil structure and stability damaged.

Seedling mortality is moderate because of the unfavorable soil characteristics resulting from erosion. Losses of from 25 to 50 percent of the planted stock generally can be expected, and some replanting may be needed.

The erosion hazard is moderate on the more gentle slopes and very severe on the steep ones.

Woodland Suitability Group 5

In this group are shallow to moderately deep, well-drained to excessively drained soils. These soils are in the uplands on narrow ridgetops and on moderately long to short, very steep side slopes. The slope range is 2 to 45 percent, but in most of the acreage, it is 6 to 25 percent. Depth to hard rock generally is 15 to 50 inches. The available water capacity is low.

The soils in this group are moderately well suited to most southern pines and hardwoods grown locally. The average site index is 82 for loblolly pine and 65 for shortleaf pine, and these trees have an average yearly growth of 1.3 and 1.4 cords per acre, respectively.

Plant competition is very slight, and seedling mortality is moderate. Losses of from 25 to 50 percent of planted seedlings can be expected, unless rainfall is plentiful during the planting season and throughout the first growing season.

The equipment limitation and the erosion hazard are slight on the gentle slopes and moderate to severe on the steeper ones.

Woodland Suitability Group 6

Helena sandy loam, 2 to 6 percent slopes, is the only soil in this group. It is moderately deep and is somewhat poorly drained to moderately well drained. The surface layer is sandy loam to heavy sandy loam, and the subsoil is clay loam to clay. This soil is in the uplands, chiefly around the heads of drainageways, in slight depressions, and at the base of slopes. Depth to hard rock ranges from 3 to 6 feet. The available water capacity is medium.

This soil is moderately well suited to most southern pines grown locally, and to yellow-poplar. The average site index is 80 for loblolly pine and 70 for shortleaf pine, and these trees have an average yearly growth of 1.3 and 1.4 cords per acre, respectively. Yellow-poplar has an average site index of 85 and an average yearly growth of 1.1 cords per acre.

Competition from unwanted trees, shrubs, and vines is severe. If a large opening is made in the canopy, weeding must be done at least once, and possibly twice, for seedlings to make normal growth. Eliminating or controlling undesirable plants is not always necessary, but it improves growing conditions.

Seedling mortality is moderate because of the shallow root zone and slowly permeable subsoil. Losses of from 25 to 50 percent can generally be expected, and some replanting may be needed.

Limitation to the use of equipment on this soil is moderate. Harvesting of timber on this inadequately drained soil can damage roots of trees not harvested. The erosion hazard is slight, but drought is not a hazard.

Woodland Suitability Group 7

This group consists of shallow to moderately deep, somewhat excessively drained to somewhat poorly drained, gravelly or cobbly soils. These soils are on narrow ridgetops and on moderately long and sloping to short and very steep side slopes near drainageways. Slopes range from 6 to 45 percent, but in most places they are from 10 to 25 percent. The Musella and Iredell soils have plastic, clayey horizons, but the other soils contain little or no clay. The available water capacity is low to medium.

The soils in this group are moderately well suited to most southern pines grown locally. The average site index is 72 for loblolly pine and 62 for shortleaf pine, and these trees have an average yearly growth of 1.1 cords per acre. Virginia pine has an average site index of 68 and an average yearly growth of 1.0 cord per acre.

Plant competition is slight and seedling mortality is moderate. Losses of from 25 to 50 percent of the planted seedlings can be expected, unless rainfall is plentiful during the planting season and throughout the first growing season.

The equipment limitation and the erosion hazard are slight on the gentle slopes, but they are moderate to severe on slopes of more than 10 percent.

Woodland Suitability Group 8

In this group are somewhat poorly drained or poorly drained soils on first bottoms, around the heads of drainageways, on low stream terraces, and in depressions in the uplands. Slopes range from 0 to 6 percent. Depth to hard rock is more than 5 feet. The available water capacity is medium to high.

The soils in this group are better suited to various kinds of hardwoods than to pines. The average site index is 91 for loblolly pine, 98 for sweetgum, 85 for red oak, and 103 for yellow-poplar. The average yearly growth for loblolly pine is 1.5 cords per acre, and it is 1.4 cords per acre for yellow-poplar and sweetgum.

Competition from unwanted trees, shrubs, and vines is very severe. After an opening is made in the canopy of desirable trees, weeding must be done at least two or three times for seedlings to make normal growth. Control of the invading plants is necessary before desirable trees can be established.

The equipment limitation is severe. Heavy or frequent rains prevent the operation of logging equipment for long periods.

Seedling mortality is moderate. In some years 25 to 50 percent of naturally occurring seedlings die, and the development of fully stocked stands is thus delayed or prevented.

The windthrow hazard is slight to moderate. The excessive moisture limits development of roots, and some kinds of trees may therefore be damaged during windy periods. Erosion and drought are not hazards.

## Use of the Soils for Cultivated Crops and Pasture[4]

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

### Capability Groups of Soils

Capability classification is the grouping of soils to show, in a general way, their suitability for most kinds of farming. It is a practical classification based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment. The classification does not apply to most horticultural crops, or to rice and other crops having special requirements. The soils are classified according to degree and kind of permanent limitation, but without consideration of major and generally expensive land forming that would change the slope, depth, or other characteristics of the soils; and without consideration of possible major reclamation.

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

CAPABILITY CLASSES, the broadest grouping, 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 Gwinnett County.)

Class II soils have some limitations that reduce the choice of plants or 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 restrict the choice of plants, require very careful management, or both.

Class V soils are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife food and cover.

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 food and cover.

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

Class VIII soils and landforms have limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes.

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, but not in Gwinnett County, 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 subclasses indicated by w, s, and c, because the soils in it are subject to little or no erosion, though 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 many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-2. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation, and the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph. The Arabic numeral specifically identifies the capability unit within each subclass. A statewide system of numbering is used. Numbers for capability units are not consecutive in Gwinnett County because not all of the different units established in Georgia occur in this county.

### Management by Capability Units

In the following pages, the capability units in Gwinnett County are described and suggestions for use and management of the soils are given. For the names of the soils in any given unit, refer to the "Guide to Mapping Units" at the back of this survey.

[4] J. N. NASH, conservation agronomist, Soil Conservation Service, assisted with this subsection.

## Capability Unit IIe-1

This unit consists of moderately deep to deep, well-drained soils in the uplands and on stream terraces. Most of these soils are eroded. Slopes range from 2 to 6 percent. The uppermost 6 or 7 inches of the soils in this unit is friable to slightly hard loam, sandy loam, or gravelly sandy loam. The subsoil is friable clay loam or firm clay that ranges from strong brown to dusky red in color. Depth to hard rock generally is more than 6 feet.

The soils in this unit are strongly acid to very strongly acid. The supply of plant nutrients and the content of organic matter are low. Tilth generally is good, and plant roots penetrate effectively to a depth of 36 inches or more. Infiltration and permeability are moderate, and the available water capacity is moderately high.

These soils are suited to all crops grown locally, including grasses and legumes. About 50 percent of the acreage is cultivated or is used as pasture. The crops are easy to establish and to maintain, and they respond if fertilizer is applied. But clean-cultivated crops should not be grown continuously, for there is a slight to moderate hazard of further erosion. The soils are well suited to sprinkler irrigation.

If these soils are cultivated, they should be managed in such a way that soil losses from erosion are held within allowable limits. A suitable cropping system also is needed. The choice of this system is governed by the steepness and length of slopes and the practices used for control of erosion. An example of a suitable cropping system on a terraced slope of 2 1/2 percent is 1 year of cotton, pimiento peppers, or some other row crop and 1 year of small grain.

## Capability Unit IIe-2

This unit consists of deep, well drained to moderately well drained soils in the uplands and on stream terraces. These soils are slightly eroded to eroded. Slopes range from 2 to 6 percent. The surface layer is friable sandy loam, and the subsoil is sandy clay loam to clay. Hard rock generally is at a depth of more than 5 feet.

The soils in this unit are medium acid to extremely acid. Natural fertility and content of organic matter are low. Tilth is good, and plant roots penetrate effectively to a depth of 36 inches or more. Infiltration is moderate, permeability is moderate to moderately slow, and available water capacity is medium. These soils warm up more slowly in spring than the soils in capability unit IIe-1.

About 55 percent of the acreage in this unit is cultivated or is used as pasture. The rest is wooded, is idle, or is used as building sites for residences or industries.

These soils are well suited to most of the crops grown locally, including grasses and legumes, but they are less well suited to wheat, alfalfa, pimiento peppers, barley, and peaches than the soils in capability unit IIe-1. The crops are easy to establish and to maintain, and they respond well if fertilizer is applied. Clean-cultivated crops should not be grown continuously, for there is a slight to moderate erosion hazard. The soils are well suited to sprinkler irrigation.

If these soils are cultivated, losses are held within allowable limits by using a combination of practices that control erosion and a cropping system that includes close-growing annuals or perennials, or crops that produce large amounts of residues. An example of a suitable cropping system on a 3 percent slope is cotton, or another row crop, and small grain planted in alternating parallel strips on the contour and rotated each year. For successful yields, adequate amounts of fertilizer and lime must be applied and all plant residues must be returned to the soil.

## Capability Unit IIe-4

Only Helena sandy loam, 2 to 6 percent slopes, is in this unit. This soil is in the uplands and is moderately deep and somewhat poorly drained to moderately well drained. The surface layer is sandy loam. The subsoil ranges from sandy clay loam to clay. Depth to hard rock commonly is about 3 to 6 feet, and depth to the seasonally high water table is about 15 inches.

The soil in this unit is strongly acid to very strongly acid. Natural fertility and content of organic matter are low, but tilth generally is good. Infiltration is moderate, permeability is moderately slow, available water capacity is medium, and runoff is moderately slow.

This unit makes up less than 1 percent of the county. About 40 percent of the acreage is cultivated, and the rest is pastured, wooded, or idle.

