SOIL SURVEY OF
Panola County, Texas

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Texas Agricultural Experiment Station

Major fieldwork for this soil survey was done in the period 1966–70. Soil names and descriptions were approved in 1970. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1970. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Panola Soil and Water Conservation District.

Copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

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

Locating Soils

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

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

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetical order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the interpretive groups in which the soil has been placed.

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

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

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

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

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

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

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

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

Cover: Area of Wrightsville-Cart complex. Wrightsville soils in foreground; and Cart soils on mound. About 130,000 acres in Panola County has a moundy landscape.

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SOIL SURVEY OF PANOLA COUNTY, TEXAS

BY RAYMOND DOLEZEL, SOIL CONSERVATION SERVICE

SOILS SURVEYED BY RAYMOND DOLEZEL, TOM GALLOWAY, AND C. E. BROOKS, SOIL CONSERVATION SERVICE[1]

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

PANOLA COUNTY is in the east-central part of Texas (fig. 1). The total area is about 567,680 acres, of which 7,190 acres is water. Elevation ranges from 200 feet above sea level in the southeast corner to 450 feet above sea level in the northwestern part of the county.

About one-fourth of the county is made up of nearly level areas on bottom lands. The bottom lands of the Sabine River run from the northwest tip of the county to the southeast tip. Large, nearly level, moundy areas are on terraces adjacent to larger areas on bottom lands. The largest areas of strongly sloping to moderately steep soils are in the northwestern part of the county and near the Sabine uplift.

The early development of Panola County depended largely on farming, and cotton was the main crop for nearly 100 years. Farming has declined since the 1930's, however, and cotton has been replaced by pasture for beef and dairy cattle. Some formerly cultivated fields have been planted to rows of slash and loblolly pine for reforestation.

The discovery of gas and oil in 1940 brought in new industries and changed the county's economy. This discovery, among other factors, caused a population shift from rural to urban areas. In 1850 Panola County had a population of 3,871. By 1860 the population was 8,475; in 1900 the population was 21,404; and by 1930 it had reached 24,063. By 1960 the population had decreased to 16,870 and in 1970 it was 15,894.

How This Survey Was Made

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

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

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Ruston and Sacul, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil

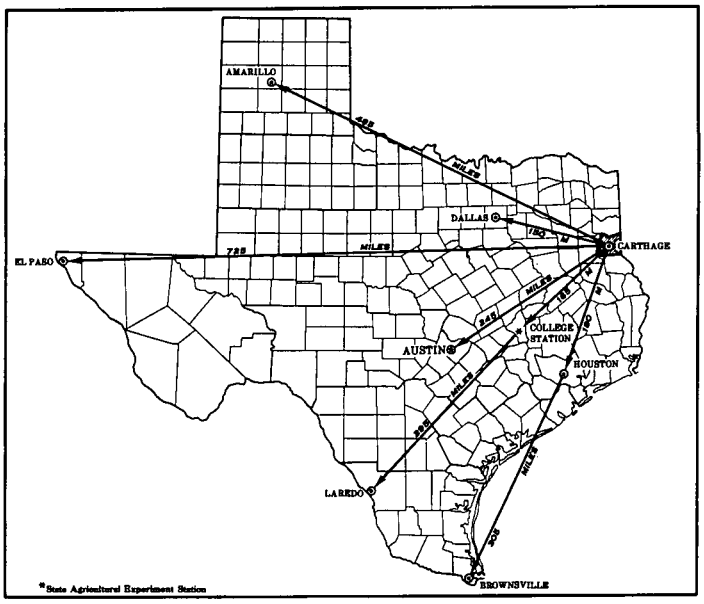

Figure 1.—**Location of Panola County in Texas.**

[1] ALAN R. FORD, CHARLES R. FUCHS, JOE LABARBERA, AND CHARLES BATTE, Soil Conservation Service, assisted in the preparation of this survey.

phase indicates a feature that affects management. For example, Sacul fine sandy loam, 1 to 5 percent slopes, is one of several phases in the Sacul series.

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

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

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

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

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

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 soil 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 soil. Yields under defined management are estimated for all the soils.

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

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

General Soil Map

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

The soil associations in Panola County are discussed in the following pages. The terms for texture used in the descriptive heading of the associations apply to the surface layer.

1. Sacul-Bowie association

Gently sloping to moderately steep, slightly acid to medium acid, loamy soils on uplands

This association is dissected by a dendritic drainage system. The soils in this association are the steepest in the county. They are strongly sloping and moderately steep soils on side slopes and gently sloping to sloping soils on broad, convex ridges.

This association occupies about 42 percent of the county. Sacul soils make up about 44 percent of the association and Bowie soils 20 percent. The remaining 36 percent is mainly Kullit, Luverne, and Kirvin soils (fig. 2).

Sacul soils are sloping to moderately steep on side slopes and gently sloping around the head of drainageways. They have a surface layer of fine sandy loam about 7 inches thick. The upper part of the surface layer is dark brown, and the lower part is yellowish brown. The subsoil is clay to a depth of 42 inches and is underlain by clay loam to a depth of 52 inches. The upper part of the subsoil is red clay; the middle part is mottled, light brownish-gray and red clay; and the lower part is mottled, red clay loam. The underlying material is weakly consolidated sandstone and shale that reaches to a depth of about 72 inches.

Bowie soils are gently sloping to sloping and are on broad, convex ridges. They have a surface layer of fine sandy loam about 12 inches thick. The upper part is dark grayish brown, and the lower part is pale brown. The subsoil is sandy clay loam that reaches to a depth of about 78 inches. It is yellowish brown mottled in shades of brown, red, and yellow in the upper 30 inches, and the lower 36 inches is mottled in shades of yellow, brown, red, and gray.

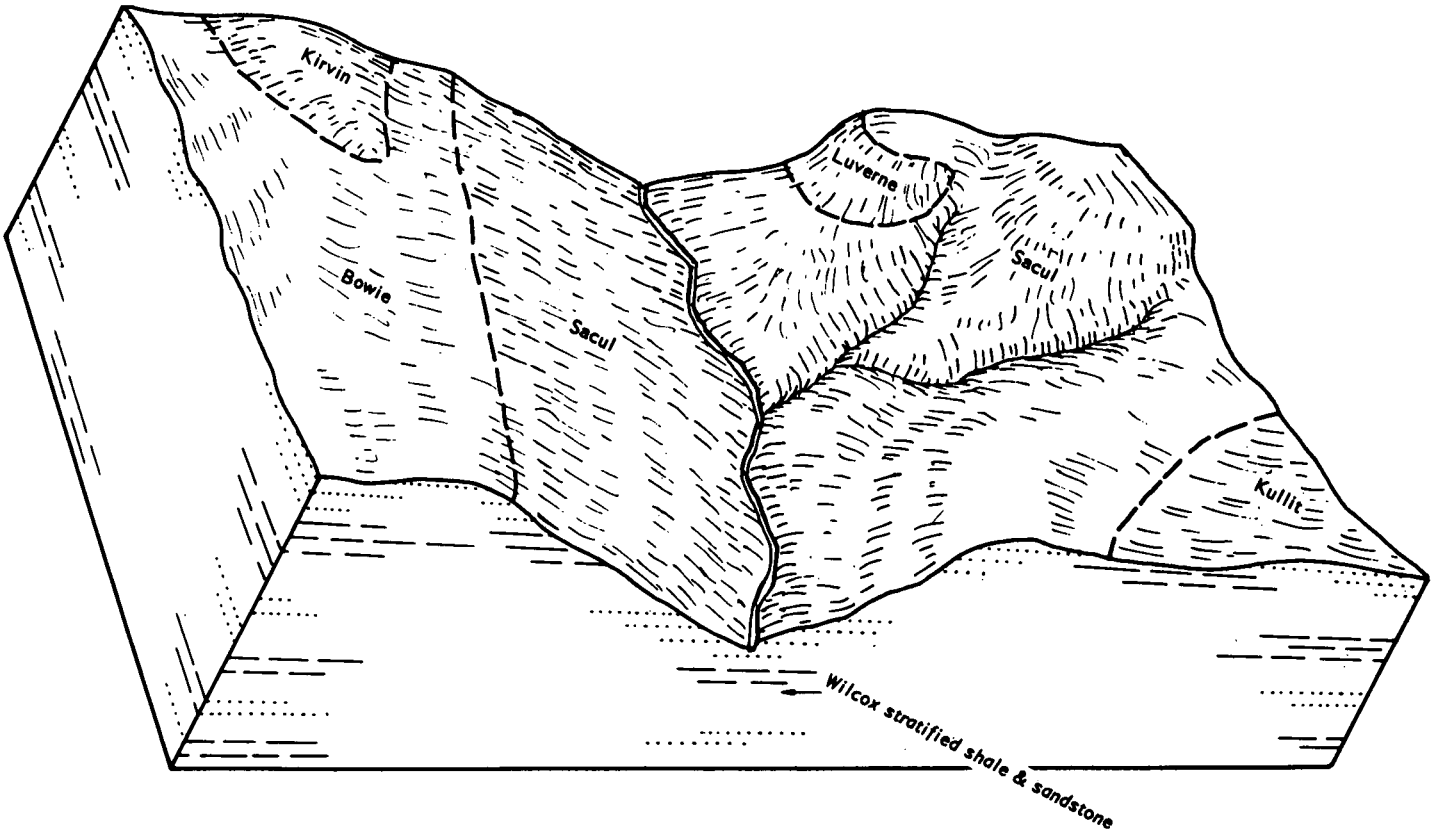

Figure 2.—**Pattern of soils and underlying material in the Sacul-Bowie association.**

Most areas of this association are used for timber and pasture, and a few small areas are used for crops. At one time all of the soils in the association, except the steep Sacul soils, were cleared for crops. After these soils were no longer used for crops, they reverted to forest or were converted to improved pasture. The gravelly Kirvin soils in this association are the only source of gravel in this county.

2. *Nahatche-Mantachie-Urbo association*

Nearly level, slightly acid to strongly acid, loamy to clayey soils on bottom lands

This association is made up of nearly level soils that are subject to annual flooding. It includes most of the bottom lands in the county.

This association occupies about 24 percent of the county. Nahatche soils make up about 19 percent of this association, Mantachie soils 19 percent, and Urbo soils 15 percent. The remaining 47 percent is Marietta, Thenas, and Bienville soils and several lakes, including Lake Murvaul.

Nahatche soils have a surface layer of dark grayish-brown sandy clay loam about 8 inches thick. The next layer extends to a depth of about 60 inches. In sequence from the top, it is 3 inches of sandy clay loam that is mottled grayish brown, dark grayish brown, strong brown, and yellowish red; 5 inches of grayish-brown loam that has mottles of strong brown; 6 inches of light brownish-gray fine sandy loam that has mottles of yellowish red and dark brown; 11 inches of gray loam that has mottles of strong brown; and 27 inches of clay loam that is light gray in the upper part and gray in the lower part and has mottles in shades of yellow, red, and brown.

Mantachie soils have a surface layer of dark grayish-brown clay loam about 6 inches thick. The next layer extends to a depth of about 48 inches. The upper 15 inches is sandy clay loam that is mottled yellowish brown, light brownish gray, dark grayish brown, and strong brown. The lower 27 inches is light gray mottled with strong brown and is sandy clay loam in the upper part and clay loam in the lower part. The underlying material is sandy clay loam that is mottled light gray and yellowish brown and extends to a depth of about 60 inches.

Urbo soils have a surface layer of very dark grayish-brown clay about 4 inches thick. The next layer extends to a depth of 60 inches. The upper part is grayish-brown clay mottled with strong brown and yellowish brown and is

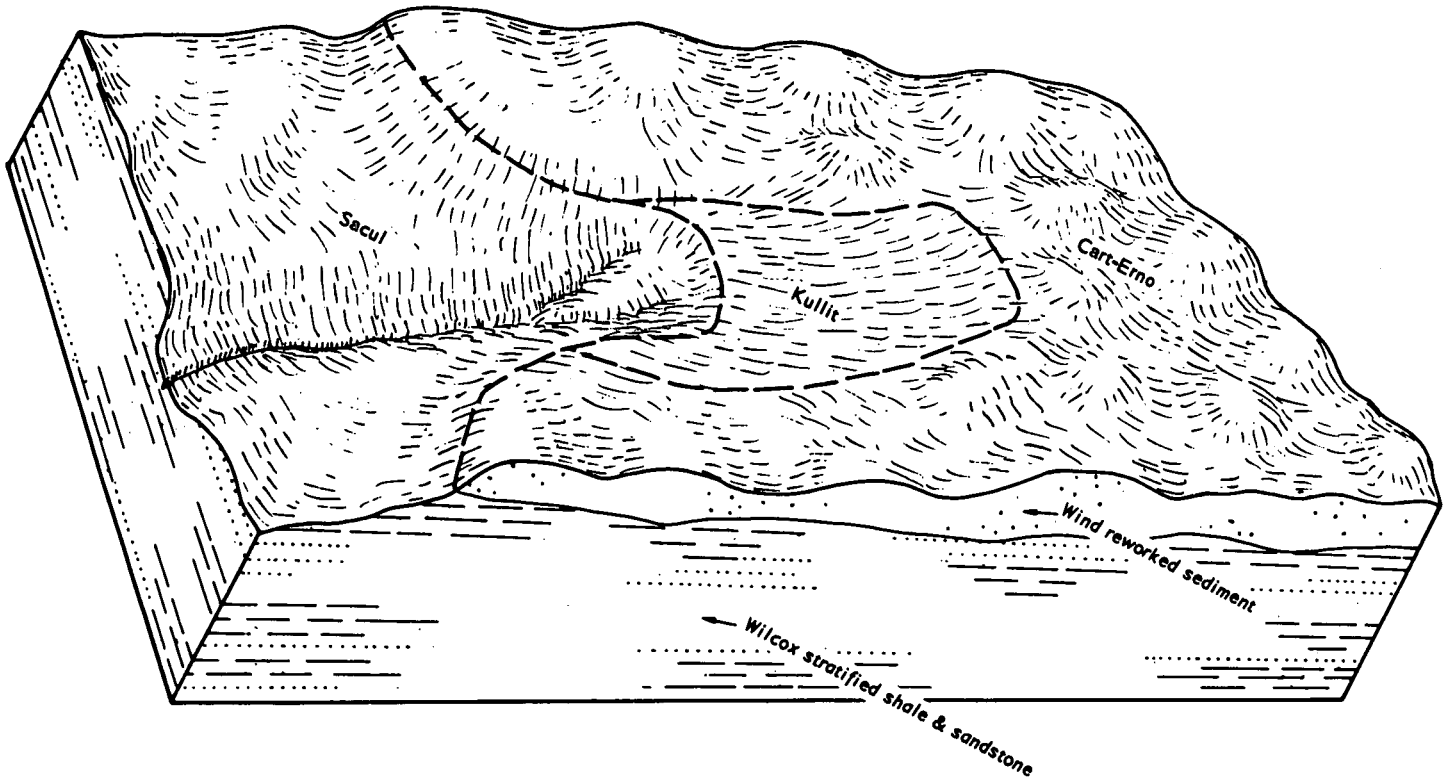

Figure 3.—**Pattern of soils and underlying material in the Cart-Erno-Sacul association.**

about 6 inches thick. The lower part is light brownish-gray clay that is mottled with strong brown.

Most areas of this association are in hardwood forest. Some areas along creek bottoms are in pasture.

3. Cart-Erno-Sacul association

Nearly level to moderately steep, slightly acid to medium acid, loamy soils on uplands

This association consists of nearly level to moderately steep soils, but much of the area is nearly level to gently sloping and moundy. The dominant soils formed in alluvial sediment that has been reworked by wind.

This association occupies about 16 percent of the county. Cart soils make up about 30 percent of the association, Erno soils 20 percent, and Sacul soils 20 percent. The remaining 30 percent is mainly Kullit, Bowie, and Kirvin soils (fig. 3).

Cart soils are on mounds. These soils have a surface layer of fine sandy loam about 23 inches thick. It is brown to a depth of 4 inches, yellowish brown between depths of 4 and 12 inches, and light yellowish brown between depths of 12 and 23 inches. The subsoil extends to a depth of about 70 inches. It is yellowish-red loam between depths of 23 and 30 inches and strong-brown loam mottled with yellowish red between depths of 30 and 42 inches. The subsoil has a brittle layer below a depth of 42 inches. This layer is strong brown mottled with light brownish gray between depths of 42 and 51 inches and is mottled red and strong brown between depths of 51 and 70 inches.

Erno soils are in areas between the mounds of Cart soils. Erno soils have a surface layer of fine sandy loam about 13 inches thick. The upper part of the surface layer is brown, and the lower part is pale brown. The subsoil extends to a depth of 70 inches. Between depths of 13 and 30 inches, it is strong-brown sandy clay loam that is mottled with yellowish red in the lower part. It has a brittle layer of sandy clay loam below a depth of 30 inches. This layer is strong brown mottled with pale brown between depths of 30 and 41 inches, is yellowish brown mottled with light brownish gray between depths of 41 and 50 inches, and is mottled red and yellowish brown between depths of 51 and 70 inches.

Sacul soils are strongly sloping to moderately steep and are on side slopes above drainageways. These soils have a surface layer of fine sandy loam 7 inches thick. The upper 4 inches is dark brown, and the lower 3 inches is yellowish

brown. The subsoil extends to a depth of 52 inches. It is clay to a depth of 42 inches and clay loam below. The subsoil is red between depths of 7 and 15 inches, is red mottled with strong brown between depths of 15 and 24 inches, is mottled light brownish gray and red between depths of 24 and 42 inches, and is red mottled with light brownish gray between depths of 42 and 52 inches. The underlying material is weakly consolidated sandstone and shale that extends to a depth of 72 inches.

Most areas of this association are used for pasture and timber. A few small areas are used for crops.

4. *Cart-Wrightsville association*

Nearly level to gently sloping, slightly acid to strongly acid, loamy soils on terraces

This association consists of nearly level to gently sloping soils on terraces adjacent to the Sabine River flood plains. It is moundy in most areas.

This association occupies about 13 percent of the county. Cart soils make up about 47 percent of this association, and Wrightsville 28 percent. The remaining 25 percent is mainly Erno, Mollville, and Bienville soils (fig. 4).

Cart soils are well drained and occur on mounds. These soils have a surface layer of fine sandy loam about 23 inches thick. To a depth of 4 inches, the surface layer is brown; between depths of 4 and 12 inches, it is yellowish brown; and between depths of 12 and 23 inches, it is mottled with yellowish brown in the lower part. The subsoil extends to a depth of about 70 inches. It is yellowish-red loam between depths of 23 and 30 inches and strong-brown loam mottled with yellowish red between depths of 30 and 42 inches. The subsoil has a brittle layer between depths of 42 and 70 inches. This layer is strong brown mottled with light brownish gray to a depth of 51 inches and is mottled red, strong brown, and light brownish gray between depths of 51 and 70 inches.

Wrightsville soils occur as wet flats. These soils have a surface layer, about 8 inches thick, of dark grayish-brown loam mottled with light brownish gray. The subsurface layer is light brownish-gray loam mottled with yellowish red and extends to a depth of about 16 inches. The subsoil is clay that reaches to a depth of about 65 inches. It is light brownish gray to grayish brown and is mottled with red.

Most areas of this association are forested, some are used for pasture, and a few are used for crops. Proper drainage is needed in many areas before improved pasture or crops can be grown.

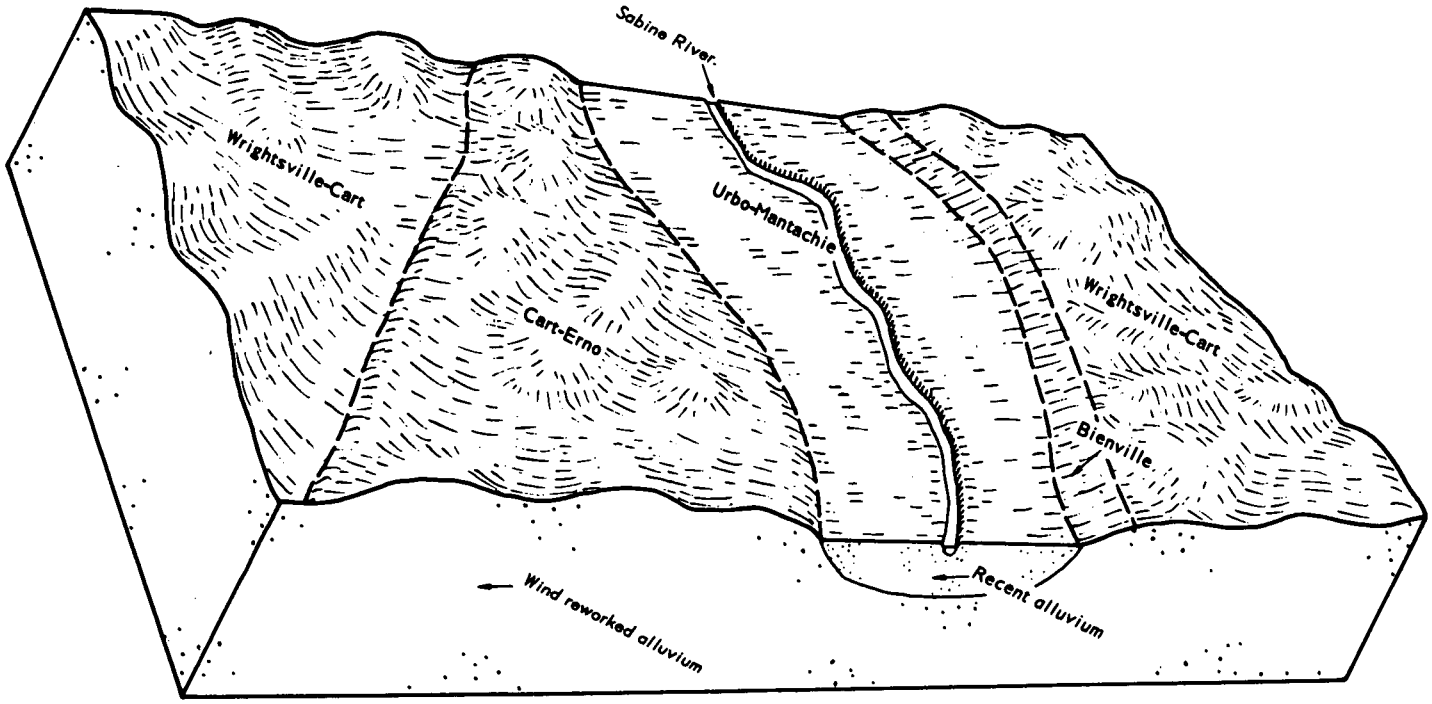

Figure 4.—**Pattern of soils and underlying material in the Cart-Wrightsville,association.**

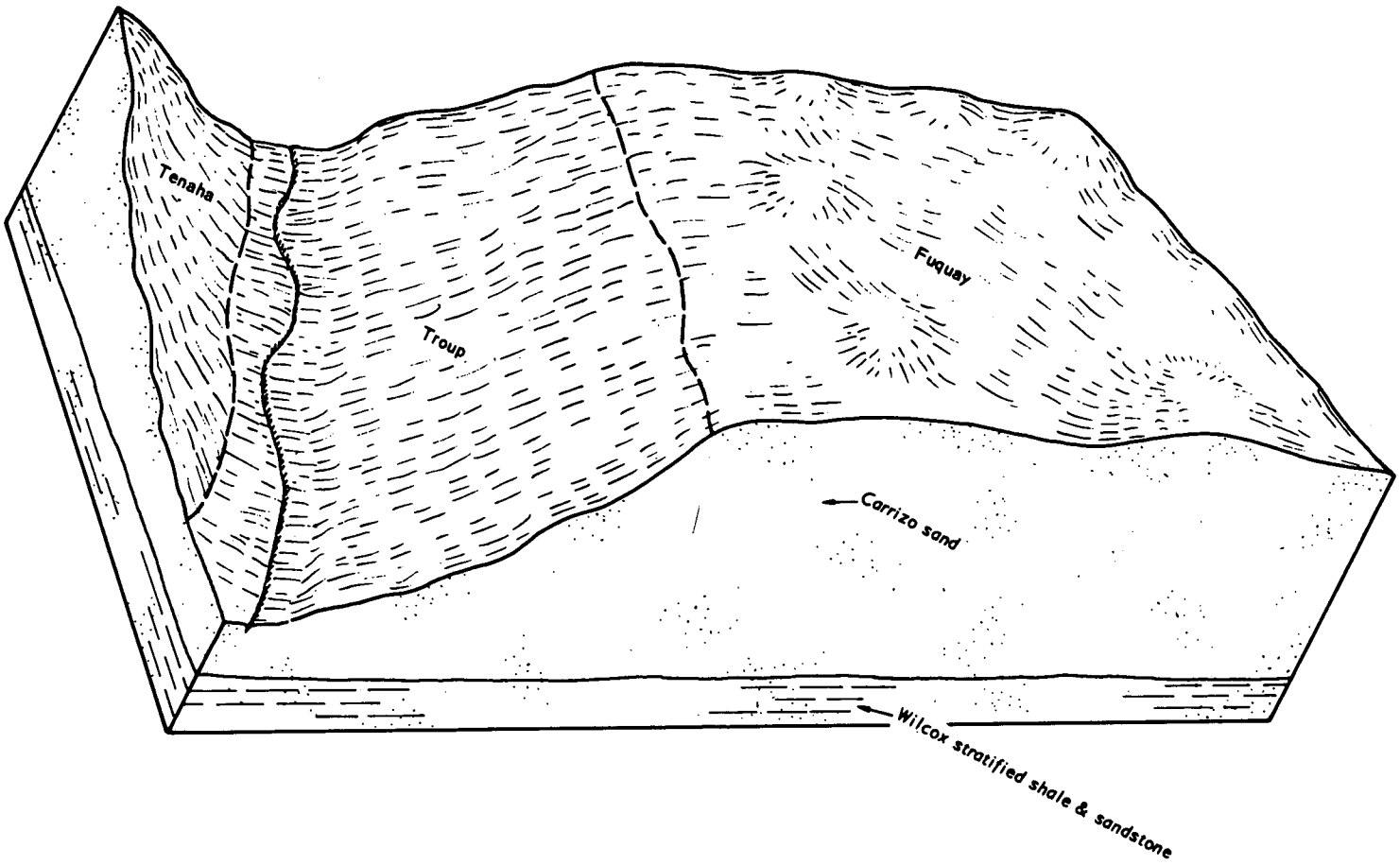

Figure 5.—**Pattern of soils and underlying material in the Fuquay-Troup association.**

5. *Fuquay-Troup association*

Gently sloping to moderately steep, slightly acid, sandy soils on uplands

This association consists of some of the highest areas in the county. The soils are sandy and are subject to blowing.

This association occupies about 5 percent of the county. Fuquay soils make up about 60 percent of this association, and Troup soils about 25 percent. The remaining 15 percent is mainly Tenaha, Lakeland, and Lucy soils (fig. 5).

Fuquay soils are gently sloping to sloping and occur on wide ridgetops. These soils have a surface layer of loamy fine sand about 24 inches thick. The upper 7 inches is grayish brown, and the lower 17 inches is pale brown. The subsoil extends to a depth of 84 inches. Between depths of 24 and 40 inches, it is yellowish brown and is mottled with shades of red, yellow, brown, and gray. It is fine sandy loam in the upper part and sandy clay loam in the lower part. Between depths of 40 and 80 inches, it is sandy clay loam mottled with shades of red, yellow, gray, and brown. The underlying material is alternate layers of shale and sand.

Troup soils are gently sloping to sloping on broad ridgetops and strongly sloping to moderately steep on side slopes above drainageways. These soils have a surface layer of loamy fine sand about 53 inches thick. It is dark brown to a depth of 5 inches, brown mottled with pale brown to a depth of about 14 inches, pale brown mottled with light yellowish brown to a depth of about 44 inches, and light yellowish brown mottled with strong brown to a depth of about 53 inches. The next layer extends to a depth of 80 inches. It is strong-brown sandy clay loam mottled with red and pale brown between depths of 53 and 67 inches, and below this it is yellowish-red sandy clay loam that is mottled with pale brown.

Most areas of this association are used for pasture, some are forested, and some are used for crops. At one time all of this association was cultivated. Most of the crops grown in Panola County are grown on these soils.

Descriptions of the Soils

In this section the soil series and mapping units of Panola County are described. Each soil series is described in detail

and then, briefly, each mapping unit in that series. It is to be assumed that statements regarding the soil series are true for the mapping units in that series as well, unless specifically mentioned otherwise. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

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

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

The approximate acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about terminology and methods of soil mapping can be obtained from the Soil Survey Manual.[2]

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

Soil	Acres	Percent
Bienville loamy fine sand, 0 to 5 percent slopes	8,704	1.5
Bienville-Mollville complex	10,757	1.9
Bowie fine sandy loam, 1 to 8 percent slopes	56,064	9.9
Cart-Erno complex	80,517	14.2
Fuquay loamy fine sand, 1 to 8 percent slopes	18,382	3.2
Kirvin fine sandy loam, 1 to 8 percent slopes	20,367	3.6
Kirvin complex, 1 to 8 percent slopes	1,035	.2
Kullit fine sandy loam, 1 to 3 percent slopes	29,295	5.2
Lakeland fine sand, 1 to 8 percent slopes	894	.2
Lucy loamy fine sand, 2 to 5 percent slopes	3,750	.7
Luverne fine sandy loam, 5 to 20 percent slopes	18,651	3.3
Mantachie clay loam	21,368	3.8
Marietta fine sandy loam	12,125	2.1
Nahatche complex	38,201	6.7
Ruston fine sandy loam, 1 to 8 percent slopes	2,469	.4
Sacul fine sandy loam, 1 to 5 percent slopes	42,819	7.5
Sacul fine sandy loam, 5 to 20 percent slopes	81,466	14.4
Tenaha loamy fine sand, 5 to 20 percent slopes	4,759	.8
Thage loam	3,437	.6
Thenas fine sandy loam	9,579	1.7
Troup loamy fine sand, 1 to 8 percent slopes	6,153	1.1
Troup loamy fine sand, 8 to 20 percent slopes	3,370	.6
Urbo-Mantachie association	45,010	7.8
Verdun-Cart complex	2,538	.4
Wrightsville loam	2,599	.5
Wrightsville-Cart complex	36,181	6.4
Water areas	7,190	1.3
Total	567,680	100.0

Bienville Series

The Bienville series consists of nearly level to gently sloping soils. These soils formed in old alluvium on terraces.

In a representative profile the surface layer is loamy fine sand about 36 inches thick. The upper 2 inches is dark grayish brown, the next 11 inches is brown, and the lower 23 inches is pale brown and light yellowish brown. The next layer, which extends to a depth of 84 inches, is pale-brown loamy fine sand that has thin layers of yellowish-red fine sandy loam about 6 inches apart (fig. 6).

Bienville soils have moderately rapid permeability and are somewhat excessively drained. They have a moderate available water capacity. These soils have a seasonal high water table that fluctuates between depths of 4 and 7 feet during wet seasons.

Representative profile of Bienville loamy fine sand, 0 to 5 percent slopes, 6 miles north of Carthage on U.S. Highway 59, 1.5 miles east and 0.9 mile south on a dirt road, 50 feet south of the road in a formerly cultivated field:

Ap—0 to 2 inches, dark grayish-brown (10YR 4/2) loamy fine sand; weak, medium, granular structure; soft, loose; slightly acid; clear, smooth boundary.

A1—2 to 13 inches, brown (10YR 4/3) loamy fine sand; single grained; soft, loose; slightly acid; clear, smooth boundary.

A2—13 to 36 inches, pale-brown and light yellowish-brown (10YR 6/3 and 6/4) loamy fine sand; single grained; soft, loose; slightly acid; clear, smooth boundary.

A3&B2t—36 to 84 inches, pale-brown (10YR 6/3) loamy fine sand; thin, yellowish-red (5YR 4/8) lamellae ¼ to ¾ inch thick at 5- to 8-inch intervals, very friable, soft; clay bridging of sand grains in lamellae; few spots of uncoated sand grains; evidence of water table at a depth of 75 inches; slightly acid.

The solum ranges from 75 to 100 inches in thickness. The A horizon ranges from 30 to 40 inches in thickness and is medium acid or slightly acid. The A1 or Ap horizon is brown, very dark brown, or dark grayish brown. The A2 horizon is pale brown, brown, or yellowish brown. The A3&Bt horizon is loamy fine sand and is strongly acid to slightly acid. The Bt part of the A3&Bt horizon ranges from yellowish red to strong brown and is fine sandy loam that is 12 to 18 percent clay. The A3 part of the A3&Bt horizon is pale brown, brown, or very pale brown.

Bienville loamy fine sand, 0 to 5 percent slopes (BE).—This soil is on terraces adjacent to the bottom lands of the Sabine River or of large creeks. It receives subsurface moisture from steeper, higher lying soils. Areas of this soil are generally elongated. This soil has the profile described as representative of the series. Some areas of this soil are flooded about once in 20 years.

Included with this soil in mapping were areas of a soil that is slightly wetter and has a more clayey subsoil between depths of 40 and 80 inches. Also included, in old stream

[2] UNITED STATES DEPARTMENT OF AGRICULTURE. Soil Survey Manual. U.S. Dept. Agr. Handbook 18, 503 pp. 1951. [Supplement issued in 1962]

Figure 6.—**Lamellae in a profile of Bienville loamy fine sand, 0 to 5 percent slopes.**

channels, are soils that are wetter than Bienville soils. These included soils make up less than 5 percent of the mapped areas.

This soil is used as woodland and pasture. Many formerly cultivated fields are now pastures of lovegrass, common bermudagrass, and Coastal bermudagrass. This soil is droughty, and the planting or sprigging of grasses should be done in times of abundant moisture. The major field crops are watermelons and cowpeas. Maintaining tilth is the major need in the management of this soil for crops; consequently, high-residue crops and cover crops are needed. Capability unit IIIs–1; woodland suitability group 3s2; Sandy woodland grazing group.

Bienville–Mollville complex (BM).—This complex consists of soils on low terraces of the Sabine River. Bienville soils make up about 55 percent of the complex, Mollville soils about 35 percent, and other soils the remaining 10 percent. Slopes are 0 to 3 percent. These soils are so intricately intermingled that they cannot be separated at the scale mapped. Areas of these soils are generally large and vary in shape. They are on a series of long, low ridges and concave, wet depressions. Sixty percent of the complex is sandy ridges that are 3 to 7 feet high, 80 to 350 feet wide, and ¼ mile to 2 miles long. The depressions are parallel to the ridges and are about 30 to 260 feet wide.

Bienville soils are mostly on ridges and have slopes of 0 to 3 percent. They have a surface layer of brown loamy fine sand about 38 inches thick. The next layer extends to a depth of about 86 inches and is pale-brown loamy fine sand that has lamellae of strong-brown fine sandy loam.

Mollville soils are mostly in wet depressions and have slopes of 0 to 1 percent. They have a surface layer of loam about 11 inches thick. It is dark gray in the upper part and light brownish gray in the lower part. The subsoil extends to a depth of about 54 inches. Between depths of 11 and 23 inches, it is grayish-brown sandy clay loam that has mottles of strong brown; between depths of 23 and 54 inches, it is mainly sandy clay loam mottled in shades of gray and brown. The underlying material is gray loamy fine sand that reaches to a depth of 65 inches. Low areas of Mollville soils are covered with water once in 5 years for a period of 4 to 12 weeks. These areas are flooded by slow-moving water mostly during winter. Damage to the soils and plants is insignificant.

Included with these soils in mapping were areas of slightly wet soils on the lower parts of sandy ridges. These soils are slightly more wet than the Bienville soils. Also included were areas of Wrightsville soils that are on flats near the Mollville soils.

Most areas of this complex are used as woodland, and a few areas are used as pasture. Common bermudagrass and lovegrass grow on the ridges, and bahiagrass and sedges grow on the wet flats. These soils are not well suited to crops. In a few areas Bienville soils on ridges are used for gardens. Both soils in capability unit IVw–1; Bienville soils in woodland suitability group 3s2 and Sandy woodland grazing group; Mollville soils in woodland suitability group 3w9 and Flatwood woodland grazing group.

Bowie Series

The Bowie series consists of gently sloping to sloping soils on uplands. These soils formed in the more sandy strata of the Wilcox Group.

In a representative profile the surface layer is fine sandy loam about 12 inches thick. It is dark grayish brown in the upper 6 inches and pale brown in the lower 6 inches. The subsoil is sandy clay loam that extends to a depth of about 78 inches. The upper 30 inches is yellowish brown and is mottled in shades of brown, yellow, and red. The lower 36 inches is mottled in shades of yellow, brown, red, and gray (fig. 7).

Bowie soils are moderately slowly permeable and well drained. They have high available water capacity.

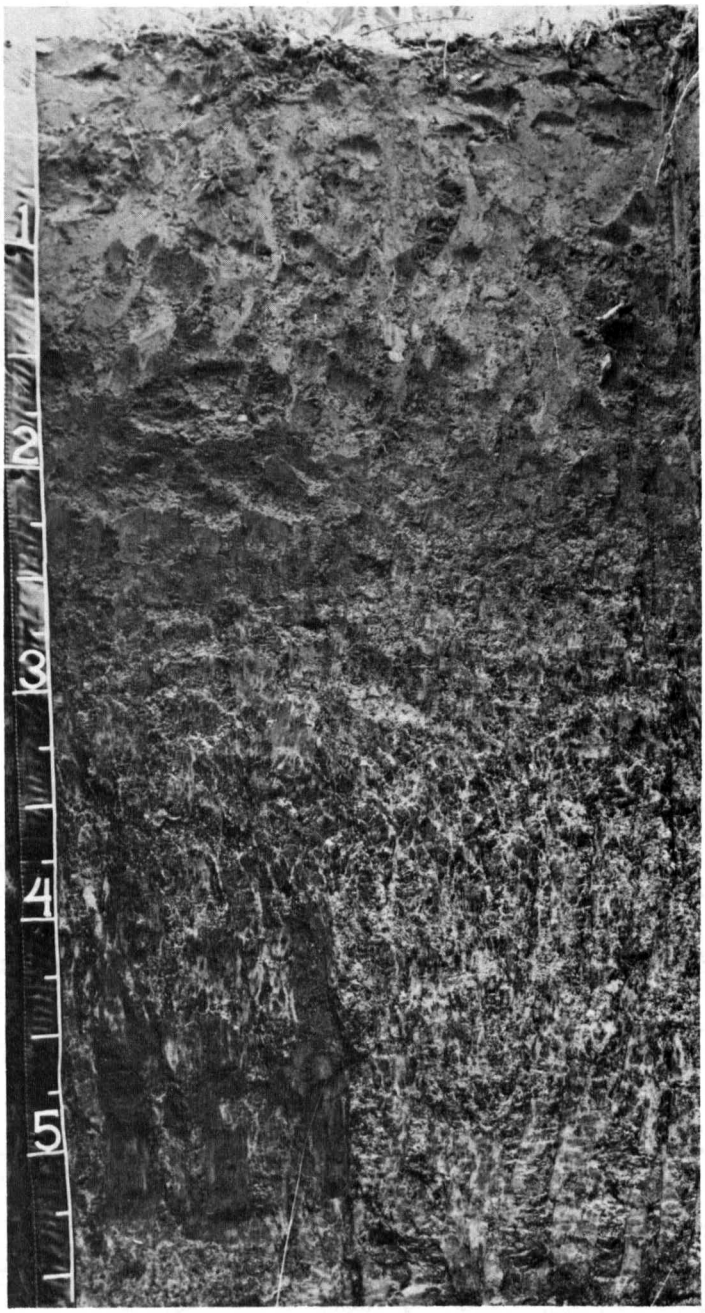

Figure 7.—**Profile of Bowie fine sandy loam, 1 to 8 percent slopes. Plinthite is in lower part of profile.**

Representative profile of Bowie fine sandy loam, 1 to 8 percent slopes, 12 miles southeast of Carthage, 2 miles east of Gary on Farm Road 999, about 125 feet south of the road:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) fine sandy loam, grayish brown (10YR 5/2) when dry; massive; soft, very friable; many roots; few wormcasts; slightly acid; clear, smooth boundary.

A2—6 to 12 inches, pale-brown (10YR 6/3) fine sandy loam, very pale brown (10YR 7/3) when dry; massive; soft, very friable; many roots; common fine pores; few wormcasts; slightly acid clear, wavy boundary.

B21t—12 to 30 inches, yellowish-brown (10YR 5/6) sandy clay loam, brownish yellow (10YR 6/6) when dry; few, fine and medium, distinct, strong-brown (7.5YR 5/6), and reddish-yellow (5YR 6/6) mottles; weak, medium, subangular blocky structure; hard, friable; common roots; common fine pores; thin patchy clay films on ped faces and in pores; few wormcasts; few, fine, strongly cemented, pitted, brown iron oxide concretions; strongly acid; gradual, wavy boundary.

B22t—30 to 42 inches, yellowish-brown (10YR 5/6), sandy clay loam, brownish yellow (10YR 6/6) when dry; common, medium, prominent, red (2.5YR 4/8), and yellowish-red (5YR 5/6) mottles; weak, medium, subangular blocky structure; very hard, friable; few roots; common fine pores; thin patchy clay films on ped faces and in pores; 2 percent, by volume, plinthite; few, fine, strongly cemented, pitted, brown iron oxide concretions and few weakly cemented iron oxide concretions; strongly acid; diffuse, wavy boundary.

B23t—42 to 60 inches, prominently mottled, yellowish-brown (10YR 5/6), red (2.5YR 4/8), and gray (10YR 6/1) sandy clay loam; weak, medium, subangular blocky and blocky structure; very hard, friable; few roots in gray mottles; thin, patchy, gray clay films; 25 percent, by volume, red mottles of brittle plinthite; very strongly acid; diffuse, irregular boundary.

B24t—60 to 78 inches, prominently motted, light-gray (10YR 6/1), red (2.5YR 4/8), and strong-brown (7.5YR 5/6) sandy clay loam; weak, coarse, blocky structure; very hard, friable, few roots; few pores; red mottles are brittle plinthite; few clay films; very strongly acid.

The solum ranges from 60 inches to more than 100 inches in thickness. Depth to the horizons that contain more than 5 percent plinthite ranges from 30 to 45 inches. The A horizon ranges from 9 to 20 inches in thickness and from slightly acid to strongly acid in reaction. The A1 horizon, where present, ranges from brown to dark grayish brown. The A2 horizon is brown or pale brown. The upper 20 inches of the Bt horizon is 20 to 35 percent clay, 20 to 40 percent silt, and more than 15 percent sand coarser than very fine sand. Strongly cemented to indurated iron oxide concretions that are less than ½ inch in diameter make up less than 1 percent to about 5 percent, by volume, of the upper part of the Bt horizon. Reaction of the Bt horizon ranges from medium acid to very strongly acid in the upper part and is strongly acid to very strongly acid in the lower part. The B21t and B22t horizons range from yellowish brown to yellow and strong brown and have few to common mottles of reddish yellow, strong brown, yellowish red, and red. The B23t and B24t horizons have distinct to prominent mottles of red, strong brown, and gray separated by yellowish brown and light gray and are 10 to 35 percent, by volume, plinthite.

Bowie fine sandy loam, 1 to 8 percent slopes (BO).—This soil occupies broad interstream divides on uplands. Areas of this soil average about 50 acres in size.

Included with this soil in mapping were areas of Ruston soils and a few areas of Kirvin soils on ridges and knobs. Also included were Kullit soils in slightly concave areas and some areas of Thage soils in depressions. These included soils make up about 20 percent of the mapped areas

Runoff is slow to medium. The hazard of erosion is moderate.

Most areas of this soil are used for pasture. Bahiagrass, common bermudagrass, and Coastal bermudagrass are used extensively on this soil. Pine trees are dominant in wooded areas. Major field crops include corn and oats. Lime and a complete fertilizer are needed. Contour rows and terraces are needed to reduce erosion. Tilth can be maintained or improved by growing high-residue crops and cover crops. Capability unit IIIe–3; woodland suitability group 3o1; Sandy Loam woodland grazing group.

Cart Series

The Cart series consists of nearly level to gently sloping soils in slightly convex areas and on mounds on old terraces near creeks and rivers. These soils formed in old alluvial sediment that has been reworked by wind.