The soil in this unit is suited to most of the crops grown locally, and the crops respond well if fertilizer is applied. It is especially well suited to permanent pasture and to supplemental summer pasture, but it generally is not suited to alfalfa, wheat, or barley. If this soil is cultivated, soil losses are held within allowable limits by using a combination of practices that control erosion and a cropping system that includes close-growing crops, or crops that produce large amounts of residues. An example of a suitable cropping system on a terraced slope of 3 percent is 1 year of corn, grain sorghum, or some other row crop and 2 years of small grain or lespedeza. For successful yields, adequate amounts of fertilizer and lime are required and all plant residues must be returned to the soil.

## Capability Unit IIe-5

Only Congaree soils, local alluvium, is in this unit. These soils consist of deep, well-drained deposits of local alluvium. They are in depressions and at the heads of drainageways; slopes range from 0 to 6 percent. The surface layer varies in texture and consistence, but it generally

is friable to loose stratified sand and silt. The layer below also varies in texture and consistence but is predominantly friable fine sandy loam. Depth to hard rock generally is more than 5 feet.

The soils in this unit are medium acid to strongly acid. Natural fertility is low, and content of organic matter is medium. Tilth is good, and plant roots penetrate effectively to a depth of 36 inches or more. Infiltration and permeability are moderate, and available water capacity is high.

About 75 percent of this unit is cultivated or pastured. The rest is wooded or is idle.

The soils in this unit are suited to all crops grown locally, including grasses and legumes. They can be cultivated intensively and are well suited to sprinkler irrigation. The soils are especially well suited to home gardens and to truck crops. Crops on these soils are easy to establish and to maintain, and they respond well if fertilizer is applied. Erosion is a slight hazard in places. The areas, however, are small and irregular in shape and special practices for control of erosion are not needed or are impractical to use. In cultivated areas management similar to that required for adjoining soils is suitable for these soils.

## Capability Unit IIw-2

In this unit are deep, nearly level, well drained to moderately well drained soils on first bottoms. The surface layer varies greatly in texture, but it commonly is sandy loam, fine sandy loam, or silt loam. Below is sandy clay loam or stratified layers of silt and sand. In most places depth to hard rock is more than 10 feet.

These soils are strongly acid to very strongly acid. They are low to medium in natural fertility and in content of organic matter. Tilth is good, and plant roots can penetrate effectively to a depth of 30 inches or more. Runoff is slow, water moves into and through the soil at a moderate rate, and available water capacity is high.

About 40 percent of the acreage of this unit is cultivated or is used for pasture. Crops on these soils respond well if large amounts of fertilizer are applied, and yields of suitable crops are good to very good.

These soils generally are not subject to erosion, but they are subject to occasional scouring by floodwater. A cropping system that helps to maintain organic matter and to improve soil structure is needed. Corn can be grown continuously if adequate amounts of fertilizer and lime are applied and if all plant residues are returned to the soil.

## Capability Unit IIIe-1

In this unit are deep to moderately deep, well-drained soils that are mostly eroded. These soils are in the uplands. Slopes range from 2 to 10 percent. In the less eroded areas, the uppermost 5 to 7 inches is friable sandy loam, gravelly sandy loam, or loam. In the more eroded areas, the surface layer is friable sandy clay loam or clay loam. The subsoil ranges from sandy clay loam to clay in texture and from 20 to 60 inches in thickness. It is red to dark red and firm to friable. Depth to hard rock commonly ranges from 6 to 20 feet.

These soils are mostly medium to low in natural fertility, contain little organic matter, and are medium acid to strongly acid. Plant roots can penetrate effectively to a depth of 40 inches or more. Water moves into and through the soils at a moderate rate, and the available water capacity is medium.

The surface layer generally is in good tilth, but in the more clayey areas it consists chiefly of material formerly in the subsoil and is in poor tilth. Here, tillage is difficult and the soil can be cultivated only within a narrow range of moisture content.

These soils make up about 32 percent of the county. More than half of the acreage is in crops and pasture, and the rest is in woods or is used for some other purpose.

The soils in this unit are suited to scuppernongs, apples, truck crops, and similar specialty crops and to all other crops commonly grown in the county. The crops respond well if fertilizer is applied.

Because of runoff, erosion is the chief hazard if these soils are cultivated. Practices that help to reduce erosion are contour tillage, terracing, and applying adequate amounts of fertilizer and lime. The cropping system should include close-growing crops, and all plant residues should be returned to the soil. The steepness and length of slopes govern the choice of the cropping system and of the practices for holding soil and water losses within allowable limits. An example of a suitable cropping system on a terraced slope of 5 percent is 1 year of cotton, pimiento peppers, or some other row crop and 2 years of small grain and lespedeza.

## Capability Unit IIIe-2

This capability unit consists of well-drained, very gently sloping to sloping soils that are eroded. The surface layer ranges from sandy loam to sandy clay loam. The subsoil is sandy clay loam to sandy clay that in places slightly restricts movement of water. It is mottled with yellowish brown, red, reddish yellow, or strong brown. Depth to hard rock commonly is more than 6 feet.

In most of the acreage, the soils are strongly acid, are low in natural fertility, and contain little organic matter. Plant roots can penetrate effectively to a depth of 32 inches or more. Movement of water into and through the soils is moderate to moderately slow, and the available water capacity is moderate. The surface layer generally is in good tilth, but in the more eroded areas it consists mostly of material formerly in the subsoil and is in poor tilth. Here, tillage is difficult and the soils can be cultivated only within a narrow range of moisture content.

About 55 percent of the acreage is used for crops and pasture. The rest is in woods or is used as building sites for residences or industries.

If fertility and the content of organic matter are maintained, these soils are suited to truck crops, scuppernongs, apples, and other specialty crops and to most other crops grown locally. They are not suited to alfalfa. Movement of water through the subsoil is slightly restricted, and yields of most crops generally are slightly lower than on soils of capability unit IIIe-1.

Erosion is a hazard in cultivated areas of these soils, and a complete system for disposal of water is needed, as well as other practices that help to control erosion. The steepness and length of slopes govern the choice of the cropping system and the practices needed to hold soil and water losses within allowable limits. An example of a suitable cropping system, on a slope of 8 percent that is 150 feet long, is cotton or some other row crop planted on the contour in alternating strips with grass and rotated every 2 years.

## Capability Unit IIIs-1

Only Buncombe loamy fine sand is in this unit. It is a deep, excessively drained soil on flood plains and is subject to flooding. The surface layer is very friable to loose loamy fine sand 6 to 8 inches thick. Below is loamy sand that is very friable and rapidly permeable. Depth to the seasonally high water table is more than 4 feet.

This soil is very strongly acid. The content of organic matter and the supply of available plant nutrients are low. The soil is in good tilth, and plant roots penetrate effectively to a depth of 48 inches or more. Infiltration is rapid, available water capacity is low, and runoff is slow.

This soil is suited to Coastal bermudagrass and other perennial plants but only moderately well suited to corn, grain sorghum, oats, rye, annual lespedeza, crimson clover, and sericea lespedeza. It generally is not suited to cotton, wheat, alfalfa, or white clover. The crops respond well if fertilizer is applied, but the good effects of the fertilizer do not last long. Moderate yields can be maintained, however, if lime and fertilizer are applied. Practices that help to maintain the content of organic matter and the supply of moisture are keeping all crop residues on the surface between cropping seasons and, if feasible, on or near the surface while the crop is growing.

A suitable cropping system for this soil is 2 years or more of Coastal bermudagrass and 1 year of corn or grain sorghum.

## Capability Unit IIIw-2

This unit consists of deep, well-drained and somewhat poorly drained soils on flood plains. The slope range is 0 to 2 percent. The surface layer ranges from silt loam to fine sandy loam. The subsoil is reddish-brown or brown, mottled silty clay loam or is fine sandy loam to sandy clay loam.

The soils in this unit are very strongly acid. Natural fertility is low, and the content of organic matter is medium. Except for wet spots, tilth is good. Infiltration and permeability are moderate, available water capacity is high, and runoff is slow.

About 80 percent of the acreage in this unit is wooded or is idle. The soils are suited to corn, grain sorghum, tall fescue, bermudagrass, annual lespedeza, and white clover. They generally are not suited to cotton, wheat, alfalfa, sericea lespedeza, kudzu, or crimson clover. These soils generally are suited to sprinkler irrigation, and nearby streams usually are a good source of water.

Row crops can be grown continuously on these soils if flooding is controlled and if all crop residues are turned under. These practices also help to maintain the content of organic matter and to keep the soils in good tilth. Crops on these soils respond well if fertilizer is applied, and lime and a complete fertilizer are needed for favorable yields.

Overflow from streams is the main hazard when these soils are cultivated. A drainage system that removes excess surface water and improves internal drainage is needed.

## Capability Unit IIIw-3

This unit consists only of Augusta soils. These soils are deep and are somewhat poorly drained. They are on low stream terraces, around the heads of drainageways, in depressions, and at the base of slopes. Slopes range from 0 to 2 percent. The surface layer generally is loose sandy loam, but it is loam or silt loam in places. The subsoil is mottled sandy clay loam to clay loam. Depth to hard rock generally is more than 10 feet.

The soils in this unit are very strongly acid to extremely acid. Natural fertility and content of organic matter are low. Tilth is good. Plant roots can penetrate effectively to a depth of about 22 to 30 inches. Infiltration and permeability are slow, available water capacity is medium, and runoff is slow.

About 75 percent of the acreage of these soils is wooded. The soils are suited to tall fescue and white clover and are moderately well suited to corn, grain sorghum, bermudagrass, soybeans, annual lespedeza, and sericea lespedeza. They generally are not suited to wheat, alfalfa, oats, or kudzu. They also are not suited to cotton, and some other clean-tilled crops may fail in some years because of wetness. Crops on these soils respond fairly well if fertilizer is applied. An example of a suitable cropping system is 1 year of corn, or some other row crop, and 2 years of grass.

In areas used intensively for row crops, turning under cover crops and including a suitable perennial in the cropping system are ways to maintain the supply of organic matter and to keep the soils in good tilth. If annual crops are grown, all res-

idues should be kept on the surface between cropping seasons. Most crops require lime and a complete fertilizer, applied regularly, for favorable yields, but legumes need nitrogen only at the time of planting.

Excess surface water and somewhat poor internal drainage are the chief limitations. A drainage system is needed to carry off the excess surface water.

## Capability Unit IVe-1

This unit consists of deep, well-drained, eroded soils that are in the uplands. The slope range is 6 to 15 percent. In the less eroded areas, the uppermost 5 to 7 inches is friable sandy loam, gravelly sandy loam, or loam. In the more eroded areas, the surface layer is made up chiefly of material formerly in the subsoil. In most places the subsoil is sandy clay loam to clay that is reddish in color, but in some places it is mottled red, yellowish red, or olive yellow.

These soils are strongly acid to extremely acid. Natural fertility and content of organic matter are low. Tilth is good, except in the more eroded areas. Plant roots can penetrate effectively to a depth of 36 inches or more. Infiltration is moderate to slow, permeability is moderate to moderately slow, available water capacity is medium, and runoff is moderately rapid to rapid.

About 35 percent of the acreage of this unit is cultivated or is used as pasture. The rest is wooded or is idle.

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. The Appling soil is not suited to wheat and alfalfa. Row crops can be grown occasionally in rotation with perennial crops. The more eroded soils are difficult to till, and they can be cultivated only within a narrow range of moisture content without clodding or puddling.

If these soils are cultivated, erosion is the chief hazard. Contour tillage, terracing, grassed waterways, and stripcropping are practices that help to prevent further erosion. In addition a close-growing crop should be included in the cropping system. Lime and fertilizer are needed for favorable yields, and they should be applied regularly. An example of a suitable cropping system on a slope of 8 percent is 3 years of grass and 1 year of corn planted on the contour.

## Capability Unit IVe-4

Only Louisburg loamy sand, 2 to 10 percent slopes, is in this unit. It is shallow to moderately deep, is well drained to excessively drained, and is in the uplands. In most places loamy sand or sandy loam directly overlies broken rock, which generally is at a depth of less than 3 feet.

This soil is strongly acid to very strongly acid. Natural fertility and content of organic matter are low. Tilth is good, and plant roots can penetrate effectively to a depth of about 12 to 24 inches. Infiltration and permeability are rapid, available water capacity is low, and runoff is medium. Tillage can be done throughout a wide range of moisture content without damaging structure or tilth. The root zone is shallower than in soils of capability unit IVe-1 and droughtiness is more pronounced.

About 75 percent of the acreage in this unit is wooded. The soils are moderately well suited to cotton, corn, annual lespedeza, oats, bermudagrass, ryegrass, crimson clover, and sericea lespedeza. They are not suited to alfalfa, tall fescue, white clover, and wheat. Erosion is the chief hazard, and crops that are clean tilled cannot be grown continuously. Yields of all crops are limited because of the low available water capacity.

If these soils are cultivated, contour tillage, terracing, grassed waterways, and stripcropping are suitable practices for control of erosion. Including a suitable perennial in the cropping system helps to maintain the supply or organic matter and to keep the soil in good tilth. Lime and a complete fertilizer are needed for favorable yields, and they should be applied regularly. An example of a suitable cropping system on a terraced slope of 6 percent is 2 years of grass and 1 year of corn.

## Capability Unit IVw-1

This unit consists only of Wehadkee soils, frequently flooded. These soils are moderately deep to deep and are poorly drained. They are on flood plains, and the slope range is 0 to 2 percent. The surface layer is slightly sticky silt loam or loam. It overlies mottled silty clay loam or sandy clay loam.

The soils in this unit are strongly acid to extremely acid. Natural fertility and content of organic matter are low. Tilth is good in some places and poor in others. The water table generally is near the surface, and plant roots can penetrate effectively to a depth of only about 8 to 12 inches. Infiltration is moderate to slow, permeability is slow, available water capacity is medium, and runoff is very slow to ponded. These soils are wetter than the soils in capability unit IIIw-2 and are flooded for longer periods.

About 90 percent of this unit is wooded. The soils are suited to annual lespedeza, white clover, tall fescue, dallisgrass, and vetch, but unless they are drained, they are not suited to other crops grown locally. Crops on these soils respond fairly well if fertilizer is applied. Lime and a complete fertilizer are needed for favorable yields, and they should be applied regularly.

Flooding is the chief hazard on these soils. A drainage system is needed to remove the excess surface water and to improve internal drainage.

## Capability Unit Vw-1

In this unit are deep, poorly drained soils in depressions, near the heads of drainageways, and along the base of slopes. The slope range is 0 to 6 percent. The surface layer is mottled sandy loam or silt loam 5 to 8 inches thick. Below is mottled sandy clay loam.

The soils in this unit are very strongly acid. Natural fertility and content of organic matter are low. Tilth generally is poor. The water table commonly is near the surface and the subsoil is slowly permeable; consequently, plant roots penetrate effectively to a depth of only about 8 inches. Infiltration is moderate, available water capacity is medium, and runoff is slow.

About 80 percent of the acreage of this unit is wooded. The soils are too wet to be cultivated, but they can produce pasture and trees. They are fairly well suited to annual lespedeza, tall fescue, white clover, and dallisgrass. They are wetter, produce less, and respond to management more poorly than the soils in capability unit IVw-1. Lime and fertilizer are required for best yields of pasture and should be applied regularly.

Excess surface water and slow internal drainage are the chief limitations. Artificial drainage is not feasible in many areas, because of the slow lateral movement of water and the need for close spacing of drains.

## Capability Unit VIe-2

This unit consists of moderately deep or deep, well-drained soils that are eroded. These soils are in the uplands. Slopes range from 10 to 25 percent. The uppermost 5 to 8 inches is friable sandy loam, cobbly loam, gravelly sandy loam, or stony silt loam in the less eroded soils and friable clay loam or sandy clay loam in the more eroded ones. The subsoil is predominantly yellowish-red to dark-red sandy clay loam to clay and is mottled in some places. Depth to hard rock is more than 5 feet.

These soils are strongly acid to extremely acid. Natural fertility and content of organic matter are low. Tilth generally is good in the less eroded soils and poor in the more eroded ones. Plant roots generally can penetrate effectively to a depth of 36 inches or more. Infiltration ranges from moderately high to low, permeability from moderate to slow, and runoff from medium to rapid. The eroded soils clod or puddle unless tilled only within a narrow range of moisture content.

Most of the acreage in this unit has been cultivated at some time, but about 75 percent is now wooded or is idle. Poor tilth, strong slopes, the severe hazard of further erosion, and frost heaving in winter make the soils unsuited to cultivation. All of the grasses and legumes grown locally except alfalfa, can be grown, but establishing a stand is difficult. Pasture plants or hay crops can be established if tillage and planting is done on the contour. Yields are favorable if lime and fertilizer are applied. If replanting must be done, seeding pasture plants and hay crops in alternate strips helps to control erosion. Grazing must be controlled in pastured areas to avoid weakening the plant cover.

## Capability Unit VIe-3

Only Louisa gravelly sandy loam, 6 to 15 percent slopes, is in this unit. It is shallow to weathered mica schist, is somewhat excessively drained, and is in the uplands. The surface layer ranges from gravelly sandy loam to gravelly fine sandy loam. It overlies yellowish-red to red gravelly sandy loam to gravelly sandy clay loam. Depth to hard rock generally is more than 5 feet.

This soil is strongly acid. Natural fertility and content of organic matter are low. Tilth generally is good, and plant roots can penetrate effectively to a depth of 12 to 24 inches. Infiltration is moderate to rapid, permeability is moderately rapid, available water capacity is low, and runoff is moderately rapid to rapid. This soil is more shallow and more droughty than the soils in capability unit VIe-2.

The severe erosion hazard, slopes, and shallowness make this soil unsuitable for cultivation. The soil is better suited to pine trees than to other uses. Placing logging roads and firebreaks on the contour and doing all other woodland operations on the contour are ways of controlling erosion.

## Capability Unit VIIe-1

This unit consists of deep and moderately deep, well-drained soils in the uplands. These soils are slightly eroded to eroded, and their slopes range from 15 to 45 percent. The uppermost 5 inches is yellowish-red to red, friable sandy clay loam, cobbly sandy loam, sandy loam, or clay loam. Below is yellowish-red to dark-red sandy clay loam to clay. Depth to hard rock commonly is more than 6 feet.

These soils are strongly acid to very strongly acid. Natural fertility and content of organic matter are low. The soils are in poor tilth. Plant roots can penetrate effectively to a depth of 36 inches or more. Infiltration is slow, permeability is moderate, available water capacity is medium, and runoff is rapid to very rapid.

Much of the acreage in this unit has been cultivated in the past, but about 85 percent is now wooded. The strong slopes and severe erosion hazard make the soils unsuitable for cultivation, but they are suitable for shortleaf and loblolly pines.

Placing logging roads and firebreaks on the contour and doing all other woodland operations on the contour are ways of controlling erosion.

## Capability Unit VIIe-2

In this unit are shallow to moderately deep, slightly eroded to eroded, well-drained to somewhat poorly drained soils. These soils are in the uplands. The slope range is 6 to 45 percent. The uppermost 6 to 8 inches is friable gravelly sandy loam, loamy sand, stony loamy sand, or cobbly loam. The subsoil is light yellowish-brown, loose loamy coarse sand or stony loamy coarse sand in places, but in other places it is reddish-brown to dark-red sandy clay loam to clay.

These soils are strongly acid to very strongly acid. Natural fertility and content of organic matter are low. Tilth is poor in the stony and cobbly soils and fairly good in the others. Plant roots can penetrate effectively to a depth of only 16 to 30 inches. Infiltration and permeability are moderate to rapid, available water capacity is medium to low, and runoff is moderately rapid to rapid. These soils are more shallow, droughty, and stony than the soils in capability unit VIIe-1.

The strong slopes, many pebbles and cobblestones in the surface layer, and severe erosion hazard make these soils unsuitable for cultivation, but they are suitable for shortleaf and loblolly pines. Placing logging roads and firebreaks on the contour and doing all other woodland operations on the contour are suitable ways of controlling erosion.

## Capability Unit VIIe-4

This unit consists of the land type Gullied land. Erosion has removed most of the original soil material from the areas, and in more than half of the acreage, shallow and deep gullies form an intricate pattern. The areas generally are small.