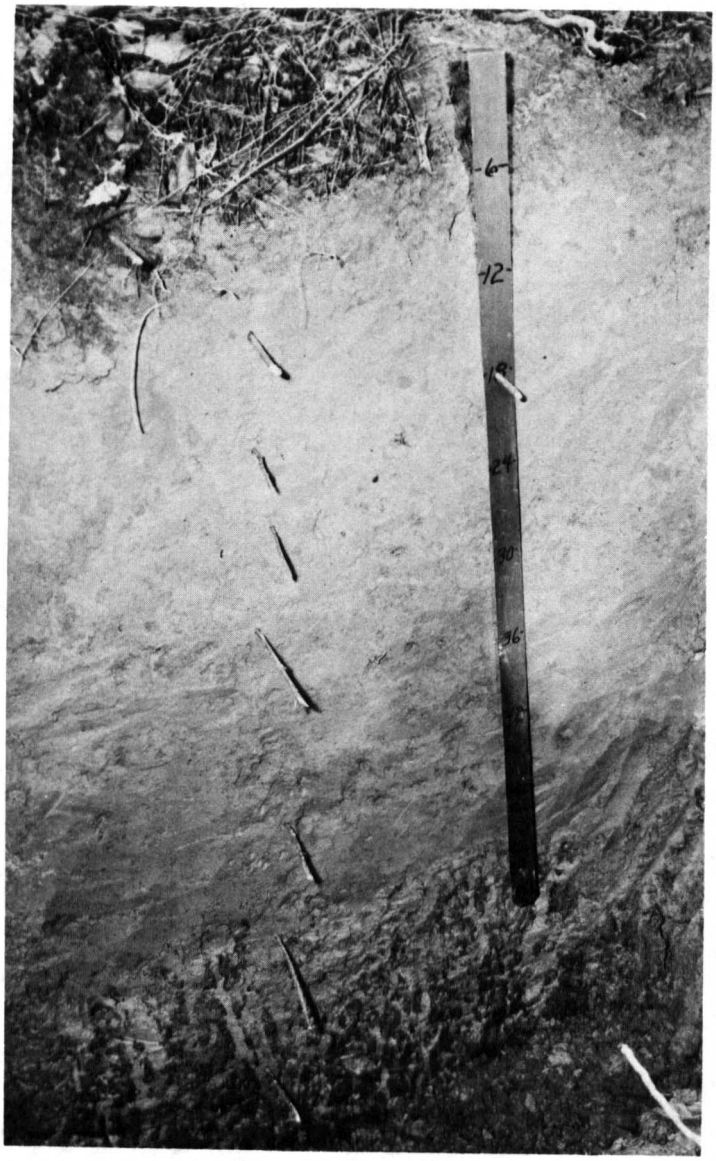

Figure 8.—**Profile of a Cart fine sandy loam. Fragipan is at a depth of about 50 inches.**

In a representative profile the surface layer is fine sandy loam about 23 inches thick. This layer is brown in the upper 4 inches and light yellowish brown to yellowish brown between depths of 4 and 23 inches. The subsoil extends to a depth of about 70 inches. It is yellowish-red loam between depths of 23 and 30 inches and strong-brown loam mottled with yellowish red between depths of 30 and 42 inches. It has a brittle layer between depths of 42 and 70 inches. The upper 9 inches is strong-brown loam mottled with light brownish gray, and the lower 19 inches is mottled, red, strong-brown, and light brownish-gray sandy clay loam (fig. 8).

Cart soils are moderately slowly permeable and well drained. They have high available water capacity. These soils have a seasonal high water table that is at a depth of 3 to 4 feet during wet seasons.

Representative profile of a Cart fine sandy loam in an area of Cart-Erno complex, about 14 miles west of Carthage on U. S. Highway 79, about 2.3 miles south on Farm Road 1798 and 0.9 mile east on a dirt road, about 400 feet south of the road, on a mound:

A1—0 to 4 inches, brown (10YR 4/3) fine sandy loam; weak, medium, granular structure; very friable, soft; many fine roots; slightly acid; clear, smooth boundary.

A21—4 to 12 inches, yellowish-brown (10YR 5/4) fine sandy loam; massive; very friable, soft; many fine roots; slightly acid; clear, smooth boundary.

A22—12 to 18 inches, light yellowish-brown (10YR 6/4) fine sandy loam; massive; very friable, soft; common fine roots; slightly acid; clear, smooth boundary.

A3—18 to 23 inches, light yellowish-brown (10YR 6/4) fine sandy loam; common, medium, faint mottles of yellowish brown (10YR 5/6); tongues of A horizon material extend to a depth of 42 inches; massive; friable, soft; common fine roots; slightly acid; clear, irregular boundary.

B21t&A—23 to 30 inches, yellowish-red (5YR 4/6) loam; pale-brown (10YR 6/3) material extends through this horizon; weak, medium, subangular blocky structure; friable, slightly hard; few fine roots; common fine pores; clay bridging of sand grains; strongly acid; gradual, wavy boundary.

B22t&A—30 to 42 inches, strong-brown (7.5YR 5/8) loam, common, medium, distinct mottles of yellowish red (5YR 4/8); weak, medium, subangular blocky structure; friable, slightly hard; few fine roots; common fine pores; clay bridging and a few clay films; medium acid; gradual, wavy boundary.

Bx1—42 to 51 inches, strong-brown (7.5YR 5/6) loam; exteriors of peds are light brownish-gray (10YR 6/2); moderate, medium, subangular blocky structure; slightly brittle, hard; many fine pores; common voids 1 to 2 millimeters in diameter, some are clay coated; medium acid; abrupt, smooth boundary.

Bx2&A'2—51 to 70 inches, mottled red (2.5YR 4/8) and strong-brown (7.5YR 5/8) sandy clay loam; surface of A'2 peds is light brownish gray (10YR 6/2); strong, coarse, prismatic structure parting to weak, angular, blocky; very brittle, extremely hard; common voids 1 to 2 millimeters in diameter; medium acid.

The solum ranges from 60 to 100 inches in thickness. The A horizon ranges from 20 to 36 inches in thickness and from slightly acid to strongly acid in reaction. The A1 horizon ranges from very dark grayish brown to brown. The A2 horizon is brown, pale brown, yellowish brown, or light yellowish brown. The Bt horizon is yellowish red, strong brown, or yellowish brown and has none to common mottles in shades of red, brown, yellow, and gray. Reaction of the Bt horizon is medium acid or strongly acid. Texture of the upper 20 inches of the Bt horizon is fine sandy loam or loam. Content of clay ranges from 12 to 18 percent, content of silt ranges from 20 to 45 percent, and content of sand coarser than very fine sand is more than 15 percent. Depth to the fragipan ranges from 40 to 56 inches. The fragipan is strong brown, yellowish brown, and light yellowish brown and has mottles of red, brown, gray, and yellow. Uncoated sand and silt grains are on the faces of most peds in the fragipan. Reaction of the fragipan is strongly acid or medium acid.

Cart-Erno complex (CE).—This complex consists of soils on broad terraces near all major creeks and along the Sabine River. Cart soils make up 45 to 60 percent of the complex, Erno soils make up 30 to 50 percent, and other soils make up less than 20 percent. Slopes are 0 to 3 percent. These soils are so intricately intermingled that they cannot be separated at the scale mapped. Areas of these soils have been reworked by wind into a moundy landscape. The mounds make up 60 to 80 percent of the mapped area. They are 55 to 225 feet in width and length. The high parts are 2 to 4 feet above the low parts, and the low parts are continuous and sinuous. Cart soils occupy the higher, more nearly flat part of the mounds, and Erno soils occupy the lower third of the mounds and the adjacent low areas. The Cart and Erno soils have the profiles described as representative of their respective series.

Included with this complex in mapping were areas of Thage, Wrightsville, and Kullit soils. Thage and Wrightsville soils occupy small depressions in the low areas of Erno soils, and Kullit soils occupy a part of the mounds.

Runoff is medium on the mounds, but it is slower in the low areas.

These soils are used mainly for pasture and hay. Coastal bermudagrass and bahiagrass are the main grasses grown. Corn is the main field crop. Pine trees are dominant in wooded areas. Crop residue needs to be managed on or near the surface to help maintain soil tilth. All cropped areas of these soils need a complete fertilizer, and most areas need some lime. Capability unit IIs–1; woodland suitability group 2o7; Sandy Loam woodland grazing group.

Erno Series

The Erno series consists of nearly level to gently sloping soils in convex to concave areas on old terraces near creeks and rivers. These soils formed in old alluvial sediment that has been reworked by wind. Slopes are 0 to 3 percent.

In a representative profile the surface layer is fine sandy loam about 13 inches thick. The upper 7 inches is brown, and the lower 6 inches is pale brown. The subsoil extends to a depth of about 70 inches. The upper 17 inches is strong-brown sandy clay loam that is mottled with yellowish red in the lower part. The lower 40 inches is brittle sandy clay loam. Between depths of 30 and 41 inches, it is strong brown mottled with pale brown; between depths of 41 and 51 inches, it is yellowish brown and has light brownish-gray coatings; and between depths of 51 and 70 inches, it is red and yellowish brown and has light brownish-gray coatings.

Erno soils are moderately slowly permeable and well drained. They have high available water capacity. These soils have a seasonal high water table that fluctuates between depths of 3 and 4 feet during wet seasons.

Erno soils are mapped only in a complex with Cart soils.

Representative profile of Erno fine sandy loam in an area of Cart–Erno complex, about 14 miles west of Carthage on U.S. Highway 79, about 2.3 miles south on Farm Road 1798, 0.9 mile east on dirt road, and about 400 feet south of the road, in a low area:

A1—0 to 7 inches, brown (10YR 5/3) fine sandy loam; weak, medium, granular structure; very friable, soft; common fine roots; medium acid; clear, smooth boundary.

A2—7 to 13 inches, pale-brown (10YR 6/3) fine sandy loam; massive; very friable, soft; common fine roots; medium acid; clear, wavy boundary.

B21t—13 to 21 inches, strong-brown (7.5YR 5/6) sandy clay loam; weak, medium, subangular blocky structure; friable, slightly hard; few, fine roots; common fine pores; medium acid; clear, wavy boundary.

B22t—21 to 30 inches, strong-brown (7.5YR 5/6) sandy clay loam; common, medium, distinct mottles of yellowish red (5YR 4/6); weak, medium, subangular blocky structure; friable, slightly hard; few fine roots; common fine pores; few clay films; medium acid; clear, wavy boundary.

Btx1—30 to 41 inches, strong-brown (7.5YR 5/8) sandy clay loam; common, medium, distinct mottles of pale brown (10YR 6/3); moderate, medium, subangular blocky structure; friable, slightly brittle, slightly hard; few fine roots; few fine pores; few clay films; medium acid; clear, wavy boundary.

Btx2—41 to 51 inches, yellowish-brown (10YR 5/6) sandy clay loam; light brownish-gray (10YR 6/2) coatings on peds; moderate, medium, subangular blocky structure; brittle, extremely hard; common voids that are partially lined with clay; medium acid; abrupt, smooth boundary.

Bx&A'2—51 to 70 inches, red and yellowish-brown (2.5YR 4/6 and 10YR 5/6) sandy clay loam that has light brownish-gray (10YR 6/2) coatings on peds; weak, coarse, prismatic structure; extremely brittle, extremely hard; common, fine, medium voids that are partially lined with clay; very strongly acid.

The solum ranges from 60 to 100 inches or more in thickness. Reaction of all horizons is slightly acid to very strongly acid. The A1 horizon ranges from dark grayish brown to brown. The A2 horizon is pale brown, brown, or light yellowish brown. The Bt horizon is yellowish red, strong brown, and yellowish brown and has mottles in shades of strong brown, yellow, gray, and red. The upper part of the Bt horizon is sandy clay loam to loam that is about 18 to 30 percent clay. The content of silt ranges from 20 percent to about 45 percent, and the content of sand coarser than very fine sand is more than 15 percent. Depth to the fragipan ranges from 25 to 40 inches. The fragipan is mottled in shades of brown, yellow, red, and gray.

Fuquay Series

The Fuquay series consists of gently sloping to sloping soils in convex areas on uplands. These soils formed in the Carizzo Sand and in the more sandy sediment of the Wilcox Group.

In a representative profile the surface layer is loamy fine sand about 24 inches thick. The upper 7 inches is grayish brown, and the lower 17 inches is pale brown. The subsoil extends to a depth of about 84 inches. Between depths of 24 and 32 inches it is yellowish-brown fine sandy loam that has mottles in shades of yellow, red, and brown. Between depths of 32 and 84 inches the subsoil is sandy clay loam that has mottles of red, brown, and gray between depths of 32 and 40 inches and red, gray, yellow, and brown between depths of 40 and 84 inches.

Fuquay soils are slowly permeable and well drained. They have moderate available water capacity.

Representative profile of Fuquay loamy fine sand, 1 to 8 percent slopes, about 3.8 miles west of Beckville on an oil-top county road, and about 200 feet north in a field:

Ap—0 to 7 inches, grayish-brown (10YR 5/2) loamy fine sand; weak, medium, granular structure; loose; slightly acid; clear, smooth boundary.

A2—7 to 24 inches, pale-brown (10YR 6/3) loamy fine sand; single grained; very friable, soft; medium acid; clear, wavy boundary.

B21t—24 to 32 inches, yellowish-brown (10YR 5/8) fine sandy loam; few, fine, prominent, yellowish-red (5YR 5/8) mottles and few, fine, distinct, strong-brown (7.5YR 5/6) mottles; few clay films; weak, medium, subangular blocky structure; friable, slightly hard; medium acid; clear, wavy boundary.

B22t—32 to 40 inches, yellowish-brown (10YR 5/8) sandy clay loam; common, medium, prominent, red (2.5YR 4/8) mottles and few, fine, distinct, light brownish-gray (10YR 6/2) mottles; few clay films; weak, medium, subangular blocky structure; friable, slightly hard; very strongly acid; gradual, wavy boundary.

B23t—40 to 50 inches, mottled yellowish-brown (10YR 5/8), light brownish-gray (10YR 6/2), and red (2.5YR 4/8) sandy clay loam; weak, medium, subangular blocky structure; friable, slightly hard; few ironstone iron ore pebbles 10 millimeters in diameter; 3 percent, by volume, plinthite; very strongly acid; gradual, wavy boundary.

B24t—50 to 84 inches, mottled strong-brown (7.5YR 5/6), red (2.5YR 4/6), and gray (10YR 6/1) sandy clay loam; weak, medium, blocky structure; friable, hard; few patchy clay films; 15 percent, by volume, plinthite; very strongly acid; gradual, smooth boundary.

C—84 to 90 inches, stratified layers of gray, red, and light olive-brown sand and shale; very strongly acid.

Depth to the horizon that contains more than 5 percent plinthite, by volume, ranges from 45 to 56 inches. The A horizon ranges from 20 to 40 inches in thickness, and it is slightly acid or medium acid. The A1 horizon, where present, is grayish brown, dark grayish

brown, or dark gray. The A2 horizon is brown or pale brown. The upper part of the Bt horizon ranges from yellowish brown to strong brown, has few to common mottles in shades of red, brown, gray, or yellow, and is very strongly acid to medium acid. The upper 20 inches of the Bt horizon ranges from 22 to 35 percent clay. The lower part of the Bt horizon is 3 to 25 percent, by volume, plinthite that appears as red mottles. It is prominently mottled in shades of red, yellow, brown, and gray, and it is very strongly acid. The C horizon is layers of red, gray, brown, and yellow sand to clay and shale.

Fuquay loamy fine sand, 1 to 8 percent slopes (FU).—This soil is in broad areas that are irregular in shape. The areas occur throughout the county. They vary in size but average less than 40 acres.

Included with this soil in mapping were small, concave, slightly wet areas of loamy fine sand that has gray mottles throughout the subsoil. Also included were areas of Bowie and Troup soils on ridges. These included soils make up less than 20 percent of the mapped areas.

The hazard of erosion is moderate.

Most of this soil is used for pasture. Coastal bermudagrass is the main grass grown, but many areas are planted to common bermudagrass and lovegrass. Watermelons and corn are the major field crops. Pine trees are dominant in wooded areas. Because of the droughty surface layer, care must be taken in the sprigging of Coastal bermudagrass. If lime and a complete fertilizer are used, this soil is well suited to pasture or hay. Maintenance of tilth is the main concern of management, and cover crops and fertilizer are needed. Capability unit IIIe–1; woodland suitability group 3s2; Sandy woodland grazing group.

Kirvin Series

The Kirvin series consists of soils on broad interstream divides on uplands. These soils formed in the sediment of the Wilcox Group. Slopes ranges from 1 to 8 percent.

In a representative profile the surface layer is fine sandy loam about 10 inches thick. The upper 4 inches is brown, and the lower 6 inches is mottled brown and yellowish brown. The subsoil extends to a depth of about 48 inches. It is red clay between depths of 10 and 26 inches, red clay loam that is mottled with strong brown between depths of 26 and 42 inches, and sandy clay loam that is mottled with red, strong brown, and pale brown between depths of 42 and 48 inches. The underlying material is partially weathered, soft sandstone that has layers of grayish shale and extends to a depth of about 65 inches.

Kirvin soils are moderately slowly permeable and well drained. They have high available water capacity.

Representative profile of Kirvin fine sandy loam, 1 to 8 percent slopes, south of Carthage, about 8.6 miles south of the loop on U. S. Highway 59 (this is 1 mile northwest of Woods), 300 feet west on oilfield road, about 50 feet north of the road:

A1—0 to 4 inches, brown, (10YR 4/3) fine sandy loam; weak, medium, granular structure; friable, slightly hard; many fine roots; many iron concretions 1 to 2 millimeters in diameter; medium acid; clear, smooth boundary.

A2—4 to 10 inches, mottled brown (10YR 5/3) and yellowish-brown (10YR 5/6) fine sandy loam; weak, medium, subangular blocky structure; friable, slightly hard; few fine roots; many fine pores; strongly acid; clear, smooth boundary.

B21t—10 to 26 inches, red (2.5YR 4/8) clay; moderate, medium, subangular blocky structure; very firm, very hard; few fine roots; strongly acid; gradual, smooth boundary.

B22t—26 to 42 inches, red (2.5YR 4/8) clay loam; common, fine, prominent, strong-brown (7.5YR 5/6) mottles; moderate, medium, subangular blocky structure; very firm, very hard; thick continuous clay films; very strongly acid; gradual, smooth boundary.

B23t—42 to 48 inches, distinctly mottled red (2.5YR 4/8), strong-brown (7.5YR 5/6), and pale-brown (10YR 6/3) sandy clay loam; moderate, medium, blocky structure; thick continuous clay films; friable, slightly hard; very strongly acid; clear, smooth boundary.

C&B3—48 to 55 inches, red (10YR 4/6) partially weathered sandstone; sandy clay loam fills interstices along ped faces; common, medium, distinct mottles of yellowish brown (10YR 5/6) and pale brown (10YR 6/3); strong, medium, blocky structure; friable, slightly hard; very strongly acid; clear, smooth boundary.

C—55 to 65 inches, yellowish-red (5YR 5/6) soft sandstone; faint mottles of strong brown (7.5YR 5/6); common, medium, prominent, light-gray (10YR 7/1) shaly plates; very strongly acid.

The solum ranges from 40 to 60 inches in thickness. The A horizon ranges from 6 to 16 inches in thickness, and in some profiles it is 12 to 35 percent gravel. The A1 horizon is brown, grayish brown, or dark grayish brown. The A2 horizon is brown, pale brown, or yellowish brown, or it is mottled in combinations of these colors. It is medium acid or strongly acid. The B2t horizon ranges from red to yellowish red. The lower part of the B horizon and the C horizon of most profiles contain bits of unweathered gray shale. The lower part of the B horizon and the C horizon are 8 to 30 percent gravel and are strongly acid or very strongly acid. The C horizon is stratified layers of partially weathered soft sandstone and shale. The sandstone layers are about ½ inch to 4 inches or more in thickness, are red, reddish yellow, yellowish red, or strong brown, and are sandy loam when crushed. The shale layers are ⅛ inch to 1 inch in thickness and are gray.

Kirvin fine sandy loam, 1 to 8 percent slopes (KF).—This soil is on broad ridges that are interstream divides. The areas occupy some of the highest points on the landscape. Narrow ridges and round knobs are common. The areas average less than 40 acres in size. This soil has the profile described as representative of the series.

Included with the soil in mapping were areas of Bowie soils in slightly concave areas that are generally lower than the Kirvin soils on ridges. Also included were areas of the steeper Luverne soils. These included soils make up less than 20 percent of the mapped areas.

Most areas of this soil are used for pasture, and common bermudagrass and bahiagrass are the main pasture plants. A few areas are used for crops, and some of these areas are used for garden crops and small grain. Lime and a complete fertilizer are needed. Pine trees are dominant in wooded areas, but some hardwoods are scattered throughout some areas. Capability unit IIIe–2; woodland suitability group 3o1; Sandy Loam woodland grazing group.

Kirvin complex, 1 to 8 percent slopes (KP).—This complex consists of soils on hogback ridges, mainly around Beckville. The areas of this complex are less than 30 acres in size. Kirvin gravelly fine sandy loam makes up about 60 percent of the complex, and a soil that is similar to the Kirvin soil but has a combined thickness of the surface layer and subsoil of less than 40 inches makes up about 30 percent. These soils are so intricately intermingled that they cannot be separated at the scale mapped.

These Kirvin soils have a surface layer of gravelly fine sandy loam that is about 14 inches thick and is about 35 percent gravel. The subsoil is red clay loam that extends to a depth of 46 inches and has mottles of strong brown in the lower part. The subsoil is about 10 percent gravel. The underlying material is stratified sand and shale.

Included with this complex in mapping were knobs of a gravelly soil that has a sandy clay loam subsoil. This included soil makes up about 10 percent of the mapped areas.

These soils have moderate available water capacity. They are droughty because of the gravelly surface layer.

Most areas of the soils in this complex are used for pasture or woodland. Common bermudagrass and lovegrass are planted for improved pasture. Lime and a complete fertilizer are needed. Pine trees are dominant in wooded areas. In most areas of this complex, the surface layer is being removed for gravel. Capability unit IVe–2; woodland suitability group 3o1; Sandy Loam woodland grazing group.

Kullit Series

The Kullit series consists of nearly level to gently sloping soils on uplands. These soils formed in the clayey sediment of the Wilcox Group.

In a representative profile the surface layer is about 7 inches thick. It is brown fine sandy loam in the upper 2 inches and light yellowish–brown loam in the lower 5 inches. The subsoil extends to a depth of about 65 inches. The upper part is strong–brown loam that extends to a depth of about 13 inches. The middle part, between depths of 13 and 20 inches, is strong–brown clay loam that has mottles of pale brown. The lower part of the subsoil, between depths of 20 and 65 inches, is clay that has mottles in shades of red, yellow, gray, and brown.

Kullit soils are moderately slowly permeable and moderately well drained. They have high available water capacity. The seasonal high water table fluctuates between the surface and a depth of 2 feet during wet seasons.

Representative profile of Kullit fine sandy loam, 1 to 3 percent slopes, near Dotson, about 300 feet west and 500 feet northwest of Dotson Store, 0.9 mile west and 0.6 mile south on a dirt road, about 75 feet east of the road:

Ap—0 to 2 inches, brown (10YR 4/3) fine sandy loam; weak, medium, granular structure; very friable, soft; few, medium and fine roots; many fine pores; slightly acid; abrupt, smooth boundary.

A2—2 to 7 inches, light yellowish-brown (10YR 6/4) loam; weak, medium, subangular blocky structure; friable, slightly hard; few fine roots; many fine pores; medium acid; clear, wavy boundary.

B21t—7 to 13 inches, strong-brown (7.5YR 5/6) loam; weak, medium, subangular blocky structure; friable, slightly hard; few fine roots; strongly acid; clear, wavy boundary.

B22t—13 to 20 inches, strong-brown (7.5YR 5/6) clay loam; common, medium, distinct mottles of pale brown (10YR 6/3); moderate, medium, subangular blocky structure; very firm, very hard; clay films on surface of peds; very strongly acid; clear, wavy boundary.

B23t—20 to 29 inches, mottled, yellowish-red (5YR 4/6), light brownish-gray (10YR 6/2), and yellowish-brown (10YR 5/6) clay; moderate, medium, blocky structure; very firm, very hard; few thin clay films on surface of peds; very strongly acid; clear, wavy boundary.

B24t—29 to 65 inches, coarsely and prominently mottled, red (2.5YR 4/6) and gray (10YR 6/1) clay; moderate, medium, blocky structure; very firm, very hard; few clay films; very strongly acid; clear, wavy boundary.

The solum ranges from 60 to 80 inches in thickness. The A horizon ranges from 6 to 12 inches in thickness and from slightly acid to strongly acid in reaction. The A1 horizon, where present, is brown, grayish brown, or dark grayish brown. The A2 horizon is pale brown or light yellowish brown. The B21t horizon ranges from 6 to 15 inches in thickness, is yellowish red to strong brown, and is 16 to 25 percent clay. Mottles of gray are in some profiles. The upper 20 inches of the B2t horizon ranges from 27 to 35 percent clay. The lower part of the B2t horizon is clay or clay loam that is prominently mottled with red, yellow, and gray and is 45 to 65 percent clay. The gray becomes dominant in the lower part. Reaction of the B2t horizon is very strongly acid or strongly acid.

Kullit fine sandy loam, 1 to 3 percent slopes (KU).—This soil is mainly in broad concave areas at the head of drainageways on uplands. Areas are irregular in shape and average about 50 acres in size.

Included with this soil in mapping were areas of Bowie fine sandy loam on knobs or ridges. Also included were a few areas of Thage soils in slight depressions, a few areas of Cart soils on mounds, and some areas of Sacul fine sandy loam on slopes or breaks. These included soils make up less than 15 percent of the mapped areas.

Most areas of this soil are used for pasture. Bahiagrass, common bermudagrass, and Coastal bermudagrass are the main grasses grown. Pine trees are dominant in wooded areas. A few areas are planted to field crops such as corn and oats. This soil is wet early in spring, which necessitates late planting of crops. Lime and fertilizer are needed for most crops and for improved pastures. Capability unit IIe–1; woodland suitability group 2w8; Sandy Loam woodland grazing group.

Lakeland Series

The Lakeland series consists of gently sloping to sloping soils that occupy broad, convex ridges on uplands. These soils formed in the deep deposits of the Carrizo Sand.

In a representative profile the surface is dark grayish-brown fine sand about 6 inches thick. The underlying material is yellowish-brown fine sand that is mottled with very pale brown and extends to a depth of 86 inches.

Lakeland soils are rapidly permeable and excessively drained. They have low available water capacity.

Representative profile of Lakeland fine sand, 1 to 8 percent slopes, about 4 miles west of Beckville on oil-top county road, 200 feet east in field:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) fine sand; single grained; loose; moist; slightly acid; clear, smooth boundary.

C—6 to 86 inches, yellowish-brown (10YR 5/4) fine sand; few, fine, faint, very pale brown (10YR 8/3) mottles; single grained, loose; moist; slightly acid.

The profile, to a depth of more than 80 inches, is loose fine sand. Between depths of 10 and 40 inches, the content of silt and clay is 5 to 10 percent. Reaction is neutral to slightly acid. The Ap or A1 horizon ranges from 5 to 10 inches in thickness. The A horizon is dark grayish brown or grayish brown. The C horizon is pale brown, very pale brown, yellowish brown, or strong brown.

Lakeland fine sand, 1 to 8 percent slopes (LA).—This is soil on broad interstream divides. Areas are irregular in shape and average about 100 acres in size.

Included with this soil in mapping were a few small areas of Troup soils on ridges and knolls. These included soils make up less than 5 percent of the mapped areas.

Runoff is slow.

This soil is used about equally as pastureland, woodland, and cropland. Weeping lovegrass is the main grass used for pasture. Watermelons are the main field crop. High-residue crops are needed to help maintain tilth in cultivated areas. Complete fertilizers are needed for all crops and grasses. Capability unit IVs–1; woodland suitability group 5s3; Deep Sand woodland grazing group.

Lucy Series

The Lucy series consists of gently sloping soils in the higher, better drained areas on uplands. These soils formed in the Carrizo Sand and the sandy parts of the Wilcox Group.

In a representative profile the surface layer is loamy fine sand about 22 inches thick. It is dark grayish brown in the upper 6 inches and brown in the lower 16 inches. The subsoil is sandy clay loam and extends to a depth of 60 inches. It is yellowish red between depths of 22 and 29 inches, is mottled red and strong brown between depths of 29 and 39 inches, and is mottled red, yellow, brown, and gray between depths of 39 and 60 inches.

The surface layer of Lucy soils is rapidly permeable, and the subsoil is moderately permeable. These soils have moderate available water capacity and are well drained.

Representative profile of Lucy loamy fine sand, 2 to 5 percent slopes, about 15 miles east of Carthage, 3.2 miles south of intersection of Farm Road 31 and Farm Road 2517 south of Deadwood on Farm Road 31, 1.7 miles west on an oiled county road, about 400 feet north of the road:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) loamy fine sand; weak, fine, granular structure; very friable, soft; medium acid; clear, wavy boundary.

A2—6 to 22 inches, brown (10YR 5/3) loamy fine sand; single grained; very friable, soft; slightly acid; clear, wavy boundary.

B1t—22 to 29 inches, yellowish-red (5YR 4/8) sandy clay loam; weak, medium, subangular blocky structure; friable, slightly hard; medium acid; clear, wavy boundary.

B21t—29 to 39 inches, mottled, red (2.5YR 4/6) and strong-brown (7.5YR 5/6) sandy clay loam; moderate, fine, angular blocky structure; friable, slightly hard; clay films on peds; very strongly acid; gradual, wavy boundary.

B22t—39 to 60 inches, mottled, red (10YR 4/6), yellowish-brown (10YR 5/8), and gray (10YR 6/1) sandy clay loam; weak, medium, angular blocky structure; friable, slightly hard; clay films on peds; very strongly acid; gradual, wavy boundary.

The solum ranges from 60 to 100 inches in thickness. The A horizon ranges from 20 to 40 inches in thickness and is medium acid or slightly acid. The A1 horizon is dark grayish brown, grayish brown, or brown. The A2 horizon is brown or pale brown. The Bt horizon is mostly red or yellowish red mottled with shades of brown, gray, or yellow. The upper 20 inches of the Bt horizon ranges from 18 to 35 percent clay and averages 25 percent. The lower part of the Bt horizon has few to many mottles of yellowish brown and gray. Reaction of the Bt horizon ranges from very strongly acid to medium acid.

Lucy loamy fine sand, 2 to 5 percent slopes (LU).—This soil is in broad areas that are less than 30 acres in size.

Included with this soil in mapping were 15 percent Fuquay soils and 8 percent Troup soils that occur is small irregularly shaped areas in some places. Fuquay soils are in low spots and at the base of gently sloping areas. Also included were 5 percent Ruston soils.

Runoff is slow to medium. The hazard of erosion is moderate.

The soil is used about equally as woodland and cropland. Lovegrass, common bermudagrass, and Coastal bermudagrass are the main grasses used for pasture. Watermelons and grasses are the major field crops. Pine trees are dominant in the wooded areas. High-residue crops are needed in cultivated areas to help maintain tilth. Lime and a complete fertilizer are needed. Capability unit IIIe–1; woodland suitability group 3s2; Sandy woodland grazing group.

Luverne Series

The Luverne series consists of moderately deep, sloping to moderately steep soils that occupy side slopes of drainageways on uplands. These soils formed in the stratified material of the Wilcox Group.

In a representative profile the surface layer is fine sandy loam about 6 inches thick. It is dark grayish brown in the upper part and brown in the lower part. The subsoil extends to a depth of about 37 inches. It is yellowish-red clay between depths of 6 and 17 inches, yellowish-red clay loam and weathered layers of light-gray shale between depths of 17 and 33 inches, and sandy clay loam and layers of light-gray shale between depths of 33 and 37 inches. The underlying material is sandstone and gray shale.

Luverne soils are moderately slowly permeable and well drained. They have moderate available water capacity.

Representative profile of Luverne fine sandy loam, 5 to 20 percent slopes, about 15.5 miles southwest of Carthage on Texas Highway 315, 0.9 mile east on Jumbo Church Road, 300 feet south of road in timbered area:

A1—0 to 3 inches, very dark grayish-brown (10YR 3/2) fine sandy loam; weak, medium, granular structure; friable, soft; slightly acid; clear, smooth boundary.

A2—3 to 6 inches, brown (10YR 4/3) fine sandy loam; weak, medium, granular structure; friable, soft; medium acid; clear, smooth boundary.

B21t—6 to 17 inches, yellowish-red (5YR 4/8) clay; moderate, medium, subangular blocky structure; very firm, very hard; many clay films; strongly acid; clear, smooth boundary.

B22t—17 to 33 inches, yellowish-red (5YR 4/8) clay loam; light-gray (10YR 7/1) weathered shale layers that are ¼ to ⅜ inch thick and ½ inch to 2 inches apart; many clay films; moderate, fine, subangular blocky and platy structure; very firm, very hard; very strongly acid; gradual, smooth boundary.

B3&C—33 to 37 inches, yellowish-red (5YR 4/8) sandy clay loam; light-gray layers of shale that are ¼ to ¾ inch thick and ½ inch to 2 inches apart; moderate, coarse, platy structure; firm, hard; thick reddish clay films; very strongly acid; clear, smooth boundary.

C—37 to 70 inches, alternate layers of reddish soft sandstone and light-gray shale; soft sandstone layers are ½ inch to 6 inches thick and make up 60 percent of the horizon, shale layers are ½ to 1 inch thick; many mica flakes; very strongly acid.

The solum ranges from 21 to 40 inches in thickness. The A horizon ranges from 4 to 10 inches in thickness. The A1 horizon is very dark grayish brown, dark grayish brown, or brown and ranges from strongly acid to neutral. The A2 horizon is brown, pale brown, or light yellowish brown and ranges from very strongly acid to medium acid. The Bt horizon ranges from 19 to 32 inches in thickness and is strongly acid or very strongly acid. The B21t horizon is red, yellowish red, or reddish yellow. The lower part of the Bt horizon is red, reddish yellow, or yellowish red. The C horizon is interbedded alternate layers of soft sandstone and shale.

Luverne fine sandy loam, 5 to 20 percent slopes (LV).—This soil is in long, narrow areas immediately above areas leading to the major drainageways. Stones are common along the steep breaks. Areas average about 150 acres in size.

Included with this soil in mapping were areas of gently sloping Kirvin soils near the top of areas of the steeper Luverne soils. Also included were a few areas of Luverne soils that have slopes of as much as 40 percent and areas of Tenaha and Sacul soils. Tenaha soils are near the base of slopes, and the Sacul soils are at the head of drainageways. These included soils make up less than 20 percent of the mapped areas.

Runoff is medium to rapid.

Most areas of this soil are used for timber, but some areas are in pasture. Lovegrass, bahiagrass, common bermudagrass, and Coastal bermudagrass are used for pasture. Fertilization is needed. This soil is not suited to crops. Capability unit VIe–1; woodland suitability group 3c2; Sandy Loam woodland grazing group.

Figure 9.—**Standing water in an area of Mantachie clay loam.**

Mantachie Series

The Mantachie series consists of nearly level soils on bottom lands along creeks and the Sabine River. These soils formed in recent alluvial sediment.

In a representative profile the surface layer is dark grayish-brown clay loam that has mottles of grayish brown and is about 6 inches thick. The next layer extends to a depth of about 48 inches. It has mottles in shades of yellow, gray, and brown to a depth of about 21 inches and is light gray and has mottles of strong brown to a depth of 48 inches. This layer is sandy clay loam between depths of 6 and 35 inches and clay loam between depths of 35 and 48 inches. The underlying material is sandy clay loam that is mottled in shades of gray, yellow, and brown.

Mantachie soils are moderately permeable and somewhat poorly drained. They have high available water capacity (fig. 9). A seasonal high water table fluctuates between the surface and a depth of about 20 inches during wet seasons.

Representative profile of Mantachie clay loam, south of Carthage near Gary, about 2.1 miles east of Gary on Farm Road 999, 1.1 miles north on dirt road to Murvaul Creek bottom, 50 feet east of road in area of timber:

A1—0 to 6 inches, dark grayish-brown (10YR 4/2) clay loam; few, fine, faint mottles of grayish brown (10YR 5/2); moderate, medium, granular structure; firm, hard; medium acid; gradual, wavy boundary.

B21—6 to 21 inches, sandy clay loam; distinct mottles, about 30 percent of mottles are light brownish gray (10YR 6/2), 30 percent are yellowish brown (10YR 5/4), 20 percent are dark grayish brown (10YR 4/2), and 20 percent are strong brown (7.5YR 5/6); weak, medium, subangular blocky structure; friable, slightly hard; very strongly acid; gradual, wavy boundary.

B22—21 to 35 inches, light-gray (10YR 6/1) sandy clay loam; common, medium, distinct mottles of strong brown (7.5YR 5/8); weak, medium, subangular blocky structure; few dark concretions; friable, slightly hard; very strongly acid; clear, wavy boundary.

B23—35 to 48 inches, light-gray (10YR 6/1) clay loam; common, medium, distinct mottles of strong brown (7.5YR 5/8) and a few soft spots of very dark grayish brown (10YR 3/2); weak, medium, subangular blocky structure; firm, hard; very strongly acid; gradual, wavy boundary.

C—48 to 60 inches, distinctly mottled, light-gray (10YR 6/1) and yellowish-brown (10YR 5/8) sandy clay loam; massive; firm, hard; very strongly acid.

The soil ranges from medium acid to very strongly acid. Between depths of 10 and 40 inches, the soil is clay loam or sandy clay loam that averages 18 to 35 percent clay. The A horizon is 4 to 12 inches thick. It is grayish brown or dark grayish brown and has mottles in shades of yellow, gray, or brown. Twenty to 40 percent of the upper part of the B2 horizon is mottled with gray, and 60 to 70 percent is mottled with brown. The lower part of the B2 horizon is light gray to light brownish gray and has mottles in shades of brown or yellow. The C horizon is loamy fine sand to clay that is mottled in shades of yellow, brown, or gray.

Mantachie clay loam (MN).—This soil is in broad uniform areas along rivers and creeks. Old stream channels occur without pattern and at irregular intervals. This soil is flooded two or three times a year in 7 years out of 10. Flooding generally lasts from 2 to 14 days. Slopes are 0 to 1 percent.

Included with this soil in mapping were areas of Urbo soils, which are at the same level as this Mantachie soil or are in old stream channels. Also included were areas of the high-lying and sandier Thenas soils. These included soils make up less than 15 percent of the mapped areas.

Runoff and internal drainage are slow. The seasonal high water table is near the surface during cool wet seasons, which hinders the growth of roots.

This soil is used mainly for hardwoods. Some pine trees grow in small included areas of Thenas soils on ridges. Bahiagrass and common bermudagrass are the main grasses

grown for pasture, but white clover has been seeded in many areas. Lime and fertilizer are needed. Because of the hazard of flooding, this soil is not suited to crops. Drainage is beneficial in most areas that are used as pasture. Capability unit Vw–1; woodland suitability group 1w9; Loamy Bottomland woodland grazing group.

Marietta Series

The Marietta series consists of nearly level soils on bottom lands. These soils formed in recent alluvial material.

In a representative profile the surface layer is fine sandy loam about 12 inches thick. It is brown in the upper 6 inches and dark brown in the lower 6 inches. The next layer extends to a depth of about 36 inches. It is yellowish-brown sandy clay loam that has mottles of light brownish gray to a depth of about 24 inches, and sandy clay loam that has mottles of gray, yellow, and brown to a depth of about 36 inches. The underlying material is sandy clay loam that has mottles of light brownish gray, dark yellowish brown, and strong brown.

Marietta soils are moderately permeable and moderately well drained. They have high available water capacity. A seasonal high water table fluctuates between depths of about 20 and 30 inches during wet seasons.

Representative profile of Marietta fine sandy loam, about 14 miles southwest of Carthage on Texas Highway 315, to the intersection of Farm Road 348, then 3 miles south on county road, 1.2 miles southwest to Jumbo Church, 1.3 miles south to intersection, 0.3 mile east to Linthicum Creek bottom, about 200 feet south of the road:

A11—0 to 6 inches, brown (10YR 5/3) fine sandy loam; common, fine, distinct mottles of strong brown; weak, fine granular structure; friable, slightly hard; many fine roots; medium acid; abrupt boundary.

A12—6 to 12 inches, dark-brown (10YR 4/3) fine sandy loam; weak, fine, granular structure; friable, soft; many fine roots; slightly acid; abrupt boundary.

B21—12 to 24 inches, yellowish-brown (10YR 5/4) sandy clay loam; common, medium, distinct, light brownish-gray (10YR 6/2) mottles; weak, medium, subangular blocky structure; friable, slightly hard; many fine roots; very strongly acid; gradual boundary.

B22—24 to 36 inches, mottled light brownish-gray (10YR 6/2), yellowish-brown (10YR 5/4), and strong-brown (7.5YR 5/6) sandy clay loam; weak, medium, subangular blocky structure; friable, slightly hard; very strongly acid; gradual boundary.

C—36 to 62 inches, mottled light brownish-gray (10YR 6/2), dark yellowish-brown (10YR 4/4), and strong-brown (7.5YR 6/6) sandy clay loam; massive; friable, moist; very strongly acid.

The A horizon is 3 to 16 inches thick and is neutral to strongly acid. It is dark brown, very dark grayish brown, or brown. The B2 horizon is 24 to 50 inches thick. It is yellowish brown or strong brown. The material between depths of 10 and 40 inches is fine sandy loam, sandy clay loam, or clay loam that is 18 to 30 percent clay. Reaction is very strongly acid to slightly acid. The upper part of the B2 horizon has few to many mottles of gray to light brownish gray. The lower part of the Bt horizon is dominantly gray, light gray, or light brownish gray and has few to many mottles of yellowish red, strong brown, or yellowish brown.

The Marietta soils mapped in Panola County are slightly more acid in the B22 and C horizons than is defined as within the range for the series, but use and behavior are similar.

Marietta fine sandy loam (MR).—This soil is in long and narrow areas on bottom lands of streams. It formed in loamy alluvial sediment. The areas are more than 100 acres in size. This soil is subject to flooding nearly every year. Flooding usually lasts from 12 hours to 2 days.

Included with this soil in mapping were areas of Thenas and Mantachie soils. The Thenas soils occupy the sandier ridges, and the Mantachie soils occupy the wetter, lower, concave areas. These included soils make up less than 15 percent of the mapped areas.

Most areas of this soil are in mixed hardwoods and pine trees. Some areas have been cleared and are used for pasture. Common bermudagrass and dallisgrass are suitable pasture plants, but bahiagrass and white clover are used in most improved pastures. All of these grasses respond well to fertilizer. Because of the hazard of flooding, this soil is not suited to crops. Capability unit Vw–1; woodland suitability group 1w8; Loamy Bottomland woodland grazing group.

Mollville Series

The Mollville series consists of nearly level and concave soils on terraces. These soils formed in old alluvial sediment that has been reworked by wind.

In a representative profile the surface layer is loam about 11 inches thick. It is dark gray in the upper 5 inches and light brownish gray in the lower 6 inches. The subsoil extends to a depth of about 54 inches. Between depths of 11 and 23 inches, it is grayish-brown sandy clay loam that has mottles of strong brown; between depths of 23 and 54 inches, it is mainly sandy clay loam mottled in shades of gray and brown. The underlying material is gray loamy fine sand.

Mollville soils are slowly permeable and poorly drained. They have high available water capacity.

The Mollville soils are mapped only in a complex with the Bienville soils.

Representative profile of Mollville loam in an area of Bienville-Mollville complex, about 6 miles east of Carthage, about 5 miles east of the loop on Hills Lake Road, 0.8 mile south on dirt road, 0.2 mile west on pipeline:

O1—2 inches to 0, humus, oak leaves, and light-gray (10YR 7/1) silt loam overwash.

A1—0 to 5 inches, dark-gray (10YR 4/1) loam; weak, medium, granular structure; slightly hard, friable; many fine roots; very strongly acid; clear, wavy boundary.

A2g—5 to 11 inches, light brownish-gray (10YR 6/2) loam, light gray (10YR 7/1) dry; massive; slightly hard, friable; many fine roots; strongly acid; clear, irregular boundary.