The soil material is strongly acid to extremely acid. Natural fertility and content of organic matter are very low. Infiltration and permeability are slow, available water capacity is low, and runoff is very rapid.

Most of Gullied land is wooded or is idle. Gullied land is suitable for pine trees, but the gullies and severe hazard of further erosion make it unsuitable for cultivation and generally undesirable for pasture. Establishing any vegetation on the areas requires care and skill.

## Capability Unit VIIIs-1

This unit consists of the land type Rock land. Hard rock is at or near the surface of the areas. Rock land has no value for farming, but in places the areas are a source of crushed stone, and some areas can be developed for recreational use. Establishing and maintaining any vegetation on Rock land requires care and skill.

## Estimated Yields

Table 6 gives estimated average acre yields for principal crops on the soils of Gwinnett County. The estimates assume a high level of management and are based on records of actual yields on individual farms, on yields obtained in long-term experiments, and on estimates made by agronomists who have had experience with crops and the soils. Yields are not estimated for some crops on some of the soils. Where an estimate has not been entered in table 6, it can be assumed that yields would be so low as to make production of that crop impractical, or that such intensive management would be required that production would not be feasible.

Generally, the management required to obtain the yields shown in table 6 is of the kind described in the section "Management by Capability Units." In addition, special practices for particular crops are as follows:

Corn: Apply 70 to 100 pounds of nitrogen (N) per acre and 60 to 70 pounds each of phosphoric acid ($P_2O_5$) and potash ($K_2O$); plant enough seed to produce 12,000 to 15,000 plants an acre; turn under all crop residues, or grow a winter cover crop and turn it under.

Cotton: Apply 60 to 100 pounds each of nitrogen (N), phosphoric acid ($P_2O_5$), and potash ($K_2O$) per acre; plant enough seed to produce 25,000 to 40,000 plants per acre; provide effective control of insects.

Oats: Apply 20 to 30 pounds of nitrogen (N) and 40 to 60 pounds each of phosphoric acid ($P_2O_5$) and potash ($K_2O$) per acre at time of planting; apply 40 to 60 pounds of nitrogen per acre late in winter; provide adequate control of plant diseases.

Grain sorghum: Apply 20 to 30 pounds of nitrogen (N) and 40 to 60 pounds each of phosphoric acid ($P_2O_5$) and potash ($K_2O$) per acre at the time of planting; side dress at the rate of 40 to 50 pounds of nitrogen (N) per acre; provide adequate control of plant diseases.

Sericea lespedeza: Apply 40 to 70 pounds each of phosphoric acid ($P_2O_5$) and potash ($K_2O$) and 1 ton of lime per acre at the time of seeding; apply 40 to 70 pounds each of phosphoric acid ($P_2O_5$) and potash ($K_2O$) per acre annually thereafter; apply 1 ton of lime per acre at least 1 year in 3, or as indicated by the results of soil tests.

Pasture: On soils for which table 6 lists an estimated acre yield of 9 or 10 animal-unit months or more for Coastal bermudagrass, apply 125 to 175 pounds of nitrogen (N) and 70 to 90 pounds each of phosphoric acid ($P_2O_5$) and potash ($K_2O$) per acre. On soils for which table 6 lists an estimated acre yield of 6 animal-unit months or more for tall fescue and white clover, apply 80 to 100 pounds of nitrogen (N) and 60 to 80 pounds each of phosphoric acid ($P_2O_5$) and potash ($K_2O$) per acre.

267-726 O - 67 - 7

## TABLE 6.--ESTIMATED ACRE YIELDS OF THE PRINCIPAL CROPS GROWN UNDER A HIGH LEVEL OF MANAGEMENT

[Yields are assumed to be without irrigation. Absence of yield indicates that the crop is not suited to the particular soil or generally is not grown on it]

| Soil | Corn [1] | Cotton (lint) | Oats | Grain sorghum | Sericea lespedeza for hay | Coastal bermudagrass for hay | Tall fescue for hay | Tall fescue and white clover for pasture | Coastal bermudagrass for pasture | Sericea lespedeza for pasture |
|---|---|---|---|---|---|---|---|---|---|---|
| | Bu. | Lb. | Bu. | Bu. | Tons | Tons | Tons | A.U.M. [2] | A.U.M. [2] | A.U.M. [2] |
| Altavista fine sandy loam, 0 to 2 percent slopes | 70 | 450 | 65 | 55 | 3.0 | 5.5 | 3.7 | 6.2 | 9.2 | 5.0 |
| Appling sandy loam, 2 to 6 percent slopes, eroded | 68 | 625 | 70 | 50 | 3.0 | 5.0 | 3.7 | 6.2 | 8.3 | 5.0 |
| Appling sandy loam, 6 to 10 percent slopes, eroded | 60 | 525 | 60 | 45 | 2.6 | 4.5 | 3.1 | 5.2 | 7.5 | 4.3 |
| Appling sandy clay loam, 6 to 10 percent slopes, eroded | 45 | 400 | 42 | 40 | 2.1 | 4.0 | 2.6 | 4.3 | 6.7 | 3.5 |
| Augusta soils | 65 | --- | 55 | 50 | --- | 3.5 | 3.6 | 6.0 | 5.8 | --- |
| Buncombe loamy fine sand | 45 | --- | 45 | 30 | 1.7 | 5.0 | --- | --- | 8.3 | 2.8 |
| Cecil sandy loam, 2 to 6 percent slopes, eroded | 68 | 625 | 70 | 50 | 3.0 | 5.0 | 3.7 | 6.2 | 8.2 | 5.0 |
| Cecil sandy loam, 6 to 10 percent slopes, eroded | 60 | 525 | 60 | 45 | 2.6 | 4.5 | 3.1 | 5.2 | 7.5 | 4.3 |
| Cecil sandy loam, 10 to 15 percent slopes, eroded | 50 | 450 | 55 | 40 | 2.5 | 4.0 | 2.9 | 4.8 | 6.7 | 4.2 |
| Cecil clay loam, 6 to 10 percent slopes, eroded | 45 | 400 | 42 | 40 | 2.1 | 4.0 | 2.6 | 4.3 | 6.7 | 3.5 |
| Cecil gravelly sandy loam, 2 to 10 percent slopes | 60 | 525 | 60 | 45 | 2.6 | 4.0 | 3.1 | 5.2 | 6.7 | 4.3 |
| Chewacla soils, frequently flooded | 85 | --- | -- | 65 | --- | 4.0 | 4.0 | 6.7 | 6.6 | --- |
| Congaree loam | 90 | 650 | 75 | 65 | 3.1 | 4.5 | 4.2 | 7.0 | 7.5 | 5.2 |
| Congaree soils, frequently flooded | 90 | 650 | 75 | 65 | 3.1 | 4.5 | 4.2 | 7.0 | 7.5 | 5.2 |
| Congaree soils, local alluvium | 85 | 550 | 75 | 55 | 3.1 | 5.5 | 4.0 | 6.6 | 9.1 | 5.1 |
| Davidson loam, 2 to 6 percent slopes, eroded | 70 | 525 | 70 | 50 | 3.0 | 5.0 | 3.4 | 5.7 | 8.3 | 5.0 |
| Davidson loam, 6 to 10 percent slopes, eroded | 65 | 475 | 65 | 48 | 2.7 | 4.5 | 3.3 | 5.5 | 7.5 | 4.5 |
| Davidson clay loam, 2 to 6 percent slopes, eroded | 55 | 425 | 58 | 42 | 2.6 | 4.5 | 3.0 | 5.3 | 7.5 | 4.3 |
| Davidson clay loam, 6 to 10 percent slopes, eroded | 45 | 375 | 48 | 35 | 2.5 | 4.0 | 2.9 | 4.8 | 6.6 | 4.2 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Davidson clay loam, 10 to 15 percent slopes, eroded | 40 | 325 | 40 | 30 | 2.2 | 3.5 | 2.7 | 4.5 | 5.8 | 3.5 |
| Durham sandy loam, 2 to 6 percent slopes | 70 | 550 | 62 | 45 | 3.1 | 5.5 | 3.8 | 6.3 | 9.1 | 5.1 |
| Gullied land | -- | --- | -- | -- | --- | --- | --- | --- | --- | --- |
| Gwinnett loam, 2 to 6 percent slopes, eroded | 70 | 525 | 70 | 50 | 1.5 | 5.0 | 3.5 | 5.8 | 8.3 | 2.5 |
| Gwinnett loam, 6 to 10 percent slopes, eroded | 65 | 475 | 65 | 48 | 1.5 | 4.5 | 3.1 | 5.2 | 7.5 | 2.5 |
| Gwinnett loam, 10 to 25 percent slopes, eroded | -- | --- | -- | -- | 1.0 | --- | 2.4 | 4.0 | --- | 1.7 |
| Gwinnett clay loam, 2 to 6 percent slopes, eroded | 55 | 425 | 58 | 42 | 1.5 | 4.5 | 2.9 | 4.8 | 7.5 | 2.5 |
| Gwinnett clay loam, 6 to 10 percent slopes, eroded | 45 | 375 | 48 | 35 | 1.5 | 4.0 | 2.6 | 4.3 | 6.6 | 2.5 |
| Gwinnett clay loam, 10 to 25 percent slopes, eroded | -- | --- | -- | -- | --- | --- | 2.2 | 3.7 | --- | --- |
| Helena sandy loam, 2 to 6 percent slopes | 60 | 525 | 60 | 45 | 2.8 | 4.0 | 3.4 | 5.7 | 6.6 | 4.7 |
| Louisa gravelly sandy loam, 6 to 15 percent slopes | 30 | 325 | 40 | -- | 1.4 | 3.3 | 1.8 | 3.0 | 5.5 | 2.3 |
| Louisa gravelly sandy loam, 15 to 45 percent slopes | -- | --- | -- | -- | --- | --- | --- | --- | --- | --- |
| Louisburg loamy sand, 2 to 10 percent slopes | 30 | 325 | 40 | -- | 1.4 | 3.5 | 2.1 | 3.5 | 5.8 | 2.3 |
| Louisburg loamy sand, 10 to 25 percent slopes | -- | --- | -- | -- | --- | --- | --- | --- | --- | --- |
| Louisburg stony loamy sand, 6 to 15 percent slopes | -- | --- | -- | -- | --- | --- | .9 | 1.5 | --- | --- |
| Louisburg stony loamy sand, 15 to 45 percent slopes | -- | --- | -- | -- | --- | --- | --- | --- | --- | --- |
| Made land | -- | --- | -- | -- | --- | --- | --- | --- | --- | --- |
| Madison gravelly sandy loam, 2 to 6 percent slopes, eroded | 60 | 592 | 65 | 45 | 2.7 | 4.5 | 3.2 | 5.3 | 7.5 | 4.5 |
| Madison gravelly sandy loam, 6 to 10 percent slopes, eroded | 55 | 500 | 55 | 37 | 2.5 | 4.0 | 3.1 | 5.2 | 6.7 | 4.1 |
| Madison sandy clay loam, 2 to 6 percent slopes, eroded | 45 | 400 | 45 | 35 | 2.3 | 4.5 | 2.8 | 4.7 | 7.5 | 3.8 |

See footnotes at end of table.