B21t&A2g—11 to 23 inches, grayish-brown (10YR 5/2) sandy clay loam; many, medium, prominent mottles of strong brown (7.5YR 5/6); dark grayish-brown coatings on peds (10YR 4/2); about 20 percent of horizon is tongues and streaks of light-gray (10YR 7/2) loam (A2g); coarse, medium, blocky structure; very hard, very firm; many thick clay films; strongly acid; clear, wavy boundary.

B22tg—23 to 42 inches, gray (10YR 5/1), grayish-brown (10YR 5/2), and strong-brown (7.5YR 5/6) sandy clay loam; thin lenses, or streaks, of light-gray (10YR 7/2) loam; moderate, medium, blocky structure; very hard, very firm; common, thick, discontinuous clay films; strongly acid; clear, wavy boundary.

B23tg—42 to 47 inches, mottled, light brownish-gray (10YR 6/2), grayish-brown, (10YR 5/2) and strong-brown (7.5YR 5/6) clay loam; moderate, medium, blocky structure; very hard, very firm; common discontinuous clay films on surface of peds; blocky structure; slightly acid; clear, wavy boundary.

B3g—47 to 54 inches, light-gray (10YR 7/2) and strong-brown (7.5YR 5/6) sandy clay loam; moderate, medium, blocky structure; hard, firm; neutral; clear, wavy boundary.

C—54 to 65 inches, gray (10YR 6/1) loamy fine sand; single grained; midly alkaline.

The solum ranges from 40 to 70 inches in thickness. The A horizon ranges from 8 to 22 inches in thickness and is very strongly acid to medium acid. The A1 horizon is very dark grayish brown, dark gray, gray, grayish brown, or dark grayish brown. The A2g horizon is light gray, light brownish gray, or grayish brown. Tongues or streaks of A2 material, ½ inch to 4 inches wide, extend

through the B21t horizon. The Bt horizon is clay loam, sandy clay loam, loam, or silt loam that is 23 to 35 percent clay and about 20 to 40 percent sand that is coarser than very fine sand. It has few to many, strong-brown and yellowish-red mottles. The B21t horizon is light brownish gray or grayish brown; ped exteriors are coated with dark grayish brown or very dark grayish brown. The B21tg and B22tg horizons are very strongly acid to medium acid. The B22tg and B23tg horizons are gray, light gray, light brownish gray, or grayish brown. The B23tg and B3g horizons are strongly acid to mildly alkaline. The C horizon is medium acid to mildly alkaline, grayish loamy fine sand, fine sandy loam, sandy clay loam, or clay loam.

Nahatche Series

The Nahatche series consists of nearly level to level soils on flood plains. These soils formed in recent alluvial material.

In a representative profile the surface layer is dark grayish-brown sandy clay loam that has mottles of strong brown and gray and is about 8 inches thick. The next layer extends to a depth of about 60 inches. In sequence from the top, the upper 14 inches is mainly loam or fine sandy loam that has mottles of grayish brown and light brownish gray; the next 11 inches is gray loam that has mottles of strong brown; and the lower 27 inches is light-gray and gray clay loam that has mottles of yellow, red, or brown.

Nahatche soils are subject to frequent flooding. They are moderately permeable, are somewhat poorly drained, and have high available water capacity. A seasonal high water table fluctuates between depths of 15 and 30 inches during wet seasons.

Representative profile of Nahatche sandy clay loam in an area of Nahatche complex, in the southeastern part of Panola County, about 14 miles southeast of Carthage at Old Center, about 2 miles southeast on county road to McFaddin Creek bottom, east side of channel and south of road:

A—0 to 8 inches, dark grayish-brown (10YR 4/2) sandy clay loam; few, medium, faint mottles of strong brown (7.5YR 5/6) and gray (10YR 5/1); weak, medium, subangular blocky structure; friable, slightly hard; slightly acid; clear, wavy boundary.

B21—8 to 11 inches, distinctly mottled, grayish-brown (10YR 5/2), dark grayish-brown (10YR 4/2), strong-brown (7.5YR 5/6), and yellowish-red (5YR 4/6) sandy clay loam; weak, medium, subangular blocky structure; friable, slightly hard; calcareous; moderately alkaline; clear, wavy boundary.

B22—11 to 16 inches, grayish-brown (10YR 5/2) loam; common, medium, distinct mottles of strong brown (7.5YR 5/6); weak, medium, subangular blocky structure; friable, soft; calcareous; moderately alkaline; clear, smooth boundary.

B23—16 to 22 inches, light brownish-gray (10YR 6/2) fine sandy loam; common, medium, prominent mottles of yellowish red (5YR 4/6) and common, medium, distinct mottles of dark brown (10YR 3/3); weak, medium, subangular blocky structure; friable, soft; calcareous; moderately alkaline; clear, smooth boundary.

B24—22 to 33 inches, gray (10YR 6/1) loam; common, coarse, prominent mottles of strong brown (7.5YR 5/8); weak, medium, subangular blocky structure; friable, slightly hard; calcareous; moderately alkaline; clear, smooth boundary.

B25—33 to 47 inches, light-gray (10YR 7/1) clay loam; common, medium, prominent mottles of yellowish red (5YR 4/6); common, medium, distinct, dark-brown (10YR 3/3), soft iron spots and iron stains; weak, medium, subangular blocky structure; firm, slightly hard; calcareous; moderately alkaline; clear, smooth boundary.

B26—47 to 60 inches, gray (10YR 6/1) clay loam; common, medium, prominent mottles of red (2.5YR 4/8); weak, medium, subangular blocky structure; firm, slightly hard; calcareous; moderately alkaline.

The solum is more than 60 inches thick and is slightly acid to moderately alkaline. The A horizon is 6 to 10 inches thick and is dark grayish brown or very dark grayish brown. The upper part of the B horizon is grayish brown and has mottles of yellowish red, dark grayish brown, or strong brown. The lower part of the B horizon and the C horizon are dominantly gray, light brownish gray, or light gray and have few to many distinct and prominent mottles of red, yellow, dark brown, yellowish red, and strong brown. Between depths of 10 and 40 inches, the profile is loam, fine sandy loam, clay loam, or sandy clay loam and is 18 to 30 percent clay.

Nahatche complex (NC).—This complex consists of soils on the wide, long alluvial flood plains of most of the creeks in the county. Slopes are 0 to 1 percent. Nahatche soils make up 40 percent of the complex; a soil that is similar to Nahatche soils but is more alkaline makes up 35 percent; and other included soils make up the remaining 25 percent. These Nahatche soils are so intricately intermingled that they cannot be separated at the scale mapped.

Included with this complex in mapping were areas of Marietta soils on slightly higher ridges. Also included were areas of more clayey and wetter soils in channels and areas of more sandy soils on ridges near stream channels. In some areas there are scab spots caused by a high concentration of salt.

The soils in this complex are flooded nearly every year, sometimes two or three times a year, and the flooding generally lasts from 10 hours to several days.

Most areas of this complex are used for hardwoods, although pine trees are scattered throughout some areas. Other areas have been cleared and planted to pasture. Bahiagrass and dallisgrass, planted in combination with white clover, are used in most improved pastures. Because of the hazard of flooding, this complex is not suited to crops. Capability unit Vw–1; woodland suitability group 1w6; Loamy Bottomland woodland grazing group.

Ruston Series

The Ruston series consists of gently sloping to sloping soils on uplands. These soils formed in the sandy material of the Wilcox Group.

In a representative profile the surface layer is fine sandy loam about 9 inches thick. It is dark grayish brown in the upper 4 inches and brown in the lower 5 inches. The subsoil is sandy clay loam that extends to a depth of about 74 inches. It is red between depths of 9 and 36 inches, is red and has mottles of strong brown between depths of 36 and 52 inches, and has mottles of red, yellowish red, and brownish yellow between depths of 52 and 74 inches.

Ruston soils are moderately permeable and well drained. They have high available water capacity.

Representative profile of Ruston fine sandy loam, 1 to 8 percent slopes, about 17 miles northwest of Carthage, about 15 miles west of the square on U. S. Highway 79 to Fairplay, 5 miles north on Farm Road 124, about 20 feet east of road in Youngblood Churchyard:

A1—0 to 4 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, medium, granular structure; very friable, soft; few concretions; medium acid; clear, smooth boundary.

A2—4 to 9 inches, brown (10YR 5/3) fine sandy loam; massive; very friable, soft; medium acid; clear, smooth boundary.

B21t—9 to 36 inches, red (2.5YR 4/6) sandy clay loam; moderate, fine, subangular blocky structure; friable, hard; dark-red (2.5YR 3/6) ped faces and clay films; very strongly acid; gradual, smooth boundary.

B22t—36 to 52 inches, red (2.5YR 4/6) sandy clay loam; common, fine, distinct, strong-brown (7.5YR 5/6) mottles; moderate, fine, subangular blocky structure; friable, slightly hard; dark-red (2.5YR 3/6) ped faces and clay films; very strongly acid; gradual, smooth boundary.

B23t—52 to 74 inches, prominently mottled, red (2.5YR 4/6), yellowish-red (5YR 4/6), and brownish-yellow (10YR 6/6) sandy clay loam; weak, fine, subangular blocky structure; friable, hard; thick clay films; few pockets of clean sand grains; very strongly acid.

The solum ranges from 62 to 80 inches in thickness. The A horizon is 5 to 18 inches thick and is strongly acid to slightly acid. The A1 horizon is grayish brown, pale brown, brown, or dark grayish brown. The A2 horizon is yellowish brown, brown, or pale brown. The Bt horizon is strongly acid to very strongly acid. The upper part of the Bt horizon is 18 to 32 percent clay. The B2t horizon is red, strong brown, or yellowish red. The lower part of the Bt horizon is commonly mottled red, yellow, brown, and gray. As much as 5 percent plinthite is in the lower part of the Bt horizon in some places, and in some places the lower part of the Bt horizon is clayey. The C horizon is brownish yellow throughout or has mottles of yellow, gray, yellowish red, or red. It is sandy clay to sandy clay loam, and in some profiles it is soft consolidated sandstone.

Ruston fine sandy loam, 1 to 8 percent slopes (RF).—This soil occupies gentle interstream divides. The areas are irregular in shape and about 30 acres in size.

Included with this soil in mapping were small spots of Bowie soils. Also included were a few areas of Thage soils, a few areas of Kullit fine sandy loam 1 to 2 acres in size in slightly depressional areas, and some areas of Lucy soils 1 to 2 acres in size. All of these included soils make up less than 10 percent of the mapped areas.

The hazard of erosion is moderate.

Almost all areas of this soil are used for pasture. Bahiagrass, lovegrass, common bermudagrass, and Coastal bermudagrass are used in most improved pastures. Corn and oats are the major field crops. Applications of lime and a a complete fertilizer are needed. Terraces, contour rows, and high-residue crops are needed in cultivated areas. Pine trees are dominant in forested areas. Capability unit IIIe–3; woodland suitability group 3o1; Sandy Loam woodland grazing group.

Sacul Series

The Sacul series consists of gently sloping to moderately steep soils on uplands. These soils formed in interbedded sandstone and shale of the Wilcox Group.

In a representative profile the surface layer is fine sandy loam about 7 inches thick. The upper 4 inches is dark brown, and the lower 3 inches is yellowish brown. The subsoil is clay between depths of 7 and 42 inches. It is red between depths of 7 and 15 inches, red mottled with strong brown between depths of 15 and 24 inches, and mottled light brownish gray and red between depths of 24 and 42 inches. The subsoil is red clay loam mottled with light brownish gray between depths of 42 inches and 52 inches. The underlying material is weakly consolidated sandstone and shale that extends to a depth of 72 inches.

Sacul soils are moderately well drained and slowly permeable. They have high available water capacity.

Representative profile of Sacul fine sandy loam, 1 to 5 percent slopes, 14.5 miles east of Carthage, about 2 miles east of intersection of Farm Road 31 and Farm Road 2517, and 50 feet east of the road:

A1—0 to 4 inches, dark-brown (10YR 4/3) fine sandy loam; weak, medium, subangular blocky structure; soft, very friable; medium acid; clear, wavy boundary.

A2—4 to 7 inches, yellowish-brown (10YR 5/4) fine sandy loam; massive; soft, very friable; medium acid; clear, wavy boundary.

B21t—7 to 15 inches, red (2.5YR 4/8) clay; moderate, medium, blocky structure; hard, firm; continuous clay films; medium acid; gradual, wavy boundary.

B22t—15 to 24 inches, red (2.5YR 4/6) clay; common, medium, distinct mottles of strong brown (7.5YR 5/6); strong, medium, blocky structure; very hard, very firm; many clay films; medium acid; gradual, wavy boundary.

B23t—24 to 42 inches, mottled, light brownish-gray (10YR 6/2) and red (2.5YR 4/6) clay; strong, medium, blocky structure; very hard, very firm; few clay films; very strongly acid; gradual, wavy boundary.

B3—42 to 52 inches, red (2.5YR 4/6) clay loam; common, medium, prominent mottles of light brownish gray (10YR 6/2); weak, medium, blocky structure; hard, firm; very strongly acid; gradual, wavy boundary.

C—52 to 72 inches, mottled, light brownish-gray (10YR 6/2), light-brown (7.5YR 6/4), and strong-brown (7.5YR 5/8) weakly consolidated sandstone and shale; common mica flakes; very strongly acid.

The solum ranges from 40 to 64 inches in thickness. The A horizon is 5 to 13 inches thick and is medium acid to slightly acid. The A1 horizon is dark grayish brown, brown, or dark brown. The A2 horizon is brown, pale brown, or yellowish brown. The upper part of the Bt horizon is 45 to 55 percent clay and ranges from very strongly acid to medium acid. Mottles in the upper part of the Bt horizon are in shades of gray and brown. The lower part of the Bt horizon is mottled in shades of red, brown, or gray. The B21t horizon is red or yellowish red. Few to common mottles of strong brown are in some profiles. The lower part of the Bt horizon and the C horizon are very strongly acid or strongly acid.

Sacul fine sandy loam, 1 to 5 percent slopes (SAC).—This soil is in slightly convex to slightly concave areas at the head of drainageways. The areas are irregular in shape and are less than 50 acres in size. This soil has the profile described as representative of the series (fig. 10).

Included with this soil in mapping were small areas of Kullit soils in concave spots and Bowie and Kirvin soils on knobs and ridges. Also included were areas where the surface layer has been lost through erosion. These included soils make up less than 20 percent of the mapped areas.

Most of the acreage of this soil is in timber, but some cleared areas are in tame pasture. Many formerly cultivated areas are reverting to timber. Bahiagrass, common bermudagrass, and Coastal bermudagrass are the main grasses used in improved pastures. Lime and a complete fertilizer are needed. Only garden crops are grown on this soil. Capability unit IVe–1; woodland suitability group 3c2; Tight Sandy Loam woodland grazing group.

Sacul fine sandy loam, 5 to 20 percent slopes (SAF).—This soil is on hills and on long, narrow breaks along drainageways. The areas are about 80 acres in size.

This soil has a surface layer of brown fine sandy loam about 5 inches thick. The subsoil is clay that extends to a depth of 45 inches. It is red between depths of 5 and 20 inches, is red mottled with gray between depths of 20 and 35 inches, and is mottled with red and gray between depths of 35 and 45 inches. The underlying material is sandstone and shale that reaches a depth of about 70 inches.

Included with this soil in mapping were areas of Luverne soils. Also included were areas of Kirvin soils on knobs and ridges. These included soils make up less than 20 percent of the mapped areas.

Runoff is rapid, and the hazard of erosion is severe.

Most areas of this soil are in pine and scattered hardwoods. Common bermudagrass, lovegrass, and bahiagrass are used in most of the improved pastures. Lime and a complete fertilizer are needed. This soil is not suited to crops. Capability unit VIe–1; woodland suitability group 3c2; Tight Sandy Loam woodland grazing group.

Figure 10.—**Profile of Sacul fine sandy loam, 1 to 5 percent slopes. The clay subsoil is at a depth of about 11 inches.**

Tenaha Series

The Tenaha series consists of sloping to moderately steep soils on uplands. These soils formed in the Carrizo Sand.

In a representative profile the surface layer is loamy fine sand about 32 inches thick. It is very dark grayish brown in the upper 11 inches and yellowish brown in the lower 21 inches. The subsoil is yellowish-red sandy clay loam mottled with red and strong brown and extends to a depth of about 43 inches. The underlying material is red and strong-brown, weakly consolidated sandstone that reaches a depth of about 60 inches.

Tenaha soils are moderately permeable and well drained. They have low available water capacity.

Representative profile of Tenaha loamy fine sand, 5 to 20 percent slopes, northwest of Carthage near Beckville, about 1 mile west of intersection of Texas Highways 149 and 152, 1.75 miles northwest on unpaved road and 100 feet west of road:

A1—0 to 11 inches, very dark grayish-brown (10YR 3/2) loamy fine sand; weak, medium, granular structure; soft, loose; slightly acid; clear, wavy boundary.
A2—11 to 32 inches, yellowish-brown (10YR 5/4) loamy fine sand; single grained; soft, loose; few concretions; strongly acid; gradual, smooth boundary.
B2t—32 to 43 inches, yellowish-red (5YR 4/6) sandy clay loam; common, fine, distinct mottles of red (10YR 4/6) and strong brown (7.5YR 5/6); weak, medium, subangular blocky structure; continuous thick clay films; few pebbles; very strongly acid; gradual, smooth boundary.
C—43 to 60 inches, red (2.5YR 4/8) and strong-brown (7.5YR 5/6) soft sandstone; weakly consolidated; very strongly acid.

The solum ranges from 40 to 60 inches in thickness. A few pebbles occur in most profiles. The A horizon is 22 to 40 inches thick and it is strongly acid to slightly acid. The A1 horizon is dark brown, dark grayish brown, and very dark grayish brown. The A2 horizon is brown, light yellowish brown, yellowish brown, and brown. The upper part of the Bt horizon is 25 to 35 percent clay. The Bt horizon is yellowish red, strong brown, or red, and it is strongly acid to very strongly acid. The C horizon is soft, reddish sandstone that has thin lenses of gray shale ⅛ to ¾ inch thick in most places.

Tenaha loamy fine sand, 5 to 20 percent slopes (TE).—This soil is in broad areas along stream channels. Most areas are long and narrow and are about 60 acres in size.

Included with this soil in mapping were areas, on knobs and ridges, of loamy fine sand that is 15 to 25 percent gravel. Also included were areas of Troup soils. These included soils make up less than 10 percent of the mapped areas.

This soil has slow runoff.

Most areas of this soil are used for woodland in which pine trees are dominant. A few areas are in improved pastures of lovegrass or Coastal bermudagrass. Lime and a complete fertilizer are needed. This soil is not suitable for cultivation. Capability unit VIe–2; woodland suitability group 3s2; Sandy woodland grazing group.

Thage Series

The Thage series consists of nearly level to gently sloping soils on terraces and uplands. These soils formed in old alluvial sediment that has been reworked by wind.

In a representative profile the surface layer is loam about 6 inches thick. The upper 3 inches is brown, and the lower 3 inches is pale brown mottled with yellowish brown. The subsoil extends to a depth of about 70 inches. It is strong-brown loam that has mottles in shades of gray and brown between depths of 6 and 32 inches, and brittle loam that has mottles in shades of gray, brown, yellow, and red between depths of 32 and 53 inches. Below this the subsoil is brittle clay loam that has mottles of yellowish brown, light brownish gray, and gray.

Thage soils are moderately slowly permeable and somewhat poorly drained. They have high available water capacity. A seasonal high water table fluctuates between depths of 2 and 4 feet during wet seasons.

Representative profile of Thage loam, 4 miles east of De Berry on U. S. Highway 79, 1.7 miles north on oiled county road, 320 feet east of road, 40 feet south of pipeline in forest:

A1—0 to 3 inches, brown (10YR 5/3) loam; weak, medium, granular structure; very friable, soft; many tree roots; few 2- to 5-millimeter iron concretions; medium acid; clear, wavy boundary.

A2—3 to 6 inches, pale-brown (10YR 6/3) loam, common, fine, distinct mottles of yellowish brown (10YR 5/6); weak, medium, subangular blocky structure; friable, slightly hard; many tree roots; strongly acid; clear, smooth boundary.

B1t—6 to 10 inches, strong-brown (7.5YR 5/6) loam; many, medium, distinct mottles of light brownish gray (10YR 6/2) and pale brown (10YR 6/3); weak, medium, subangular blocky structure; friable, slightly hard; few tree roots; clay bridging on sand grains; very strongly acid; clear, smooth boundary.

B2t—10 to 32 inches, strong-brown (7.5YR 5/6) loam; common, medium, distinct mottles of gray (10YR 6/1) and pale brown (10YR 5/3); weak, medium, subangular blocky structure; friable, slightly hard; few clay films; very strongly acid; gradual, smooth boundary.

Bx1—32 to 39 inches, prominently mottled, gray (10YR 6/1), strong-brown (7.5YR 5/8), and yellowish-red (5YR 5/8) loam; weak, coarse, prismatic structure parting to weak and moderate, medium, subangular blocky; brittle when ped exteriors are saturated with water and ped interiors are moist; common large pores and voids lined with clay; about 3 percent plinthite; few iron concretions; very strongly acid; clear, wavy boundary.

Bx2—39 to 53 inches, distinctly and coarsely mottled, strong-brown (7.5YR 5/6), gray (10YR 6/1), and brown (10YR 5/3) loam; weak, coarse, prismatic structure parting to weak and moderate, medium, subangular blocky; very brittle; ped faces are coated with light brownish-gray clay films; clean silt grains between peds; common voids; very strongly acid; clear, wavy boundary.

Bx3—53 to 70 inches, distinctly mottled, yellowish-brown (10YR 5/6) and light brownish-gray (10YR 6/2) clay loam; light-gray (10YR 6/1) coatings on peds; weak, coarse, prismatic structure parting to weak and moderate, medium, subangular blocky; brittle; few clay films on faces of peds; strongly acid.

The solum ranges from 60 to 100 inches in thickness. The A horizon ranges from 5 to 20 inches in thickness and it is strongly acid or medium acid. The A1 horizon is very dark grayish brown, dark grayish brown, or brown and has few to common yellowish mottles. The Bt horizon is yellowish brown or strong brown and has mottles in shades of brown or gray. The upper part of the Bt horizon is 19 to 30 percent clay. Depth to the fragipan ranges from 28 to 40 inches. The fragipan is mottled with shades of gray, red, yellow, or brown and is very strongly acid or strongly acid. It contains up to 5 percent plinthite in some profiles.

Thage loam (TH).—This soil is on low terraces and uplands near large streams. The areas are irregular in shape and are about 30 acres in size. Slopes range from 0 to 3 percent.

Included with this soil in mapping were areas of Bowie, Wrightsville, and Cart soils. Bowie soils are on ridges, Cart soils are on mounds, and Wrightsville soils are in flat or depressional areas. These included soils make up less than 5 percent of the mapped area.

Most areas of this soil are used for timber that consists mainly of pine trees. A few areas have been cleared and are used for tame pasture. Bahiagrass is used mainly in improved pastures, but some areas are planted to common bermudagrass. A complete fertilizer is needed. Because this soil is wet, only a few crops are grown on it. Capability unit IIw–1; woodland suitability group 2w8; Sandy Loam woodland grazing group.

Thenas Series

The Thenas series consists of nearly level soils on bottom lands along small streams. These soils formed in recent alluvial material.

In a representative profile the surface layer is fine sandy loam that is dark brown to a depth of about 6 inches and brown and mottled with grayish brown, reddish brown, and brown to a depth of about 11 inches. The next layer is fine sandy loam that extends to a depth of about 32 inches. It is brown and is mottled with light brownish gray to a depth of about 24 inches, and it is yellowish brown and is mottled with light brownish gray and yellowish red to a depth of about 32 inches. The underlying material is fine sandy loam that is mottled in shades of brown and gray and reaches a depth of about 62 inches.

Thenas soils are moderately permeable and moderately well drained. They have high available water capacity. A seasonal high water table fluctuates between depths of about 15 and 30 inches during wet seasons.

Representative profile of Thenas fine sandy loam, about 1.6 miles northeast of Tatum on Texas Highway 43, 500 feet south of highway in pasture near powerline:

A11—0 to 6 inches, dark-brown (10YR 3/3) fine sandy loam; weak, medium, granular structure; very friable, soft; slightly acid; clear, wavy boundary.

A12—6 to 11 inches, brown (10YR 4/3) fine sandy loam; common, fine, distinct mottles of grayish brown (10YR 5/2), reddish brown (5YR 4/3), and brown (7.5YR 5/4); massive; very friable, soft; medium acid; clear, wavy boundary.

B21—11 to 24 inches, brown (10YR 5/3) fine sandy loam; few, fine, distinct mottles of light brownish gray (10YR 6/2); weak, medium, subangular blocky structure; friable, slightly hard; strongly acid; gradual, wavy boundary.

B22—24 to 32 inches, yellowish-brown (10YR 5/4) fine sandy loam; common, fine, distinct mottles of light brownish gray (10YR 6/2) and yellowish red (5YR 5/6); weak, medium, subangular blocky structure; friable, slightly hard; very strongly acid; gradual, wavy boundary.

C1—32 to 42 inches, yellowish-brown (10YR 5/4) fine sandy loam; common, medium, distinct mottles of dark reddish brown (5YR 3/4); massive; very strongly acid; gradual, wavy boundary.

C2—42 to 62 inches, distinctly mottled, brown (7.5YR 5/4), dark reddish-brown (5YR 3/4) and light brownish-gray (10YR 6/2) fine sandy loam; massive; friable, slightly hard; very strongly acid.

The profile is more than 62 inches thick. Depth to a horizon that has grayish mottles is 5 to 19 inches. The material between depths of 10 and 40 inches is fine sandy loam or loam and ranges from 12 to 18 percent clay. The A horizon ranges from 4 to 11 inches in thickness, is brown, dark brown, or grayish brown, and is strongly acid to slightly acid. The B2 horizon is brown or yellowish brown and has few to many mottles in shades of gray, brown, yellow, and red. The B horizon ranges from very strongly acid to medium acid.

Thenas soils mapped in Panola County are slightly more acid in the lower part of the profile than is defined as within the range for the Thenas series. Use and behavior are similar.

Thenas fine sandy loam (TN).—This soil is on bottom lands along small creeks. Areas of this soil are long and narrow and average 100 to 300 acres in size. Slopes are 0 to 1 percent. This soil is flooded every 3 to 4 years, and flooding generally lasts 2 or 3 days.

Included with this soil in mapping were areas of the wetter Nahatche and Mantachie soils in old stream channels. Also included in some areas are small concave areas of Marietta soils. These included soils make up less than 10 percent of the mapped areas.

Most areas of this soil are used for pine and hardwoods. Bahiagrass, common bermudagrass, and Coastal bermudagrass, planted in combination with clover, are used in most improved pastures. Some areas are used for crops. Corn is the major crop. Seasonal wetness limits use. Fertilizer is needed. Crop residue needs to be managed on or near the surface to help to maintain tilth. Capability unit IIw–2; woodland suitability group 1w8; Loamy Bottomland grazing group.

Troup Series

The Troup series consists of gently sloping to moderately steep soils in broad areas on uplands. These soils formed in the Carrizo Sand.

In a representative profile the surface layer is loamy fine sand about 53 inches thick. It is dark brown to a depth of about 5 inches; brown and mottled with pale brown to a depth of about 14 inches; pale brown and mottled with light yellowish brown to a depth of 44 inches; and light yellowish brown and mottled with strong brown to a depth of about 53 inches. The next layer is strong-brown sandy clay loam that is mottled with red and pale brown between depths of 53 and 67 inches. Below this it is yellowish-red sandy clay loam that is mottled with pale brown and extends to a depth of about 80 inches.

These soils are moderately rapidly permeable and well drained. They have low available water capacity.

Representative profile of Troup loamy fine sand, 1 to 8 percent slopes, north of Beckville, about 3.7 miles north of intersection of Farm Road 124 and Farm Road 959, 200 feet east of road:

A1—0 to 5 inches, dark-brown (10YR 4/3) loamy fine sand; weak, medium, subangular blocky structure; very friable, soft; slightly acid; gradual, smooth boundary.

A21—5 to 14 inches, brown (10YR 5/3) loamy fine sand; common, medium, faint, pale-brown (10YR 6/3) mottles; single grained; soft, loose; slightly acid; gradual, smooth boundary.

A22—14 to 44 inches, pale-brown (10YR 6/3) and light yellowish-brown (10YR 6/4) loamy fine sand; single grained; soft, loose; medium acid; gradual, smooth boundary.

A3—44 to 53 inches, light yellowish-brown (10YR 6/4) loamy fine sand; few, fine, faint, mottles of strong brown (7.5YR 5/6); single grained; soft, loose; strongly acid; clear, smooth boundary.

B21t—53 to 67 inches, strong-brown (7.5YR 5/6) sandy clay loam; common, medium, distinct mottles of red (2.5YR 4/8) and common, medium, faint mottles of pale brown (10YR 6/3); weak, medium, subangular blocky structure; about 2 to 3 percent plinthite; common, thin, reddish clay films; slightly hard, friable; very strongly acid; clear, wavy boundary.

B22t—67 to 80 inches, yellowish-red (5YR 5/8) sandy clay loam; common, medium, distinct mottles of pale brown (10YR 6/3); weak, medium, subangular blocky structure; friable, slightly hard; very strongly acid.

The solum ranges from 80 inches to more than 100 inches in thickness. The lower part of the solum is very strongly acid or strongly acid. The A horizon ranges from 40 to 72 inches in thickness and is very strongly acid to slightly acid. The A1 horizon is pale brown, very dark grayish brown, brown, or dark brown. The lower part of the A horizon is pale brown, brown, yellowish brown, or light yellowish brown and has few to many mottles of red, brown, yellow, and gray. The Bt horizon ranges from yellowish red to strong brown, has common to many mottles of yellow, brown, red, and gray, and is 15 to 25 percent clay. The C horizon is reddish, partially weathered sandstone.

Troup loamy fine sand, 1 to 8 percent slopes (TRD).—This soil is in areas about 45 acres in size. Because of the slow surface runoff, it has few drainageways. This soil has the profile described as representative of the series (fig. 11).

Included with this soil in mapping were areas of Fuquay and Lucy soils on convex knobs or ridges. These included soils make up less than 15 percent of the mapped areas.

Most areas of this soil were cultivated at one time but are now in improved pasture or have been planted to trees. Lovegrass and Coastal bermudagrass are used in most improved pastures. Watermelons are the main field crop grown on this soil. High-residue crops and applications of fertilizer are needed to help maintain tilth. Capability unit IIIs–1; woodland suitability group 3s3; Sandy woodland grazing group.

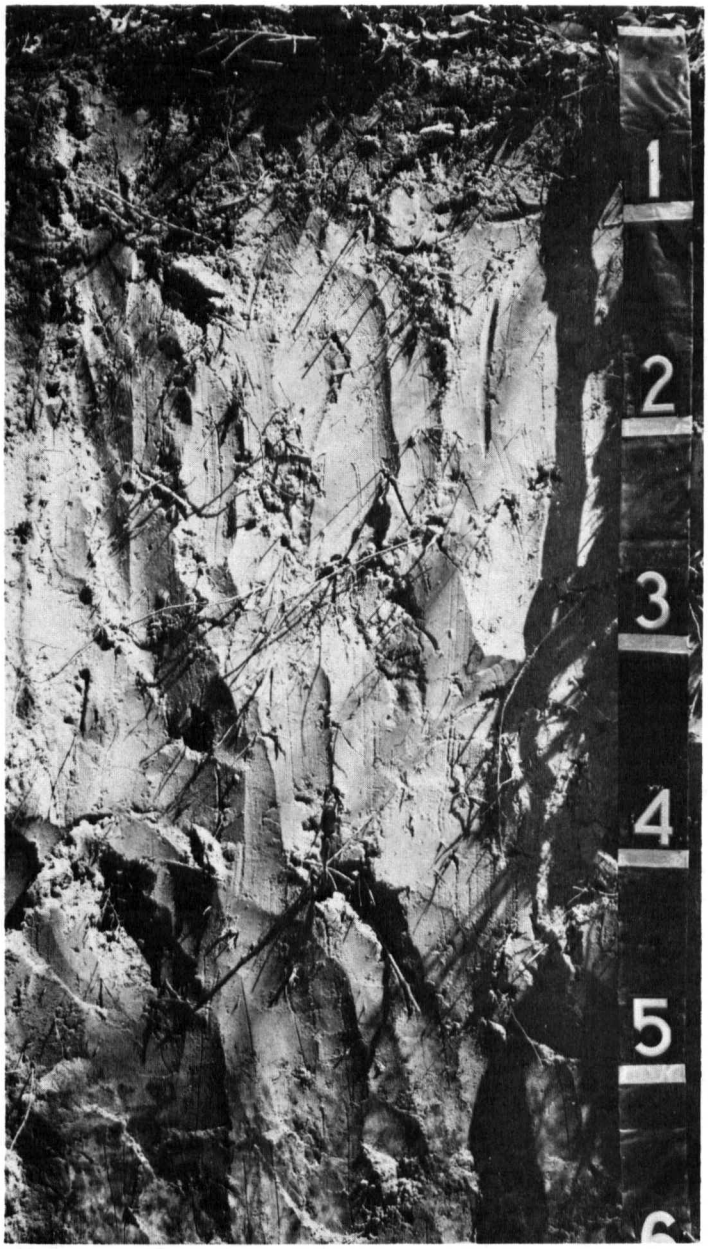

Figure 11.—**Profile of Troup loamy fine sand, 1 to 8 percent slopes. Roots extend into the layer that starts at a depth of about 53 inches.**

Troup loamy fine sand, 8 to 20 percent slopes (TRF).—This soil is in areas parallel to drainageways. The areas are long and narrow and are about 50 acres in size. Runoff is slow. The lower part of most slopes have springs that flow continuously.

This soil has a surface layer about 50 inches thick. The upper part is dark brown, and the lower part is light brown. The next layer is strong-brown sandy clay loam that extends to a depth of about 65 inches.

Included with this soil in mapping were areas of Tenaha soils on ridges. Also included were areas of a slightly wet sandy soil on the lower part of slopes. All of these included soils make up less than 20 percent of the mapped areas.

Most areas of this soil are in pine and hardwood forest. A few areas are in improved pastures of lovegrass or Coastal bermudagrass. Fertilizer is needed. This soil is not suited to cultivation. Capability unit VIe–3; woodland suitability group 3s3; Sandy woodland grazing group.

Urbo Series

The Urbo series consists of nearly level soils on bottom lands of wide flood plains. These soils formed in recent alluvial sediment.

In a representative profile the surface layer is very dark grayish-brown clay about 4 inches thick. The next layer is clay that extends to a depth of about 60 inches. It is grayish-brown and is mottled with strong brown in the upper 6 inches, and it is light brownish gray and is mottled with strong brown in the lower 50 inches.

These soils are very slowly permeable and are somewhat poorly drained. They have high available water capacity. A seasonal high water table fluctuates between the surface and a depth of 20 inches during wet seasons.

Representative profile of Urbo clay in an area of Urbo-Mantachie association, 11 miles north of Carthage on U.S. Highway 59, 5 miles southeast on private road:

A1—0 to 4 inches, very dark grayish-brown (10YR 3/2) clay; moderate, fine, granular structure; friable; many roots; strongly acid; clear, smooth boundary.

B21—4 to 10 inches, grayish-brown (10YR 5/2) clay; 30 percent fine distinct mottles of strong brown (7.5YR 5/6) and 20 percent fine distinct mottles of yellowish brown (10YR 5/6); moderate, fine, subangular blocky structure; hard, firm to friable; many roots; strongly acid; diffuse, smooth boundary.

B22g—10 to 26 inches, light brownish-gray (10YR 6/2) clay; 35 percent medium distinct mottles of strong brown (7.5YR 5/6); moderate, fine, subangular blocky structure; very hard, very firm; sticky and plastic; few roots; strongly acid; diffuse, smooth boundary.

B23g—26 to 60 inches, light brownish-gray (10YR 6/2) clay; 20 percent coarse distinct mottles of strong brown (7.5YR 5/6); moderate, fine, medium, subangular blocky structure; very hard, very firm; sticky and plastic; few roots; strongly acid.

The profile is more than 60 inches thick. It is 40 to 55 percent clay between depths of 10 and 40 inches. The A horizon ranges from 4 to 12 inches in thickness. It ranges from dark grayish brown to dark gray or very dark grayish brown when moist. The A horizon is very strongly acid or strongly acid. The B21 horizon ranges from dark grayish brown to gray and has 20 to 50 percent mottles of strong brown and yellowish red. The lower part of the B2 horizon is light brownish gray, gray, or grayish brown, and it has mottles of gray, yellow, or brown that make up 5 to 35 percent of the matrix. The B2 horizon is very strongly acid or strongly acid.

Urbo-Mantachie association (UMX).—This association is mapped as one large area on bottom lands of the Sabine River. Urbo clay makes up about 50 percent of the area in this association and is in broad flats; Mantachie clay loam makes up about 20 percent of the area and is on slight ridges or on alluvial fans; and other soils make up about 30 percent of the area. These soils occur in a regular pattern and could be separated in mapping; however, their use and management are similar, and therefore separate mapping is not justified.

Urbo soils have the profile described as representative of the Urbo series.

Mantachie soils have a surface layer of dark grayish-brown clay loam about 6 inches thick. The next layer extends to a depth of about 60 inches. The upper part is light-gray clay that is mottled in shades of yellow and brown and extends to a depth of about 19 inches. The lower part is light brownish-gray clay loam that is mottled with strong brown.

Included with this association in mapping were areas of a soil that is as clayey as Urbo soils but is slightly acid; areas of old wet sloughs; and other low wet areas. Also included were areas of Thenas soils that are on long, slightly higher ridges, and some areas of soils that have slopes of as much as 2 percent.

The soils in this association are flooded every year. Flooding generally lasts from 2 to 14 days.

Most of this association is used for hardwood timber. Pine trees grow only on the Thenas soils on the isolated, more sandy ridges. A few scattered areas have been cleared but have since reverted to forest. Very few areas are used for pasture. Bahiagrass and dallisgrass are the main grasses grown. This soil is not suited to cultivation. Both soils in capability unit VIw–1 and woodland suitability group 1w9; Urbo soils in Clayey Bottomland woodland grazing group, and Mantachie soils in Loamy Bottomland woodland grazing group.

Verdun Series

The Verdun series consists of saline soils on low wet terraces of the Sabine River. These soils formed in old alluvial sediment. Slopes are 0 to 1 percent.

In a representative profile the surface layer is grayish-brown very fine sandy loam that is mottled with brown and is about 5 inches thick. The subsurface layer is light brownish-gray and brown loam about 24 inches thick. This layer has brown mottles in the upper 11 inches. The subsoil is clay loam that extends to a depth of about 57 inches. It is yellowish brown and is mottled with shades of brown, gray, and red to a depth of about 43 inches, and it is light brownish gray and is mottled with shades of gray, red, yellow, and brown to a depth of 57 inches. The underlying material is stratified sand, sandy clay loam, and sandy loam that extends to a depth of about 76 inches.

These soils are very slowly permeable and poorly drained. They have moderate available water capacity. A seasonal high water table fluctuates between depths of 15 and 30 inches during wet seasons.

Representative profile of Verdun very fine sandy loam in an area of the Verdun-Cart complex, about 13.5 miles north of Carthage on U. S. Highway 59, or 0.7 mile north of intersection of Farm Road 1186 and U. S. Highway 59, 0.2 mile southwest on oiled county road, 0.3 mile north, 0.2 mile west, 100 feet west of road:

A1—0 to 5 inches, grayish-brown (10YR 5/2) very fine sandy loam; common, medium, brown (7.5YR 4/4) mottles; weak, medium; granular structure; friable; many roots; very strongly acid, gradual, smooth boundary.

A2—5 to 16 inches, mottled, light brownish-gray (10YR 6/2) and brown (7.5YR 4/4) loam; weak, medium, subangular blocky structure; friable; many roots; very strongly acid; gradual, smooth boundary.

A2&Bt—16 to 29 inches, light brownish-gray (10YR 6/2) loam; strong, fine, platy structure; slightly brittle in lower part, friable above; few roots; fragments (balls or biscuits) of the Bt horizon make up 20 to 30 percent of this horizon, gray coatings are on the fragments of Bt horizon; mildly alkaline.

B21t—29 to 43 inches, coarsely mottled, yellowish-brown (10YR 5/4 and 5/8) clay loam that has mottles of light brownish gray (10YR 6/2) and red (2.5YR 4/8) in ped interiors; coarse, weak, prismatic structure parting to moderate, fine, blocky; very firm; tongues from horizon above have prisms coated with light brownish-gray loam; thick patchy clay films on blocky peds; few iron and manganese concretions; few masses of salt crystals; moderately alkaline; diffuse boundary.

B22t—43 to 57 inches, coarsely mottled, light brownish-gray (10YR 7/2) and yellowish-brown clay loam; (10YR 5/6) few, fine, red mottles within peds; patches of dark grayish-brown (10YR 4/2) clay films on peds; moderate, medium and coarse, blocky structure; very firm; few fine roots on ped faces; few fine iron and manganese concretions; few masses of salt crystals; moderately alkaline; diffuse boundary.

B3&C—57 to 76 inches, stratified sand, sandy clay loam, and sandy loam.

The A horizon ranges from slightly acid to very strongly acid. The A1 horizon ranges from grayish brown to very dark grayish brown. The A2 horizon ranges from light brownish-gray to gray loam to sandy loam. The Bt horizon is light brownish-gray, grayish-brown, and gray loam to clay loam that has few to common red, brown, or yellow mottles. The upper part of the Bt horizon is moderately alkaline to neutral. The lower part of the Bt horizon and the C horizon are moderately alkaline or mildly alkaline. Vertical tongues of silt loam A2 material, 1 to 3 inches wide and 1 or 2 units higher in value than the Bt horizon, extend into the lower part of the Bt horizon. A few accumulations of gray to very dark gray clay generally occur as discontinuous, varvelike, horizontal bands within tongues of material from the A2 horizon or as coatings on the tops and sides of columns and prisms or in pores. The biscuit-shaped caps on the tops of columns are weakly expressed or are absent.

Verdun-Cart complex (VC).—This complex consists of soils on a low moundy terrace of the Sabine River. Verdun soils make up 45 to 65 percent of the complex, Cart soils 35 to 55 percent, and other soils less than 15 percent. These soils are so intricately intermingled that they cannot be separated at the scale mapped. Verdun soils are on low wet flats that are sinuous and connected and are 50 to 500 feet wide. They have slopes of 0 to 1 percent. Cart soils are mostly on round mounds that are 120 to 300 feet wide and 2.3 to 5.5 feet high. They have slopes of 0 to 3 percent.

Verdun soils have the profile described as representative for the Verdun series. Low areas of Verdun soils are covered with water once every 1 to 5 years, generally for a period of 4 to 12 weeks. Most areas of these soils are flooded during winter by slow-moving water, but damage to the soils and to plants is insignificant.

Cart soils have a surface layer of brown fine sandy loam about 4 inches thick. The subsurface layer is pale-brown fine sandy loam that extends to a depth of about 35 inches. The subsoil is strong-brown loam that extends to a depth of about 55 inches. Below this layer is yellowish-brown and gray, brittle loam that reaches a depth of 67 inches.

Included with this complex in mapping were areas of Erno soils on the lower parts of some mounds. Also included were areas of Wrightsville soils near Verdun soils in low-lying areas.

Runoff is slow on the Verdun soils and medium on the Cart soils.

Most areas of Verdun soils are used for hardwoods, and the Cart soils on mounds are used for pine trees and hardwoods. Some areas of the soils in this complex are used for improved pasture or for crops. Most of this complex is poorly suited to crops. Both soils in capability unit IVs–2; Verdun soils in woodland suitability group 5t0, and Cart soils in woodland suitability group 2o7; Verdun soils in Flatwood woodland grazing group, and Cart soils in Sandy Loam woodland grazing group.

Wrightsville Series

The Wrightsville series consists of nearly level soils in concave low areas on terraces. These soils formed in old alluvial material.

In a representative profile the surface layer is dark grayish-brown loam that is mottled with light brownish gray and is about 8 inches thick. The subsurface layer is light brownish-gray loam that is mottled with yellowish red and extends to a depth of about 16 inches. The subsoil is clay that extends to a depth of about 65 inches. It is light brownish gray and is mottled with red to a depth of about 33 inches, and it is grayish brown and is mottled with red betwen depths of 33 and 65 inches.