TABLE 6.--ESTIMATED ACRE YIELDS OF THE PRINCIPAL CROPS GROWN UNDER A HIGH LEVEL OF MANAGEMENT--Continued

| Soil | Corn [1] | Cotton (lint) | Oats | Grain sorghum | Sericea lespedeza for hay | Coastal bermudagrass for hay | Tall fescue for hay | Tall fescue and white clover for pasture | Coastal bermudagrass for pasture | Sericea lespedeza for pasture |
|---|---|---|---|---|---|---|---|---|---|---|
| | Bu. | Lb. | Bu. | Bu. | Tons | Tons | Tons | A.U.M. [2] | A.U.M. [2] | A.U.M. [2] |
| Madison sandy clay loam, 6 to 10 percent slopes, eroded | 40 | 325 | 40 | 30 | 2.0 | 4.0 | 2.4 | 4.0 | 6.7 | 3.3 |
| Madison sandy clay loam, 10 to 15 percent slopes, eroded | -- | --- | -- | -- | 1.6 | 3.5 | 2.0 | 3.3 | 5.8 | 2.7 |
| Madison sandy clay loam, 15 to 45 percent slopes, eroded | -- | --- | -- | -- | 1.4 | --- | --- | --- | --- | 2.3 |
| Musella cobbly loam, 6 to 15 percent slopes | 45 | 350 | 55 | 35 | --- | --- | --- | --- | --- | --- |
| Musella cobbly loam, 15 to 45 percent slopes | -- | --- | -- | -- | --- | --- | --- | --- | --- | --- |
| Pacolet sandy loam, 2 to 6 percent slopes, eroded | 65 | 625 | 70 | 50 | 2.8 | 4.5 | 3.4 | 5.7 | 7.5 | 4.6 |
| Pacolet sandy loam, 6 to 10 percent slopes, eroded | 55 | 525 | 60 | 40 | 2.6 | 4.0 | 3.2 | 5.3 | 6.6 | 4.3 |
| Pacolet sandy clay loam, 2 to 6 percent slopes, eroded | 45 | 400 | 45 | 35 | 2.3 | 4.5 | 2.8 | 4.7 | 7.5 | 3.8 |
| Pacolet sandy clay loam, 6 to 10 percent slopes, eroded | 40 | 325 | 40 | 30 | 2.0 | 4.0 | 2.4 | 4.0 | 6.6 | 3.3 |
| Pacolet sandy clay loam, 10 to 15 percent slopes, eroded | -- | --- | -- | -- | 1.6 | 3.5 | 1.1 | 3.3 | 5.8 | 2.6 |
| Pacolet sandy clay loam, 15 to 25 percent slopes, eroded | -- | --- | -- | -- | 1.4 | --- | --- | --- | 2.3 | 2.3 |
| Pacolet cobbly sandy loam, 15 to 45 percent slopes | -- | --- | -- | -- | 2.4 | --- | 2.6 | 4.3 | 4.0 | 4.0 |
| Red Bay sandy loam, 2 to 6 percent slopes | 70 | 525 | 70 | 50 | 3.0 | 5.0 | 3.5 | 5.8 | 8.3 | 5.0 |
| Rock land | -- | --- | -- | -- | --- | --- | --- | --- | --- | --- |
| Wedowee sandy loam, 10 to 25 percent slopes, eroded | -- | --- | -- | -- | 2.0 | 2.5 | 2.9 | 4.8 | 5.0 | 3.0 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Wehadkee soils, frequently flooded | 45 | --- | -- | -- | --- | --- | 3.2 | 5.3 | --- | --- |
| Wickham sandy loam, 2 to 6 percent slopes, eroded | 68 | 625 | 70 | 50 | 3.0 | 5.0 | 3.6 | 6.0 | 8.3 | 5.0 |
| Wickham sandy loam, 6 to 10 percent slopes, eroded | 60 | 525 | 60 | 45 | 2.6 | 4.5 | 3.1 | 5.2 | 7.5 | 4.3 |
| Wilkes-Iredell cobbly complex, 6 to 15 percent slopes | -- | --- | -- | -- | 1.8 | 4.0 | 2.5 | 4.0 | 5.5 | 3.0 |
| Worsham sandy loam, 0 to 2 percent slopes | 45 | --- | -- | -- | --- | --- | 3.1 | 5.2 | --- | --- |
| Worsham sandy loam, 2 to 6 percent slopes | -- | --- | -- | -- | --- | --- | 3.1 | 5.2 | --- | --- |

1/ For yields of corn on some soils when irrigated see Ga. Agr. Expt. Sta. Bul. N.S. 60 (3).

2/ Animal-unit month is used to express the amount of forage or feed required to maintain one animal unit for a period of 30 days.

## Use of the Soils for Wildlife[5]

Most of the soils in Gwinnett County produce food and cover for many kinds of wildlife. Some kinds of wildlife prosper in open areas near farms; others prefer the woods; and some require a water habitat. Some species eat only insects and other animal food; some eat only vegetative foods; and others eat a combination of these.

Bobwhites and doves are particularly numerous in the large, cultivated areas in the southeastern part of the county. Rabbits, squirrels, fox, opossum, raccoons, skunks, and many songbirds and other nongame birds are common throughout the county. Deer and wild turkey require extensive woodland areas with a plentiful supply of water, such as the wooded areas along the Alcovy and Yellow Rivers and in other large,wooded tracts in the county. The narrow bottom lands along the Chattahoochee, Alcovy, and Yellow Rivers and other streams in the county are good habitats for wild ducks, mink, and beavers. These areas also provide good fishing.

A summary of the food and habitat needs of the more important kinds of wildlife in Gwinnett County follows.

Beaver.--Beavers eat only plants, mainly bark, roots, and green plants. Tender bark of alder, ash, birch, cottonwood, hornbeam, maple, pine, sweetgum, and willow are the chief kinds of tree foods. Beavers also eat the tender shoots of elder, honeysuckle, grass, and weeds. Acorns and corn also are choice foods for beaver. The chief feeding areas are within 150 feet of water.

Bobwhite.--Choice foods for bobwhites are acorns, blackberries, browntop millet, bullgrass, wild black cherries, corn, cowpeas, dewberries, common beggarweed, flowering dogwood, annual lespedeza, bicolor lespedeza, oats, pecans, pine mast, common ragweed, soybeans, rye, sweetgum, tickclover, wild beans, and vetch. Bobwhites also eat many insects. The food must be close to vegetation that provides shelter and protection from predators and from extreme heat and other adverse weather.

Deer.--Choice foods for deer are acorns, clover, corn, cowpeas, greenbrier, annual lespedeza, bicolor lespedeza, oats, soybeans, rye, and holly. Woodlands of 500 acres or more generally provide adequate cover.

Dove, mourning.--Browntop millet, corn, Japanese millet, pine mast, common ragweed, and sweetgum seeds are choice food for mourning doves. Doves eat no insects, green leaves, or fruits and require water daily.

Ducks.--Choice foods for ducks are acorns, browntop millet, corn, Japanese millet, and smartweed seeds. These foods must be covered with water to be readily available to ducks. Occasionally ducks will eat acorns and corn on dry land.

Rabbits.--These animals require blackberry or plum thicket or similar cover. Choice foods are clover, winter grasses, and other succulent vegetation, which generally are available in farming areas.

Squirrel.--Acorns, blackberries, blackgum, black cherries, chinkapin, corn, flowering dogwood seed, hickory nuts, magnolia seed, pecans, and pine mast are choice foods for squirrels.

Turkey, wild.--This bird survives only in areas of mature woodland that generally are 2,000 acres or more in size. Turkeys need water to drink each day, and they often roost in large trees over or near water. Choice foods are insects, acorns, blackberries, dewberries, browntop millet, chufa, clover leaves, corn, cowpeas, peanuts, flowering dogwood, wild grapes, oats, pecans, pine seeds, ryegrass forage, and soybeans.

Nongame birds.--The foods of the many kinds of nongame birds vary greatly. Some species eat only insects, some eat only seeds, and others eat only fruits and nuts. Several others eat insects, seeds, and fruits.

Fish.--The principal fish in the county are bluegill, bass, and several kinds of catfish. Rainbow trout are stocked in Lake Sidney Lanier and in the Chattahoochee River, below Buford Dam. The choice foods of bluegill are mostly aquatic worms, insects, and insect larvae. Bass and trout feed chiefly on small fish, insects, and other animal organisms. The supply of food for fish depends on the fertility of the water, the kinds of soils in the watershed, and, to some extent, on the kinds of soils on the bottom of the pond or stream. Because of the low fertility and the acidity of the soils, most ponds in the county need fertilizer and lime to produce enough algae to feed large numbers of worms and other organisms and thus provide sufficient food for fish.