These soils are very slowly permeable and poorly drained. They have high available water capacity. A seasonal high water table fluctuates between the surface and a depth of about 15 inches during wet seasons.

Representative profile of Wrightsville loam, about 20 miles northeast of Carthage, about 1.1 miles south of De Berry on Farm Road 31, 0.8 mile east to church, 0.4 mile south, 150 feet east of road:

A1—0 to 8 inches, dark grayish-brown (10YR 4/2) loam, few, fine, distinct mottles of light brownish gray (10YR 6/2); weak, medium, granular structure; very friable, slightly hard; few fine roots; strongly acid; clear, wavy boundary.

A2g—8 to 16 inches, light brownish-gray (10YR 6/2) loam; common, medium, prominent mottles of yellowish red (5YR 4/8); massive, but porous; friable, slightly hard; few fine roots; many fine pores; very strongly acid; clear, wavy boundary.

B21tg—16 to 33 inches, ped interiors are light brownish-gray (10YR 6/2) clay that has common, medium, prominent mottles of red (2.5YR 4/8); tongues of light-gray (10YR 7/2) loam penetrate the entire horizon and are from ½ inch to 3 inches wide at the top; moderate, medium, blocky structure; firm, very hard; few clay films; ped faces have silt coatings; strongly acid; clear, wavy boundary.

B22tg—33 to 55 inches, ped interiors are grayish-brown (10YR 5/2) clay; many, medium, prominent, red (2.5YR 4/8) mottles; tongues of white (10YR 8/2) loam coat the ped faces; moderate, medium, subangular blocky structure; very firm, very hard; few clay films; very strongly acid; gradual, wavy boundary.

B23tg—55 to 65 inches, grayish-brown (10YR 5/2) clay; about 40 percent prominent red (2.5YR 4/8) mottles; weak, medium, subangular blocky structure; very firm, very hard; medium acid.

The solum ranges from 40 to 70 inches in thickness. The A horizon is 10 to 18 inches thick and is strongly acid or very strongly acid. The A1 horizon is very dark grayish brown, dark grayish brown, or light brownish gray. The A2 horizon is light brownish gray or light gray. The Bt and C horizons range from medium acid to very strongly acid. The upper 20 inches of the Bt horizon is 38 to 55 percent clay. The B21t horizon is light gray or light brownish gray and has faint to prominent mottles in shades or red, gray, brown, and yellow. This horizon has tongues of material from the A2 horizon that penetrate the entire horizon and are ⅛ inch to 4 inches wide at the top of the horizon. The lower part of the Bt horizon, below a depth of 33 inches, is grayish brown to gray and has 20 to 50 percent mottles of red, gray, brown, and yellow. Silt coatings occur on most ped faces. The C horizon is stratified sand, silt, and shale.

The Wrightsville soils that are mapped in a complex with the Cart soils are less acid than is defined as within the range for the Wrightsville series, but their use and behavior are similar.

Wrightsville loam (WR).—This concave to flat soil is on old stream terraces. These areas are somewhat rounded in shape and are about 20 acres in size. Slopes are 0 to 1 percent. Areas of this soil are flooded during the cool season once every 1 to 5 years, and flooding generally lasts 4 to 12 weeks. They are flooded by slow-moving water, so damage

Figure 12.—**Hardwoods in an area of Wrightsville loam.**

to the soil and to plants is insignificant. This soil has the profile described as representative of the series.

Included with this soil in mapping were areas of Mollville soils and of Sacul soils in slightly elevated positions. These included soils make up less than 5 percent of the mapped areas.

Runoff and internal drainage are very slow.

Most areas of this soil are in native hardwoods (fig. 12). A few areas are used for pasture, and bahiagrass and dallisgrass are the main grasses grown. This soil needs to be drained before improved pasture grasses can be established. It is not used for cultivation. Capability unit IVw–1; woodland suitability group 3w9; Flatwood woodland grazing group.

Wrightsville-Cart complex (WT).—This complex consists of soils in alternate low areas and moundy areas on terraces near most major streams. Wrightsville soils make up 40 to 70 percent of the complex, Cart soils 30 to 50 percent, and other soils less than 20 percent. The areas are about 100 acres in size. These soils are so intricately intermingled that they cannot be separated at the scale mapped. The areas of low Wrightsville soils are sinuous and vary in length, but they are generally 30 to 130 feet wide. These soils have slopes of 0 to 1 percent. The areas are covered with water once every 1 to 5 years, generally for a period of 4 to 10 weeks. They are flooded by slow-moving water during winter, but damage to the soils and to plants is insignificant. The areas of Cart soils are on generally rounded mounds 1½ to 5 feet high and 40 to 300 feet wide. These soils have slopes of 0 to 3 percent.

The Wrightsville soils have a surface layer of dark grayish-brown loam about 6 inches thick. The subsurface layer is light brownish-gray loam about 9 inches thick. The subsoil is clay that extends to a depth of 60 inches. It is light-gray in the upper 33 inches and grayish-brown in the lower 12 inches.

The Cart soils have a surface layer of fine sandy loam about 27 inches thick. It is brown in the upper 8 inches and light yellowish-brown in the lower 19 inches. The next layer is 18 inches of strong-brown loam. Below this is yellowish-brown, brittle loam that has mottles of gray and extends to a depth of 70 inches.

Included with this complex in mapping were areas of Erno soils on the lower one-fourth of the mounds. Also included are low areas of Mollville soils. All of these included areas make up less than 20 percent of this complex.

Areas of this soil complex are suited to distinctly different types of vegetation. Most areas of Wrightsville soils are suited to hardwoods, but the Cart soils are suited to pines. The Cart soils are suited to many types of improved grasses, but the Wrightsville soils are suited to water-loving plants. The Wrightsville soils need drainage before improved pasture or pine seedlings can be established. Common bermudagrass and Coastal bermudagrass grow well on the Cart soils. If the Wrightsville soils are drained, they are suited to dallisgrass and bahiagrass. Both soils in capability unit IVw–1; Wrightsville soils in woodland suitability group 3w9, and Cart soils in woodland suitability group 2o7; Wrightsville soils in Flatwood woodland grazing group, and Cart soils in Sandy Loam woodland grazing group.

Use and Management of the Soils

The soils in Panola County are mainly used for pasture, hay, and woodland. This section discusses the use and management of the soils, capability grouping, and predicted yields. It also discusses the use of the soils for crops, wildlife habitat, engineering, and recreation.

Crops[3]

Management of the soils of Panola County is needed mainly to (1) control water erosion, (2) maintain tilth, and (3) maintain fertility. The major practices used to accomplish these purposes are discussed in the following paragraphs.

Using crop residue.—Leaving a sufficient amount of residue on the soil helps to control water erosion and conserve moisture. Incorporating residue into the soil helps to improve tilth.

Farming on the contour.—Terracing and farming on the contour help to control water erosion. This is beneficial on soils that have slopes of more than 1 percent.

Using cover crops.—Cover crops furnish protective cover in the interval between the harvesting of crops and the planting of the next cultivated crops. Some cover crops suitable for most soils in the county are small grain, hairy vetch, and mixtures of annual grasses and legumes.

Maintaining fertility.—Crops grown on the soils in Panola County respond well to fertilizer. Where the proper amount of fertilizer is applied and proper management of the soils is used, fertility can be maintained. Information on soil testing and application of fertilizer can be obtained from local offices of the Soil Conservation Service or the Agricultural Extension Service.

Pasture and Hay

The raising of livestock is one of the main farm enterprises in Panola County, and because of this pasture and hay are important. The more important grasses grown are common bermudagrass, Coastal bermudagrass, bahiagrass, and weeping lovegrass.

Converting cropland to improved pasture or meadow is the trend in the county. An improved pasture or meadow is one in which grasses are introduced to obtain high production of forage.

Coastal bermudagrass is established by sprigging. Common bermudagrass can either be sprigged or seeded, but on clayey soils sprigging is more successful than seeding. Bahiagrass and weeping lovegrass are seeded.

Good management of pasture requires rotational grazing, weed control, fertilization, and other appropriate management practices. On well-managed soils used for hay, fertilizer is applied and the forage is cut when the grasses reach the correct height.

All of the soils in Panola County need fertilizer for high production of good quality forage, and most of the soils need lime. Many of the soils on bottom lands and in wet areas on uplands need to be drained before high production can be attained.

[3] By A. L. PACE, agronomist, Soil Conservation Service.

Capability Grouping

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

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

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

The broadest grouping is the capability class, designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. In class I are the soils that have the fewest limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products.

The subclass indicates major kinds of limitations within the classes. 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 the water in or near 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 stoney; and *c*, used in some parts of the United States but not in Panola 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 the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife habitat, or recreation.

Capability units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIs–1 or IIe–3. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraphs; and the Arabic numeral specifically identifies the capability unit within each subclass.

The eight classes in the capability system, the subclasses, and the units in Panola County are described in the list

that follows. The capability unit in which each soil has been placed is given in the Guide to Mapping Units.

Class I.—Soils that have few limitations that restrict their use (no subclasses). (None in Panola County.)
Class II.—Soils that have moderate limitations that reduce the choice of plants or require moderate conservation practices.
Subclass IIe.—Soils that are subject to moderate erosion unless protected.
Unit IIe–1.—Moderately well drained, gently sloping fine sandy loams that are moderately slowly permeable.
Subclass IIw.—Soils that are moderately limited because of excess water.
Unit IIw–1.—Somewhat poorly drained, nearly level to gently sloping loams that are moderately slowly permeable.
Unit IIw–2.—Moderately well drained, nearly level fine sandy loams that are moderately permeable.
Subclass IIs.—Soils that are moderately limited because of moderately slow permeability.
Units IIs–1.—Well-drained, nearly level fine sandy loams that are moderately slowly permeable.
Class III.—Soils that have severe limitations that reduce the choice of plants or require special conservation practices, or both.
Subclass IIIe.—Soils that are subject to severe erosion if they are cultivated and not protected.
Unit IIIe–1.—Well-drained, gently sloping to sloping loamy fine sands that are moderately permeable to slowly permeable.
Unit IIIe–2.—Well-drained, gently sloping to sloping fine sandy loams that are moderately permeable to moderately slowly permeable.
Unit IIIe–3.—Well-drained, gently sloping to sloping fine sandy loams that are moderately permeable to moderately slowly permeable.
Subclass IIIs.—Soils that are severly limited because of a droughty, sandy surface layer.
Unit IIIs–1.—Well-drained to somewhat excessively drained, nearly level to sloping loamy fine sands that are moderately rapidly permeable.
Class IV.—Soils that have very severe limitations that reduce the choice of plants or require very careful management, or both.
Subclass IVe.—Soils that are subject to very severe erosion if they are cultivated and not protected.
Unit IVe–1.—Moderately well-drained, gently sloping fine sandy loams that are slowly permeable.
Unit IVe–2.—Well-drained, gently sloping to sloping gravelly fine sandy loams that are moderately slowly permeable.
Subclass IVw.—Soils that are very severely limited because of excess water.
Unit IVw–1.—Well-drained, somewhat excessively drained to poorly drained, nearly level to gently sloping loams, fine sandy loams, and loamy fine sands that are very slowly permeable to moderately rapidly permeable.
Subclass IVs.—Soils that are very severely limited because of a thick, sandy surface layer or salinity.
Unit IVs–1.—Excessively drained, gently sloping to sloping fine sands that are rapidly permeable.
Unit IVs–2.—Well-drained to poorly drained, nearly level to gently sloping fine sandy loams and very fine sandy loams that are moderately slowly permeable to very slowly permeable.
Class V.—Soils that are subject to little or no erosion but have other limitations that are impractical to remove and limit their use largely to pasture or range, woodland, or wildlife habitat.
Subclass Vw.—Soils that are subject to flooding or are too wet for cultivation; drainage or protection is not feasible.
Unit Vw–1.—Moderately well drained to somewhat poorly drained, nearly level fine sandy loams, sandy clay loams, and clay loams that are moderately permeable.
Class VI.—Soils that have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife habitat.
Subclass VIe.—Soils that are severely limited, chiefly by risk of erosion, unless protective cover is maintained.
Units VIe–1.—Well drained to moderately well drained, sloping to moderately steep fine sandy loams that are moderately slowly permeable to slowly permeable.
VIe–2.—Well-drained, sloping to moderately steep loamy fine sands that are moderately permeable.
Unit VIe–3.—Well-drained, strongly sloping to moderately steep loamy fine sands that are moderately rapidly permeable.
Subclass VIw.—Soils that are subject to flooding or are severely limited by excess water and that generally are unsuitable for cultivation.
Unit VIw–1.—Somewhat poorly drained, nearly level clays and clay loams that are very slowly permeable to moderately permeable.
Class VII.—Soils that have severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife habitat. (None in Panola County.)
Class VIII.—Soils and landforms that have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife habitat, water supply, or esthetic purposes. (None in Panola County.)

Predicted Yields

Crop yield depends mainly on tilth, fertility, and the supply of moisture at the time of planting and during the growing season. In Panola County yields are commonly limited by low fertility. Consistent high yields on any soil indicate that good management practices have been applied, such as maintaining a high level of fertility, holding rainwater in the soil, controlling erosion, and using suitable cropping systems. Consistent low yields indicate that the soil has not been given protection against the loss of soil and water and that measures have not been taken to improve fertility and tilth.

Predicted yields of principal crops and pasture plants grown in the county on arable dryfarmed soils are given in table 2. These predicted yields cannot be expected every year, because they are estimated averages for a 15- to 20-year period. The yields will be higher some years and lower in others. The predicted yields given in table 2 are based on

TABLE 2.—*Predicted average yields per acre of principal dryfarmed crops on arable soils*

[Absence of yield figure indicates the crop is not suited to, or is not commonly grown on, the soil]

Soil series and map symbols	Cotton lint	Corn	Watermelons	Oats	Hay	Pasture
	Lbs	*Bu*	*Tons*	*Bu*	*Tons*	*AUM*[1]
Bienville: BE, BM	425	60	8	40	8	10
For Mollville part of BM, see Mollville series.						
Bowie: BO	450	65		60	8	10
Cart: CE	450	65		60	8	10
For Erno part, see Erno series.						
Erno	450	65		60	8	10
Mapped only in a complex with Cart soils.						
Fuquay: FU	375	55	8	40	7	9
Kirvin: KF, KP	375	55		40	6	7
Kullit: KU	375	60		50	5	8
Lakeland: LA	250	45	7	35	4	5
Lucy: LU	375	55	8	40	7	9
Luverne: LV					5	5
Mantachie: MN					5	9
Marietta: MR					6	9
Mollville						7
Mapped only in a complex with Bienville soils.						
Nahatche: NC					6	9
Ruston: RF	450	65		60	8	10
Sacul:						
SAC	350	50		40	5	7
SAF					4	5
Tenaha: TE					6	8
Thage: TH	375	60		50	5	8
Thenas: TN	500	70		60	8	10
Troup:						
TRD	300	50	8	35	6	7
TRF					5	7
Urbo: UMX					5	8
For Mantachie part, see Mantachie series.						
Verdun: VC						5
For Cart part, see Cart series.						
Wrightsville: WR, WT						6
For Cart part of WT, see Cart series.						

[1] An animal-unit-month, AUM, is a term used to express the carrying capacity of pasture. It is the number of animal units, 1,000 pounds of live weight, that can be grazed on an acre of pasture for a period of 30 days without permanently damaging the pasture.

records of experiment stations and on information gathered from farmers and others familiar with the soils of Panola County.

Woodland

Trees cover 60 percent of Panola County. There are good stands of marketable timber in the county. Needleleaf forest types most commonly are on the hills, and broadleaf types generally predominate on bottom lands along rivers and creeks.

The value of wood products is substantial, but it is below its potential. Other important values of the woodland in the county include grazing, wildlife habitat, recreation, natural beauty, and conservation of soil and water.

In this section the effects of the soils on tree growth and tree management in the county are explained and the potential and management of wooded areas for grazing are discussed. Potential productivity and the limitations and hazards to the management of the soils for woodland in Panola County are given in table 3.

Explanations for the columns in table 3 are given in the following paragraphs.

The woodland suitability group consists of three elements. The first element in the symbol is a numeral, 1 to 5, which indicates the woodland class. Classes are based on the relative productivity of the soils for trees. Class 1 soils are the most productive for trees, class 2 soils the next productive, and so on, until class 5 soils, which are the least productive.

The second element in the symbol is a letter, *w*, *t*, *c*, *s*, or *o*. The letters indicate the suitability subclass. Soil properties that cause moderate to severe hazards or limitations in woodland use or management determine the subclass.

Some kinds of soil may have more than one set of subclass characteristics. The priority for placing each kind of soil into a subclass follows the order in which the subclass characteristics are listed in the following paragraphs.

Subclass w (*excessive wetness*). Soils in which excessive water, either seasonally or all year, causes significant limitations for woodland use or management. These soils have restricted drainage, have a high water table, or are subject to overflow that adversely affects either forest development or management.

Subclass t (*toxic substances*). Soils that have excessive alkalinity, acidity, or toxic substances such as sodium salts

TABLE 3.—*Suitability of soils for woodland*

Soil series and map symbols	Woodland suitability group	Potential productivity		Management limitations and hazards			Trees suitable for planting
		Species	Site index	Erosion hazard	Equipment limitations	Seedling mortality	
			Ft				
Bienville: BE, BM—For Mollville part of BM, see Mollville series.	3s2	Loblolly pine Shortleaf pine	83 74	Slight	Moderate	Moderate	Loblolly pine, shortleaf pine, slash pine.
Bowie: BO	3o1	Loblolly pine Shortleaf pine	83 77	Slight	Slight	Slight	Loblolly pine, shortleaf pine, slash pine.
Cart: CE—For Erno part, see Erno series.	2o7	Loblolly pine Shortleaf pine, sweetgum, red oak	90 80	Slight	Slight	Slight	Loblolly pine, slash pine.
Erno—Mapped only in a complex with Cart soils.	2o7	Loblolly pine Shortleaf pine, sweetgum, red oak	90 80	Slight	Slight	Slight	Loblolly pine, slash pine, sweetgum.
Fuquay: FU	3s2	Loblolly pine Shortleaf pine	80 70	Slight	Moderate	Moderate	Loblolly pine, shortleaf pine, slash pine.
Kirvin: KF, KP	3o1	Loblolly pine Shortleaf pine	80 70	Slight	Slight	Slight	Loblolly pine, shortleaf pine.
Kullit: KU	2w8	Loblolly pine Shortleaf pine Sweetgum	90 85 90	Slight	Moderate	Slight	Loblolly pine, sweetgum.
Lakeland: LA	5s3	Shortleaf pine Loblolly pine	53 63	Slight	Moderate	Severe	Loblolly pine.
Lucy: LU	3s2	Loblolly pine Shortleaf pine Slash pine	80 70 80	Slight	Moderate	Moderate	Loblolly pine, shortleaf pine, slash pine.
Luverne: LV	3c2	Loblolly pine Slash pine	85 85	Moderate	Moderate	Slight	Loblolly pine, shortleaf pine, slash pine.
Mantachie: MN	1w9	Water oak Loblolly pine Sweetgum Green ash Loblolly pine	100 98 100 88 98	Slight	Severe	Moderate	Water oak, sweetgum.
Marietta: MR	1w8	Water oak Green ash Sweetgum Loblolly pine	100 90 95 98	Slight	Moderate	Moderate	Cottonwood, sweetgum, loblolly pine.
Mollville—Mapped only in a complex with Bienville soils.	3w9	Water oak, willow oak, green ash, sweetgum	80	Slight	Severe	Moderate	Water oak.
Nahatche: NC	1w6	Water oak Loblolly pine, willow oak, sweetgum	100 100	Slight	Severe	Moderate	Cottonwood, water oak.

TABLE 3.—*Suitability of soils for woodland*—Continued

Soil series and map symbols	Woodland suitability group	Potential productivity		Management limitations and hazards			Trees suitable for planting
		Species	Site index	Erosion hazard	Equipment limitations	Seedling mortality	
			Ft				
Ruston: RF	3o1	Loblolly pine	88	Slight	Slight	Slight	Loblolly pine.
		Shortleaf pine	75				
Sacul: SAC, SAF	3c2	Loblolly pine	80	Moderate	Slight	Moderate	Loblolly pine, shortleaf pine.
		Shortleaf pine	70				
Tenaha: TE	3s2	Loblolly pine	80	Slight	Moderate	Moderate	Slash pine, loblolly pine.
		Shortleaf pine	70				
Thage: TH	2w8	Loblolly pine	90	Slight	Moderate	Moderate	Loblolly pine, sweetgum.
		Shortleaf pine, sweetgum	85				
Thenas: TN	1w8	Loblolly pine	110	Slight	Moderate	Moderate	Loblolly pine, sycamore, slash pine, red oak, cottonwood, sweetgum, black walnut.
		Sweetgum	100				
		Blackgum, red oak, white oak, water oak	90				
Troup: TRD, TRF	3s3	Loblolly pine	80	Slight	Moderate	Severe	Loblolly pine, shortleaf pine, slash pine.
		Shortleaf pine	70				
		Slash pine	80				
Urbo: UMX	1w9	Water oak	100	Slight	Severe	Moderate	Water oak, sweetgum, sycamore.
For Mantachie part, see Mantachie series.		Green ash	93				
		Sweetgum	98				
Verdun: VC	5t0	Loblolly pine, shortleaf pine	60	Slight	Moderate	Severe.	
For Cart part, see Cart series.							
Wrightsville: WR, WT	3w9	Loblolly pine	80	Slight	Severe	Moderate	Loblolly pine, water oak, willow oak.
For Cart part of WT, see Cart series.		Sweetgum	80				
		Water oak	80				

within the rooting zone. These substances limit or impede development of desirable tree species.

Subclass c (*clayey soils*). Soils that have restrictions or limitations for woodland use and management because of the kind or amount of clay in the upper part of the soil profile.

Subclass s (*sandy soils*). Sandy soils that have thick sandy surface layers and have moderate to severe restrictions or limitations for woodland use or management. These soils have equipment limitations, have low available water capacity, and are normally low in available plant nutrients.

Subclass o (*slight or no limitations*). Soils that have no significant restrictions or limitations for woodland use or management.