### Wildlife Suitability Groups

The soils in Gwinnett County have been placed in wildlife groups according to their suitability as habitats for specified kinds of wildlife. All of the soils in one group are estimated to have similar capacity to produce food and cover for wildlife. In the paragraphs that follow each group is described. The main characteristics of the soils in each group are given, and some of the plants that furnish choice food for wildlife and that grow well on the soils in the group are named. Further information about the soils is given in the section, "Descriptions of the Soils," and the wildlife suitability group in which each soil is placed is shown in the "Guide to Mapping Units" at the back of this survey.

[5]PAUL D. SCHUMACHER, biologist, Soil Conservation Service, assisted with this subsection.

## Wildlife Suitability Group 1

This group consists of deep, friable, well-drained or excessively drained soils. These soils are on narrow and broad flood plains or are in shallow depressions and at the heads of drainageways in the uplands. The areas range from 2 to 20 acres in size, and the slope range is 0 to 6 percent.

The surface layer of the soils in this group ranges from loam to loamy fine sand in texture and from 4 to 16 inches in thickness. The subsoil in most of the soils is moderately permeable. Its texture ranges from loamy fine sand to light sandy clay loam.

These soils have medium to high available water capacity. Tilth is good, and the soils can be cultivated within a wide range of moisture content.

The soils in this group occupy a fairly small acreage in the county, and most of the acreage is cultivated or pastured. They are well suited to many plants that provide choice food for several kinds of wildlife, and protective cover for wildlife is plentiful. Blackberry, cherry, corn, cowpeas, annual lespedeza, perennial lespedeza, oats, pecan, pine, and sorghum are among the plants that provide choice food for the bobwhites, doves, rabbits, and squirrels, which are common in the areas. Because of their position and slope, these soils are subject to flooding and provide suitable small feeding areas for ducks. Many intermittent streams throughout the areas are suitable sites for small farm ponds.

## Wildlife Suitability Group 2

In this group are moderately deep to deep, well-drained soils that have a clayey subsoil. These soils are on broad to narrow, gently sloping ridgetops and moderately long side slopes. Most areas are eroded. The surface layer is loam, sandy loam, gravelly sandy loam, fine sandy loam, or sandy clay loam. The slope range is 2 to 10 percent. Depth to hard rock ranges from about 5 to more than 10 feet.

The available water capacity in these soils is medium, and permeability is moderate to moderately slow. Plant roots penetrate effectively to a depth of 36 inches or more. Tilth generally is good.

The soils in this group are highly productive under good management. They are well suited to many plants that are choice food for several kinds of wildlife, and wildlife cover is plentiful. Some of the plants to which these soils are suited are blackberry, annual lespedeza, perennial lespedeza, ryegrass, browntop millet, and sweetgum. Deer and wild turkey feed on these plants in the large wooded areas.

## Wildlife Suitability Group 3

This group consists of moderately deep to deep, well-drained soils that have a clayey subsoil. These soils are on narrow ridgetops and short, steep side slopes near drainageways. Most areas are eroded. The surface layer is loam, sandy loam, clay loam, cobbly sandy loam, or sandy clay loam. The slope range is 10 to 45 percent. Depth to bedrock ranges from 5 to more than 10 feet.

Steep slopes make these soils difficult to work and highly susceptible to further erosion. Permeability is moderate to moderately slow, and the available water capacity is medium. Plant roots penetrate effectively to a depth of 30 inches or more.

These soils occupy large areas throughout the county, and most of the acreage is wooded. Because of the slopes, these soils are not suited to annual crops planted for wildlife, and they are marginal for perennial grasses, lespedeza, and some woody plants. They are suited to wild cherry, flowering dogwood, oak, hickory, brier, and pine. Many drainageways in the areas are favorable sites for small farm ponds. The large wooded areas are well suited to plants that provide feed for deer and turkey.

## Wildlife Suitability Group 4

Soils in this group are deep and are well drained or moderately well drained. Some are on stream terraces in broad, level to nearly level and gently sloping areas and on moderately long side slopes. Others are in the uplands on broad, level ridgetops and in shallow depressions. The surface layer is sandy loam or fine sandy loam, and the subsoil is sandy clay loam to clay loam. The slope range is 0 to 10 percent, but in most of the acreage, it is 0 to 6 percent. Depth to hard rock generally is more than 5 feet.

In these soils available water capacity is medium, and permeability is moderate to moderately slow. Plant roots penetrate effectively to a depth of 30 inches or more. Tilth is good.

These soils occupy about 10 percent of the county, and wildlife cover is plentiful in the areas. They are suited to lespedeza, ryegrass, browntop millet, sweetgum, oak, blackberries, and most other plants grown locally for wildlife food and cover (pl. IV). The level to nearly level soils on low terraces are subject to flooding, and therefore these areas provide suitable feeding places for ducks.

## Wildlife Suitability Group 5

This group consists of moderately deep to deep, well-drained soils that are eroded and have a clayey subsoil. These soils are in the uplands, and the slope range is from 2 to 10 percent. They have a surface layer of sandy clay loam or clay loam and a subsoil of red clay loam to clay. Tilth is poor in the surface layer of all but the Madison soils, where it is fair. Runoff is moderate to rapid, permeability is moderate, and available water capacity is medium.

These soils are not naturally productive, but if they are well managed, they produce moderate amounts of food for several kinds of wildlife. Many of the

areas were once cultivated but now are abandoned. Ground cover is not plentiful, and any trees on the areas are mainly pines. Some of the plants that can be grown are annual and perennial lespedezas, ryegrass, and browntop millet. These plants provide choice food for the bobwhites, doves, and rabbits that are common in the areas. Natural lakes and other large sources of water are not available, but the soils are suitable sites for developing lakes and reservoirs.

Wildlife Suitability Group 6

This group consists of shallow to moderately deep, well-drained to excessively drained soils that are slightly eroded. These soils are in the uplands on narrow ridgetops and on moderately long to short, very steep side slopes. The slope range is 2 to 45 percent, and the short, very steep side slopes generally are near the drainageways. The surface layer is loamy sand or stony sandy loam. In places discontinuous layers of sandy clay loam to sandy clay occur, and in a few small areas rocks outcrop. Depth to hard rock generally is 15 to 50 inches.

In these soils available water capacity is low, permeability is moderate, and runoff is medium to rapid. Plant roots penetrate effectively to the hard rock. Tilth is good, except in the stony and steeper soils, where it is poor.

These soils occupy a fairly small acreage in the county, and most of the areas are wooded. They are less productive than the soils in group 4, but they are suited to many plants that provide choice food and cover for several kinds of wildlife. Among the plants better suited to these soils are blackberry, wild cherry, bicolor lespedeza, pecan, oak, hickory, and dogwood. In the larger wooded areas, deer, turkey, and squirrels feed on these plants. In the small open fields, common lespedeza and bicolor lespedeza provide choice feeding grounds for bobwhites and doves.

Wildlife Suitability Group 7

This group consists of shallow to moderately deep, somewhat excessively drained to somewhat poorly drained soils. These soils are on narrow, gently sloping ridgetops; on short, steep side slopes; or in small, gently sloping areas in shallow depressions. The slope range is 6 to 45 percent. The surface layer is gravelly sandy loam, cobbly loam, cobbly sandy loam, or cobbly fine sandy loam. The subsoil varies in texture, color, drainage, and thickness. It ranges from sandy loam to heavy plastic clay in texture, from mottled gray to dark red in color, and from a few to 36 inches in thickness.

The available water capacity of these soils is moderate to low. Permeability is rapid to moderately slow. Plant roots penetrate effectively to a depth of a few to 36 inches. Tilth ranges from good to poor.

These soils occupy a small acreage in the county, most of which is wooded. They are suited to blackberry, wild cherry, bicolor lespedeza, hickory, and dogwood, which provide choice food and cover for several kinds of wildlife. The most common wildlife in the areas are squirrels, rabbits, bobwhites, doves, deer, and turkey.

Wildlife Suitability Group 8

In this group are poorly drained, somewhat poorly drained, and well drained soils. These soils are on narrow, nearly level flood plains along the many streams in the county or are around the heads of drainageways and in shallow depressions in the uplands. On an average, the areas generally are flooded for 2 to 10 days, one to five times a year. Slopes range from 0 to 6 percent, and the areas generally range from 5 to 50 acres in size. The surface layer ranges from silt loam to sandy loam, and it generally is 6 to 14 inches thick. The subsoil ranges from silty clay loam to clay loam.

These soils have medium to high available water capacity. Permeability is slow to moderate. Tilth generally is good, and the soils can be cultivated within a wide range of moisture content.

The soils in this group occupy a fairly small acreage in the county. In most places they are wooded or pastured. Protective cover and food for wildlife are plentiful. The soils are well suited to blackberry, wild cherry, gum, pine, corn, cowpeas, oats, common lespedeza, and bicolor lespedeza, which furnish choice food and cover for many local and migratory kinds of wildlife. Rabbits, squirrels, snipes, woodcock, and doves are the most common local kinds of wildlife in the areas. Migratory ducks and geese generally spend the months of October through February on the larger streams and rivers in the county, though many small areas provide good feeding areas for these birds. The many intermittent streams throughout the county are favorable sites for farm ponds.

This section tells how the factors of soil formation affected the development of soils in Gwinnett County. Then the current system of soil classification is explained and the soil series are placed in higher categories. The soil series in the county, including a profile representative of each series, are described in the section, "Descriptions of the Soils," pp. 9 to 35.

## Formation of Soils

Soil is produced when parent material, climate, relief, and plants and animals interact for a period of time. These factors, including time, determine the nature of the soil that forms at any point on the earth. All of 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 its properties, as is common where the parent material consists of pure quartz sand. Quartz sand is highly resistant to weathering, and soils formed in it generally have faint horizons. 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.

### Parent Material

Parent material is the unconsolidated mass from which soil forms. It is largely responsible for the chemical and mineralogical composition of a soil. Most of the soils in Gwinnett County formed from residual materials, that is material weathered from the underlying rock.

According to the Geologic Map of Georgia (6) granite gneiss (Lithonia type), which includes diorite and injected gneiss, underlies about 65 percent of the county. The rest of the county is underlain chiefly by Brevard schist, though biotite gneiss and schist underlie about 5 percent of the county. The Brevard schist occupies a narrow area parallel to the Southern Railroad. It is about 2 to 3 miles wide in most places, but near Suwanee it widens to about 5 miles. The biotite gneiss and schist form a triangular pattern from Lawrenceville southwestward.

The proportion of felsic and mafic minerals in these parent rocks, as well as of quartz that is very resistant to weathering, limits the amount of clay in the soils. Louisburg soils, for example, formed in material weathered from siliceous rock and quartz sand, which are very resistant to weathering. These soils therefore are sandy and have faint horizons, and in small, scattered areas hard rock is exposed. In contrast, the Appling, Cecil, and Davidson soils formed from parent material less resistant to weathering and contain fairly large quantities of clay, chiefly from feldspars. The Madison and Louisa soils, on the other hand, also contain appreciable amounts of clay, but the material from which they formed contains considerable muscovite, which is resistant to weathering and is retained in the soil.

### Climate

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

Gwinnett County has a moist, temperate climate with an average annual temperature of about 62° F. The temperature in January averages about 44° and that in July averages about 80°. The warm, moist climate promotes rapid weathering of hard 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 county. About 47 inches of water falls annually, and much of this percolates through the soil and moves dissolved or suspended materials downward so that the soils generally are low in bases. Plant remains decay rapidly and produce organic acids that help to hasten the breakdown of minerals in the underlying rock. The content of organic matter in the surface layer of soils that have good drainage thus is quite low.

### Relief

Relief influences soil formation through its effect on runoff, movement of water within the soil, plant cover, and, to some extent, soil temperature.

The length, shape, steepness, and exposure of slopes hastens or delays the rate of runoff. Runoff is more rapid on steep slopes than level ones, and thus steep soils erode faster than level ones, even if both are of the same materials. In Gwinnett County, for example, soils underlain by rock generally are thinner and have a more weakly expressed profile on steep slopes than soils forming in similar material on broad, fairly level ridgetops. Rock outcrops also are numerous.

A level or nearly level surface allows more time for water to penetrate the soil. More water thus percolates through the soil profile, and this in turn influences the solution and translocation of soluble materials. The moisture available in the soil also determines to a significant extent the amount and kinds of plants that grow. Thus steep soils that have a slowly permeable surface are generally drier than level or nearly level soils, and less vegetation grows on them.

Gwinnett County ranges from nearly level to very steep but is not extremely hilly. The effect of

relief on soil temperature therefore is not so pronounced as in more mountainous areas. In general, however, slopes that face south are warmer than slopes that face north.

### 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, relief, and age of the soil.

Most of the soils in Gwinnett County 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, though the hardwoods contribute more than the softwoods. The content of organic matter 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, permitting the entrance of more water. Also, the uprooting of trees by wind decidedly influences formation of soils through mixing of soil layers and loosening of underlying material.

Small animals, earthworms, insects, and microorganisms also influence the formation of soils by mixing organic matter into the soil and by helping to break 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 may alter it chemically. Bacteria, fungi, and other microorganisms hasten the weathering of rocks and the decomposition of organic matter.

### Time

Generally a long time is required for a soil to form (12). Most of the soils on uplands in Gwinnett County have been in place long enough for distinct horizons to develop, but some formed in alluvium have been in place too short a time for distinct horizons to form.

Most soils in Gwinnett County have distinct horizons. The surface soil 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 well enough drained that they have a red or dark-red subsoil and 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 a resulting increase in exchangeable hydrogen. Cecil and Davidson soils are examples of soils in Gwinnett County that are old.

Two 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 Augusta soils, on stream terraces, and the Congaree soils, on flood plains. These soils are similar in texture and occupy similar positions on the landscape. The Augusta soils, however, have been in place long enough to have a distinct, dark-colored surface layer and a subsoil with an accumulation of clay. The Congaree soils, on the other hand, have not been in place long enough for distinct horizons to form and much clay to accumulate.

## Classification of Soils

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

Thus in classification, soils are placed in narrow categories that are used in detailed soil surveys so that knowledge about the soils can be organized and applied in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. They are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

The current system of classifying soils was placed in general use by the National Cooperative Soil Survey in 1965. It is under continual study (7,14). Therefore, readers interested in developments of this system should refer to the latest literature available. The classes in the current system are briefly defined in the following paragraphs.

ORDER: Ten soil orders are recognized in the current system. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. The exceptions, Entisols and Histosols, occur in many different climates. Four soil orders are represented in Gwinnett County--Entisols, Inceptisols, Alfisols, and Ultisols.

Entisols are young mineral soils that do not have genetic horizons or have only the beginning of such horizons.

Inceptisols are mineral soils in which horizons have definitely started to develop. They generally are on young, but not recent, land surfaces.

Alfisols are soils containing a clay-enriched B horizon that has high base saturation.

Ultisols are mineral soils that have distinct horizons and are commonly on old land surfaces. They contain a clay-enriched B horizon that has low base saturation. The base saturation decreases with increasing depth.

SUBORDER: Each order is subdivided into suborders, primarily on the basis of soil characteristics that seem to produce classes having the greatest genetic similarity. The suborders have a narrower climatic range than the orders. The criteria for suborders chiefly reflect the presence or absence of waterlogging or soil differences resulting from the climate or vegetation.

GREAT GROUP: Each suborder is divided into great groups according to the presence or absence of genetic horizons and the arrangement of these horizons.

SUBGROUP: Each great group is subdivided into subgroups. One of these subgroups represents the central (typic) segment of the great group, and the others, called intergrades, contain those soils having properties mostly of the one great group, but also one or more properties of soils in another great group, suborder, or order.

FAMILY: Each subgroup is divided into families, primarily on the basis of properties important to the growth of plants. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, consistence, and thickness of horizons.

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 soils, 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. Most of the soil series described in this publication have been established earlier. The Gwinnett, Pacolet, and Wedowee series had tentative status when the survey was sent to the printer.

In table 7 the soil series in Gwinnett County are classified according to the current system of soil classification.

TABLE 7.--SOIL SERIES CLASSIFIED ACCORDING TO THE CURRENT SYSTEM OF CLASSIFICATION

| Series | Family | Subgroup | Order |
|---|---|---|---|
| Altavista | Fine-loamy, mixed, thermic | Typic Hapludults | Ultisols. |
| Appling | Clayey, kaolinitic, thermic | Typic Hapludults | Ultisols. |
| Augusta | Fine-loamy, mixed, thermic | Aeric Ochraquults | Ultisols. |
| Buncombe | Sandy, mixed, thermic | Typic Udipsamments | Entisols. |
| Cecil | Clayey, kaolinitic, thermic | Typic Hapludults | Ultisols. |
| Chewacla | Fine-loamy, mixed, thermic | Aquic Fluventic Dystrochrepts | Inceptisols. |
| Congaree | Fine-loamy, mixed, thermic | Typic Udifluvents | Entisols. |
| Davidson | Clayey, kaolinitic, thermic | Humic Paleudults | Ultisols. |
| Durham | Fine-loamy, siliceous, thermic | Typic Hapludults | Ultisols. |
| Gwinnett | Clayey, kaolinitic, thermic | Typic Rhodudults | Ultisols. |
| Helena | Clayey, mixed, thermic | Aquic Hapludults | Ultisols. |
| Iredell | Fine, montmorillonitic, thermic | Vertic Hapludalfs | Alfisols. |
| Louisa | Fine-loamy, micaceous, thermic, shallow | Ruptic-Ultic Dystrochrepts | Inceptisols. |
| Louisburg | Coarse-loamy, mixed, thermic | Typic Dystrochrepts | Inceptisols. |
| Madison | Clayey, kaolinitic, thermic | Typic Hapludults | Ultisols. |
| Musella | Fine-loamy, mixed, thermic | Typic Rhodudults | Ultisols. |
| Pacolet | Clayey, kaolinitic, thermic | Typic Hapludults | Ultisols. |
| Red Bay | Fine-loamy, siliceous, thermic | Humic Paleudults | Ultisols. |
| Wedowee | Clayey, kaolinitic, thermic | Typic Hapludults | Ultisols. |
| Wehadkee | Fine-loamy, mixed, acid, thermic | Fluventic Haplaquepts | Inceptisols. |
| Wickham | Fine-loamy, mixed, thermic | Typic Paleudults | Ultisols. |
| Wilkes | Loamy, mixed, thermic, shallow | Ruptic-Alfic Dystrochrepts | Inceptisols. |
| Worsham | Fine-loamy, mixed, thermic | Typic Ochraquults | Ultisols. |

This section describes the physiography and drainage of the county and discusses the water supply and the climate.

## Physiography and Drainage

Gwinnett County is in the Piedmont Plateau of Georgia. The elevation is about 720 feet above sea level near the De Kalb County line, and it ranges from 900 to more than 1,200 feet on the ridgetops. The areas are made up of broad, convex ridgetops dissected by many drainageways. Slopes are gentle to strong, except near the major streams where slopes are short and steep. The areas have been subject to geologic erosion for a long time, and the igneous and metamorphic rocks that underlie the areas generally are deeply weathered.

The Alcovy, Apalachee, Chattahoochee, Mulberry, and Yellow Rivers are the major streams draining the county. The northern and extreme western parts of the county are drained by the Chattahoochee River, which forms the western boundary of the county. Drainage in the rest of the county is southeastward. The northeastern part of the county is drained by the Mulberry River; the north-central part, by the Apalachee River; the east-central part, by the Alcovy River; and the southern part, by the Yellow River.

## Water Supply

The Chattahoochee River, which forms part of the western boundary of Gwinnett County, provides water through a county system to about 35 percent of the people. The cities and towns use water from drilled wells that are 250 to 350 feet deep and supplement this water from the county system.

Lake Lanier and the Alcovy, Apalachee, Mulberry, and Yellow Rivers and the many smaller streams in the county are excellent sources of water for industries and for some farms. Water for domestic use on most farms comes from dug wells that are about 40 to 70 feet deep and from drilled wells that are about 100 to 250 feet deep. These wells generally are a dependable source of water throughout the year. The large streams, branches, and creeks and the more than 600 farm ponds in the county are the main sources of water for livestock. These streams and ponds also are suitable for production of fish and furnish recreation for many.

## Climate[6]

The climate of Gwinnett County is determined primarily by its altitude and its location in relation to the higher mountains farther north in Georgia, the Gulf of Mexico to the south, and the Atlantic Ocean to the southeast. The mountains form a partial barrier to the masses of cold air that move southward over the continent in winter. The waters of the Gulf of Mexico and the Atlantic Ocean are the source of precipitation for the county and also help to moderate the temperatures in summer and winter.

Summers in the county are moderately warm; long periods of excessive heat are rare. Temperatures of 90° F. or higher can be expected on about half of the days in summer, and temperatures of 100° or more occur on at least 4 days in 2 out of 10 years. Because of the elevation, temperatures are comfortably low at night, and by early morning they generally are in the sixties.

In an average winter, temperatures of 32° or below occur on 50 to 60 days, but temperatures of 20° or lower can be expected on less than 10 days. Most of these temperatures occur from December through February, but freezing temperatures have been recorded early in April and late in October. The last frost in spring generally occurs late in March, and the first in fall, early in November. The growing season is about 220 days. The terrain of the county is hilly, and the minimum temperatures therefore vary greatly within a relatively short distance. Drainage of cold air into the valleys on clear, calm nights causes lower temperatures and shorter growing seasons in the valleys than on nearby slopes.

Precipitation averages about 49 inches a year in Gwinnett County, and it is fairly well distributed throughout the year. March is the wettest month and averages about 6 inches, and October is the driest and averages less than 3 inches. Much of the rain comes in brief, local showers. Precipitation generally is ample, but damaging dry spells occur in some years. These generally occur late in summer and in fall when long, unbroken periods of sunny weather are likely. In winter the precipitation generally is associated with moving low-pressure centers and cold fronts, and the rains may last for several hours or longer. Light snowfall occurs in most winters, but generally the accumulation is not measurable.

Thunderstorms have occurred in every month, but they are more frequent in spring and summer. Some of the more severe thunderstorms are accompanied by damaging winds and hail.

The average monthly relative humidity ranges mostly from 80 to 90 percent early in the morning and from 50 to 60 percent early in the afternoon. Humidity generally is highest late in summer and lowest in fall and in spring.

Prevailing winds generally are from the north, northwest, or northeast in fall and winter, and they are from the south or are variable in spring and summer. Average windspeeds range from about 7 miles an hour in August to about 11 miles an hour in February and March.

Data on temperature and precipitation are given in table 8. The probabilities of the last freezing temperatures in spring and the first in fall are given in table 9.

---

6 By HORACE S. CARTER, State Climatologist, U.S. Weather Bureau, Athens, Ga.

TABLE 8.--TEMPERATURE AND PRECIPITATION DATA FOR GWINNETT COUNTY, GA.

| 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------ | 55.4 | 33.9 | 71 | 20 | 4.92 | 2.5 | 8.5 |
| February----- | 57.3 | 34.1 | 73 | 21 | 4.90 | 2.3 | 9.8 |
| March-------- | 63.6 | 39.3 | 80 | 27 | 6.06 | 3.8 | 9.4 |
| April-------- | 73.0 | 47.9 | 86 | 35 | 4.56 | 2.1 | 7.4 |
| May---------- | 82.7 | 55.5 | 93 | 45 | 3.49 | .7 | 6.3 |
| June--------- | 88.1 | 65.2 | 97 | 58 | 3.77 | 1.8 | 6.8 |
| July--------- | 89.9 | 67.5 | 98 | 64 | 4.19 | 1.9 | 7.1 |
| August------- | 88.9 | 66.7 | 98 | 62 | 3.43 | 1.1 | 6.3 |
| September---- | 83.5 | 61.9 | 96 | 51 | 3.43 | .9 | 6.1 |
| October------ | 75.5 | 49.7 | 86 | 38 | 2.53 | .5 | 5.0 |
| November----- | 63.9 | 40.1 | 78 | 25 | 3.49 | .9 | 7.1 |
| December----- | 55.9 | 33.7 | 70 | 20 | 4.45 | 1.5 | 8.1 |
| Year------ | 73.1 | 49.6 | 1/100 | 1/15 | 49.22 | 41.2 | 58.0 |

1/ The extreme temperature that will be equaled or exceeded (minimum equal or lower) on at least 4 days in 2 out of 10 years.

TABLE 9.--PROBABILITIES OF LAST FREEZING TEMPERATURES IN SPRING AND THE FIRST IN FALL

| Probability | Dates for given probability at temperature of-- | | |
|---|---|---|---|
| | 24° F. | 28° F. | 32° F. |
| Spring: | | | |
| 1 year in 10 later than-------- | March 15---------- | March 30---------- | April 15. |
| 2 years in 10 later than------- | March 8----------- | March 22---------- | April 10. |
| 5 years in 10 later than------- | February 20------- | March 13---------- | March 28. |
| Fall: | | | |
| 1 year in 10 earlier than------ | November 16------- | November 7-------- | October 28. |
| 2 years in 10 earlier than----- | November 23------- | November 10------- | November 2. |
| 5 years in 10 earlier than----- | December 1-------- | November 20------- | November 10. |

## LITERATURE CITED


(1) Abercrombie, W.F.
1954. A System of Soil Classification, Highway Res. Bd. Proc. Pub. 324, pp. 509-514, illus.

(2) American Association of State Highway Officials.
1961. Standard Specifications for Highway Materials and Methods of Sampling and Testing. Ed. 8, 2 v., illus.

(3) Boswell, F.C., Anderson, O.E., and Stacy, S.V.
1959. Some Effects of Irrigation, Nitrogen and Plant Population on Corn. Ga. Agr. Expt. Sta. Bul. N.S. 60, 51 pp., illus.

(4) Flanigan, J.C.
1959. History of Gwinnett County, v. II (Covers period 1818 to 1960), 629 pp., illus.

(5) Georgia Department of Public Health.
1964. Recommendations for the Design, Operation, and Maintenance of Sewage Oxidation Ponds, 20 pp., illus.

(6) Georgia Division of Mines, Mining and Geology.
1939. Geologic Map of Georgia. Prepared by Ga. Div. of Mines, Mining and Geol., in cooperation with the U.S. Dept. of Int., Geol. Survey, 1 p.

(7) Simonson, Roy W.
1962. Soil Classification in the United States. Sci. 137: 1027-1034.

(8) Smith, George E., Jr.
1966. Soil Survey as a Tool for Forest Managers. Soil Conservation, v. 32, No. 2.

(9) United States Department of Agriculture.
1929. Volume, Yield, and Stand Tables for Second-Growth Southern Pines. Misc. Pub. No. 50, 202 pp., illus. (Out of print.)

(10) United States Department of Agriculture.
1935. Growth and Yield of Second-Growth Red Gum in Fully Stocked Stands on Alluvial Lands in the South. Southern Forest Expt. Sta., 12 pp., illus., Occasional Paper No. 54.

(11) _____
1937. Yield, Stand, and Volume Tables for Even-Aged Upland Oak Forests. U.S. Tech. Bul. No. 560, 87 pp., illus. (Reprinted 1961.)

(12) _____
1938. Soils and Men. U.S. Dept. Agr. Ybk., pp. 979-1001, illus.

(13) _____
1951. Soil Survey Manual. U.S. Dept. Agr. Handb. 18, 503 pp., illus.

(14) _____
1960. Soil Classification, A Comprehensive System. 7th Approximation. Soil Survey Staff, Soil Conservation Service, 265 pp., illus. (Supplement issued in March 1967.)

(15) _____
1963. Georgia's Timber. Forest Service Resource Bulletin SE-1, Southeastern Forest Expt. Sta. Asheville, N.C. 39 pp., illus.

(16) United States Department of Health, Education and Welfare.
1957. Manual of Septic-Tank Practice. Public Health Service. Pub. No. 526, 93 pp., illus. (Reprinted 1963.)

(17) United States Department of Interior.
1966. Federal Assistance in Outdoor Recreation. Bureau of Outdoor Recreation. No. 1, 83 pp. (Revised 1966.)

(18) Waterways Experiment Station.
1953. The Unified Soil Classification System. Tech. Memo. 3-357, 2 v. and appendix.

Acidity, soil. See Reaction.

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

Available water capacity. The capacity of a soil to hold water in a form available to plants. The amount of moisture held in a soil between field capacity, or about one-third atmosphere of tension, and the wilting coefficient, or about 15 atmospheres of tension.

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.

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--

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

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

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

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

Loose.--Noncoherent; does not hold together in a mass.

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.

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

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

Drainage, soil. The rapidity and extent of the removal of water from the soil, in relation to additions, especially by runoff, by flow through the soil to underground spaces, or by a combination of both processes.

Felsic rock.--A term applied to light-colored rocks containing an abundance of one or all of feldspar, lenads or feldspathoids, and silica.

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 and that differs in one or more ways from adjacent horizons in the same profile.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Leaching. The removal of soluble materials from soils or other material by percolating water.

Mafic rock. Pertaining to or composed dominantly of magnesian rock-forming silicates; soil of some dark-colored igneous rocks and their constituent minerals.

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

Parent material, soil. The horizon of weathered rock or partly weathered soil material from which soil has formed; horizon C in the soil profile.

Permeability, soil. The quality that enables a soil horizon 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.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

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

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

Sand. As a soil separate, individual rock or mineral ranging from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz, but sand may be any mineral composition. As a textural class, soil that is 85 percent or more sand and not more than 10 percent clay.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a textural class, soil that 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 upon parent material, as conditioned by relief over periods of time.

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

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are--platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are (1) single grain (each grain by itself, as in dune sand) or (2) massive (the particles adhering together without any regular cleavage, as in many claypans and hardpans.

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

Substratum. Any layer lying beneath the solum, or true soil; the C or R horizon.

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

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing 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 (geologic). Land consisting of material unworked by water in recent geologic time and lying, in general, at a higher elevation than the alluvial plain or stream terrace. Land above the lowlands along rivers.



U. S. GOVERNMENT PRINTING OFFICE : 1967 O - 267-726

# NRCS Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.