The third element in the symbol is a numeral 1 to 9 or 0. This numeral indicates the degree of hazard or limitation and the general suitability of the soils for certain species of trees. The three management limitations and hazards considered are erosion, equipment limitations, and seedling mortality.

The *numeral 1* indicates soils that have few if any limitations for certain species of trees and are better suited to needleleaf trees than to other types of trees.

The *numeral 2* indicates soils that have one or more moderate limitations and are better suited to needleleaf trees than to other types of trees.

The *numeral 3* indicates soils that have one or more severe limitations and are better suited to needleleaf trees than to other types of trees.

The *numeral 4* indicates soils that have few if any limitations and are better suited to broadleaf trees than to other types of trees.

The *numeral 5* indicates soils that have one or more moderate limitations and are better suited to broadleaf trees than to other types of trees.

The *numeral 6* indicates soils that have one or more severe limitations and are better suited to broadleaf trees than to other types of trees.

The *numeral 7* indicates soils that have few if any limitations and are suited to either needleleaf or broadleaf trees.

The *numeral 8* indicates soils that have one or more moderate limitations and are suited to either needleleaf or broadleaf trees.

The *numeral 9* indicates soils that have one or more severe limitations and are suited to either needleleaf or broadleaf trees.

The *numeral 0* indicates the soils that are not suited to any type of tree that produces wood products of important commercial value.

The column "Potential productivity" gives the important species that generally grow on the listed soils.

The column "Site index" indicates the average height trees of that species can reach in 50 years.

The column "Erosion hazard" gives the risk of soil loss in well-managed woodland. The erosion hazard is *slight* if expected soil loss is small; *moderate* if some measures to control erosion are needed during logging and construction; and *severe* if intensive treatment or special equipment and methods are needed to prevent excessive soil loss.

The column "Equipment limitations" indicates the degree of limitation to the use of equipment normally used in woodland management or harvesting. A rating of *slight* indicates that there is no limitation to the kind of equipment used or to the time of the year; *moderate* indicates a seasonal limitation or a need to modifiy methods of equipment operation; and *severe* indicates a need for specialized equipment or operations.

The column "Seedling mortality" indicates the proportion of planted seedlings expected to die, without considering plant competition. Normal rainfall, good planting stock, and proper planting are assumed. *Slight* indicates expected mortality is less than 25 percent; *moderate* indicates 25 to 50 percent loss; and *severe* indicates more than 50 percent percent loss of seedlings.

Woodland suitability groups

Management of soils for woodland can be planned more effectively if the soils are grouped according to those characteristics that affect the growth of trees and the management of forests. For this reason, the soils of Panola County have been placed in twelve woodland suitability groups. Each group consists of soils that have about the same suitability for wood crops, have about the same restrictions and limitations, require about the same management, and have about the same productivity.

WOODLAND SUITABILITY GROUP 1w6

The Nahatche complex is the only mapping unit in this group. These are somewhat poorly drained soils on bottom lands. These soils are subject to flooding for long periods nearly every year. They have a surface layer of sandy clay loam.

Permeability is moderate. Available water capacity is high.

Hardwoods and a few pine trees grow naturally on these soils.

Severe plant competition from unwanted trees, shrubs, and vines is caused by the high amount of moisture in the soil. If there is an opening in the canopy, weeding is required to permit normal growth of seedlings.

WOODLAND SUITABILITY GROUP 1w8

This group consists of deep, moderately well drained soils on bottom lands. These soils are subject to flooding, but this is not considered to be a hazard to the production of timber. These soils have a surface layer of fine sandy loam.

Permeability is moderate. Available water capacity is high.

Pine trees and hardwoods grow on these soils. About half of the forested areas are in formerly cultivated fields.

Plant competition is severe on these soils. If there is an opening in the canopy, unwanted trees, shrubs, and vines must be removed to permit normal growth of seedlings.

WOODLAND SUITABILITY GROUP 1w9

This group consists of deep, somewhat poorly drained soils on bottom lands. These soils are subject to flooding for long periods almost every year, and the areas are furrowed by old stream channels that remain ponded or wet most of the year. These soils have a surface layer of clay and clay loam.

Permeability is moderate to very slow. Available water capacity is high.

Hardwoods form 80 percent of the canopy, but a few pine trees grow on microhighs or on low mounds (fig. 13). Wetness and frequent flooding severely limit the natural reseeding of pine trees.

Plant competition is severe on these soils. Unwanted trees, shrubs, and vines must be removed to permit normal growth of seedlings.

Figure 13.—**Hardwoods in an area of the Urbo-Mantachie association.**

WOODLAND SUITABILITY GROUP 2w8

This group consists of deep, moderately well drained and somewhat poorly drained soils on uplands. These soils have a surface layer of loam and fine sandy loam.

Permeability is slow. Available water capacity is high.

Pine trees are dominant on these soils, but hardwoods also grow well.

Plant competition is severe. Shrubs and vines quickly overgrow any open areas, and weeding is necessary to permit normal growth of seedlings.

WOODLAND SUITABILITY GROUP 2o7

The Cart-Erno complex is the only mapping unit in this group. These well-drained soils occur on a moundy landscape. They have a surface layer of fine sandy loam.

Permeability is moderately slow. Available water capacity is high.

Pine trees are dominant on these soils, but hardwoods also grow well.

This complex is well suited to trees, but plant competition is severe. Vines and shrubs quickly overgrow any open areas, and weeding is necessary to permit normal growth of seedlings.

WOODLAND SUITABILITY GROUP 3w9

This group consists of deep, poorly drained soils. These soils have a surface layer of loam.

Permeability is slow to very slow. Available water capacity is high.

Hardwoods are dominant on these soils, but a few pine trees grow on microhighs.

Severe plant competition from unwanted trees and shrubs is caused by the high supply of moisture in the soil. If there is an opening in the canopy, weeding is necessary to release seedlings for normal growth.

WOODLAND SUITABILITY GROUP 3c2

This group consists of deep to moderately deep, well drained to moderately well drained soils on uplands. These soils have a surface layer of fine sandy loam.

Permeability is moderately slow to slow. Available water capacity is moderate to high.

Pine trees are dominant on these soils, but there are also a few scattered hardwoods.

Plant competition is moderate. Shredding reduces plant competition and allows seedlings to grow normally.

WOODLAND SUITABILITY GROUP 3s2

This group consists of deep, well-drained to somewhat excessively drained soils. The soils have a surface layer of loamy fine sand.

Permeability is slow to moderately rapid. Available water capacity is low to moderate.

Pine trees are dominant on these soils, but there are also a few hardwoods. Pine trees have been planted on many old fields (fig. 14).

Plant competition is moderate on these soils. Most old, idle fields are overrun with persimmon and sassafras thickets.

WOODLAND SUITABILITY GROUP 3s3

This group consists of deep, well-drained soils on uplands. These soils have a surface layer of loamy fine sand.

Permeability is moderately rapid. Available water capacity is low.

Pine trees are dominant on these soils, but there are also a few scattered hardwoods. Pine trees have been planted on many old fields. These areas are clean and have little understory.

Plant competition is moderate in old fields. These fields are overrun with persimmon and sassafras thickets that limit reseeding.

WOODLAND SUITABILITY GROUP 3o1

This group consists of deep, well-drained soils on uplands. These soils have a layer of fine sandy loam and gravelly fine sandy loam.

Permeability is moderate to moderately slow. Available water capacity is high.

Pine trees are dominant on these soils.

These soils are well suited to trees.

Figure 14.—**Well-managed pine timber in an area of Fuquay loamy fine sand, 1 to 8 percent slopes.**

WOODLAND SUITABILITY GROUP 5s3

Lakeland fine sand, 1 to 8 percent slopes, is the only soil in this group. This is a deep, excessively drained soil on uplands.

Permeability is rapid. Available water capacity is low.

Pine trees and hardwoods grow in most wooded areas of this soil.

Plant competition is moderate in old, idle fields. The fields are overrun with large thickets of persimmon and sassafras.

WOODLAND SUITABILITY GROUP 5t0

The Verdun part of the Verdun-Cart complex is the only soil in this group. This soil is deep and poorly drained and occurs in flat or concave areas. The soil has a surface layer of very fine sandy loam.

Permeability is very slow. Available water capacity is moderate.

Most areas of this soil are used for woodland. The Verdun soil, however, is not suited to production of commercial timber.

Woodland grazing groups[4]

Livestock farming is an important enterprise in Panola County. About 50,000 cattle grazed the county in 1969. The cattle consisted mainly of cows and calves for beef production.

The major source of forage for the cattle is improved pasture, but most farms and ranches have woodland areas that contribute significantly to the total forage consumed by livestock in the county. Woodland areas have an understory of grasses, sedges, forbs, and shrubs that are valuable for grazing. These plants are not managed. Their composition and production are largely determined by the kind of soil, soil moisture, overstory canopy, and grazing management. The areas can be grazed by livestock, big game animals, and other wildlife without significantly affecting the value of the forest for other uses. More than 330,000 acres of commercial forest in Panola County is grazed by domestic livestock.

Good production of forage for livestock in grazed wooded areas is mainly achieved by regulating the season of use and the intensity of grazing. There are several practices designed to help the land user achieve the highest level of forage production consistent with other land uses and conservation of the grazing land. These practices are briefly described in the following paragraphs.

Proper grazing is grazing the site at an intensity that maintains or improves the quantity and quality of desirable plants. This is generally interpreted to be grazing no more than one-half, by weight, of the annual growth of key forage plants in preferred grazing areas. This practice increases vigor and reproduction of these key forage plants, conserves soil and water, improves the condition of the vegetation, increases forage production, maintains natural beauty, and reduces the hazard of wildfire.

Deferred grazing consists of postponing grazing or resting the site from grazing for a prescribed period. This rest period promotes the growth of natural vegetation by increasing the vigor of forage and permitting desirable plants to seed. This practice provides feed reserves for fall and winter grazing, improves the appearance of lands that have inadequate cover, improves hydrologic conditions, and reduces soil loss.

Planned grazing system is a system in which two or more grazing units are rested from grazing in a planned sequence throughout the year or during the growing season of key forage plants. This practice is advantageous for the production of desirable forage plants as well as for trees.

Prescribed burning involves the use of controlled fire. This practice can be used to control undesirable vegetation; remove old, unpalatable, rough growth; improve palatability and quality of forage; and increase production.

Woodland pruning or harvesting is the practice of thinning the canopy. This practice allows more light to reach the understory, which improves the quantity and quality of forage.

Livestock management and husbandry practices are essential in the management of vegetation to achieve desirable grazing use and satisfactory animal performance. Use of the following practices should be considered for each grazing unit:

1. Adequate fences properly located.
2. Adequate firebreaks.
3. Ample water supplies, properly distributed.
4. Adequate salt and minerals, especially phosphorus.
5. Proper location of feeding boxes or troughs.
6. Protein supplements when forage plants are deficient.
7. Internal and external parasite control.
8. Vitamin A supplements during periods of insufficient green forage.

The soils of Panola County have been placed in seven woodland grazing groups. A woodland grazing group is a distinctive kind of woodland that differs from other kinds of woodland in the potential to produce native plants suitable for grazing and wildlife use. These groups are determined in accordance with the characteristics that affect the growth of understory vegetation. They assist land users in the evaluation of their wooded areas for secondary use, such as production of forage for livestock and wildlife.

The criteria for differentiating grazing groups are based on (1) significant differences in the kinds and proportions of understory plants in the climax plant community and (2) significant differences in the yield of understory vegetation in the climax plant community.

In evaluating the grazing potential of any forest soil, the percentage of canopy is significant. The plant production estimates in this section assume a canopy that shades about 36 to 55 percent of the ground at noon. If less ground is shaded, production is higher; and if more ground is shaded, production is lower.

CLAYEY BOTTOMLAND WOODLAND GRAZING GROUP

This group consists of clayey, somewhat poorly drained soils on bottom lands. Permeability is very slow. Available water capacity is high.

Woody understory plants are hawthorn, greenbrier, eastern hornbeam, supplejack, and peppervine. The main species grazed by cattle are sedges, Virginia wildrye, beaked panicum, switchgrass, longleaf uniola, switch cane, eastern gamagrass, and other plants.

The potential annual plant production, in air-dry weight, ranges from 1,000 pounds per acre in unfavorable years to 3,000 pounds per acre in favorable years. The average annual production is about 2,000 pounds.

[4] By DON PENDLETON, range conservationist, Soil Conservation Service.

DEEP SAND WOODLAND GRAZING GROUP

This group consists of deep, sandy, excessively drained soils on uplands. Permeability is rapid. Available water capacity is low.

Woody understory plants are sassafras, persimmon, American beautyberry, greenbrier, peppervine, and yaupon. The main species grazed by cattle are pinehill bluestem, sand lovegrass, low panicums, paspalums, and other plants.

The potential annual plant production, air-dry weight, is 500 pounds per acre in unfavorable years and 1,500 pounds per acre in favorable years. The average annual production is about 1,000 pounds.

FLATWOOD WOODLAND GRAZING GROUP

This group consists of loamy, poorly drained soils on terraces. Permeability is very slow to slow. A seasonal high water table is at or near the surface during most of the cool season.

Woody understory plants are hawthorn, sweet myrtle, and locust. Primary species grazed by cattle are switchgrass, sedges, Florida paspalum, indiangrass, purpletop, lespedezas, and other plants.

The potential annual plant production, air-dry weight, is 1,000 pounds per acre in unfavorable years and 3,000 pounds per acre in favorable years. The average annual production is about 2,500 pounds.

LOAMY BOTTOMLAND WOODLAND GRAZING GROUP

This group consists of loamy, somewhat poorly drained to moderately well drained soils on bottom lands. Permeability is moderate. Available water capacity is high.

Woody understory plants are hawthorn, supplejack, elm, locust, and greenbrier. The main species grazed by cattle are switchgrass, sedges, redtop panicum, longleaf uniola, purpletop, lespedeza, tickclover, and other plants.

The potential annual plant production, air-dry weight, is 1,000 pounds per acre in unfavorable years and 3,000 pounds per acre in favorable years. The average annual production is about 2,000 pounds.

SANDY WOODLAND GRAZING GROUP

This group consists of sandy, well-drained and somewhat excessively drained soils on uplands. Permeability is slow to moderately rapid. Available water capacity is low to moderate.

Woody understory plants are yaupon, hawthorn, eastern redcedar, sumac, sassafras, and American beautyberry. The main species grazed by cattle are longleaf uniola, purpletop, arrowfeather, three-awn, pinehill bluestem, low panicums and paspalums, lespedeza, tickclover, and other plants.

The potential annual plant production, air-dry weight, is 750 pounds per acre in unfavorable years and 2,500 pounds per acre in favorable years. The average annual production is about 1,600 pounds.

SANDY LOAM WOODLAND GRAZING GROUP

This group consists of loamy and gravelly loamy, well-drained to somewhat poorly drained soils. Permeability is moderate to moderately slow. Available water capacity is moderate to high.

Woody understory plants are American beautyberry, sumac, pricklyash, persimmon, dogwood, supplejack, greenbrier, and hawthorn. The main species grazed by cattle are pinehill bluestem, beaked panicum, switchgrass, indiangrass, purpletop, longleaf uniola, sedges, and other plants.

The potential annual plant production, air-dry weight, is 1,000 pounds per acre in unfavorable years and 3,000 pounds per acre in favorable years. The average annual production is about 2,000 pounds.

TIGHT SANDY LOAM WOODLAND GRAZING GROUP

This group consists of loamy, moderately well drained soils on uplands. Permeability is slow. Available water capacity is high.

Woody understory plants are sumac, winged elm, American beautyberry, post oak, persimmon, hickory, and dogwood. The main species grazed by cattle are pinehill bluestem, beaked panicum, purpletop, longleaf uniola, Florida paspalum, indiangrass, and other plants.

The potential annual plant production, air-dry weight, is 750 pounds per acre in unfavorable years and 2,000 pounds per acre in favorable years. The average annual production is about 1,500 pounds.

Wildlife

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

Table 4 rates soils of the area for the production of seven elements of wildlife habitat and for three groups, or kinds, of wildlife. The ratings of habitat elements mainly take into consideration the characteristics of the soils and closely related factors of the environment. They do not consider climate, present use of soils, or present distribution of wildlife and people. For this reason, selection of a site for development as a habitat for wildlife requires inspection at the site.

A rating of *well suited* (1) means that the particular element of wildlife habitat, and habitat generally, can be easily created, improved, and maintained. Few or no limitations affect soil management, and satisfactory results are expected when the soil is used for the prescribed purpose.

A rating of *suited* (2) means that the particular element of wildlife habitat, and habitat generally, can be created, improved, or maintained in most places. Moderate intensity of soil management and fairly frequent attention may be required for satisfactory results.

A rating of *poorly suited* (3) means that the particular element of wildlife habitat, and habitat generally, can be created, improved, or maintained in most places, but management is difficult and requires intensive effort. Limitations for the designated use are rather severe.

A rating of *unsuited* (4) means that the particular element of wildlife habitat, and habitat generally, is impossible or impractical to create, improve, or maintain. Limitations are very severe, and unsatisfactory results are to be expected.

The seven habitat elements rated in table 4 are described in the following paragraphs.

Grain and seed crops.—Annual grain-producing plants, such as corn, sorghum, millet, and soybeans.

Grasses and legumes.—Domestic grasses and legumes that are established by planting. Among the grasses are

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

[A rating of 1 means well suited; 2, suited; 3, poorly suited; and 4, unsuited]

Soil series and map symbols	Elements of wildlife habitat							Kinds of wildlife		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood trees, shrubs, and vines	Coniferous woody plants	Wetland food and cover plants	Shallow water developments	Open-land	Woodland	Wetland
Bienville: BE, BM For Mollville part of BM, see Mollville series.	2	2	2	3	2	4	4	2	3	4
Bowie: BO	1	1	1	1	3	3	4	1	1	3
Cart: CE For Erno part, see Erno series.	2	1	1	1	3	4	4	1	1	4
Erno Mapped only in a complex with Cart soils.	2	1	1	1	3	4	4	1	1	4
Fuquay: FU	2	1	1	3	3	4	4	1	3	4
Kirvin: KF, KP	1	1	1	1	3	4	4	1	1	4
Kullit: KU	1	1	1	1	3	3	4	1	1	3
Lakeland: LA	3	3	3	3	1	4	4	3	3	4
Lucy: LU	2	1	1	3	3	4	4	1	3	4
Luverne: LV	2	1	1	1	3	4	4	1	1	4
Mantachie: MN	4	3	3	1	1	1	4	3	1	2
Marietta: MR	3	2	2	1	2	3	3	2	1	3
Mollville Mapped only in a complex with Bienville soils.	4	3	3	1	1	1	4	3	1	3
Nahatche: NC	4	3	3	1	1	2	4	3	1	3
Ruston: RF	1	1	1	1	3	4	4	1	1	4
Sacul:										
SAC	1	1	1	1	3	3	4	1	1	3
SAF	2	1	1	1	3	4	4	1	1	4
Tenaha: TE	2	1	1	3	3	4	4	1	3	4
Thage: TH	2	2	1	1	3	2	2	1	2	2
Thenas: TN	3	2	2	1	2	3	3	2	1	3
Troup: TRD, TRF	2	2	1	3	3	4	4	2	3	4

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

Soil series and map symbols	Elements of wildlife habitat							Kinds of wildlife		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood trees, shrubs, and vines	Coniferous woody plants	Wetland food and cover plants	Shallow water developments	Open-land	Woodland	Wetland
Urbo: UMX For Mantachie part, see Mantachie series.	4	3	3	1	1	2	4	3	1	3
Verdun: VC For Cart part, see Cart series.	3	2	2	2	2	1	1	2	2	1
Wrightsville: WR, WT For Cart part of WT, see Cart series.	3	2	2	1	2	1	1	2	1	1

bahiagrass, ryegrass, and panicgrass; and among the legumes are annual lespedeza, shrub lespedeza, and clovers.

Wild herbaceous upland plants.—Native or introduced perennial grasses, forbs, and weeds that provide food and cover for upland wildlife. Beggarweed, perennial lespedeza, wild bean, pokeweed, and cheatgrass are typical examples. On native pasture, typical plants are bluestem, grama, perennial forbs, and legumes.

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

Coniferous woody plants.—Cone-bearing trees and shrubs that provide cover and frequently furnish food in the form of browse, seeds, or fruitlike cones. They commonly grow in their natural environment, but they may be planted and managed. Typical plants in this category are pine, cedar, and ornamental trees and shrubs.

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

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

The soils are rated in table 4 according to their suitability of habitat for open-land, wetland, and woodland wildlife. These ratings are related to ratings made for the elements of wildlife habitat. For example, soils rated unsuited for shallow water developments are rated unsuited for wetland wildlife.

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

Woodland wildlife are birds and mammals that normally live in wooded areas of hardwood trees, coniferous trees, and shrubs. Woodcock, thrush, wild turkey, vireos, deer, squirrels, and raccoons are typical examples of woodland wildlife.

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

Engineering Uses of the Soils[5]

This section provides information of special interest to those who use the soils as structural material or as foundations upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

[5] By HENRY J. KELLER, civil engineer, Soil Conservation Service.

TABLE 5.—*Estimated soil prop-*

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

Soil series and map symbols	Depth to—		Hydrologic group	Frequency and duration of flooding	Depth from surface	Classification	
	Seasonal high water table	Bedrock				USDA texture	Unified
	Inches	*Inches*			*Inches*		
*Bienville: BE, BM—For Mollville part of BM, see Mollville series.	48–84	>80	A	None.	0–36	Loamy fine sand	SM
					36–84	Loamy fine sand	SM, ML
Bowie: BO	>80	>80	B	None.	0–12	Fine sandy loam	SM, SM-SC
					12–42	Sandy clay loam	SC, CL
					42–78	Sandy clay loam	SC, CL
*Cart: CE—For Erno part, see Erno series.	36–48	>80	B	None.	0–23	Fine sandy loam	ML, CL-ML
					23–42	Loam	CL-ML, CL
					42–51	Loam	CL
					51–70	Sandy clay loam	CL
Erno—Mapped only in a complex with Cart soils.	36–48	>80	B	None.	0–13	Fine sandy loam	ML, CL-ML, CL
					13–30	Sandy clay loam	CL
					30–70	Sandy clay loam	CL
Fuquay: FU	>80	>80	B	None.	0–24	Loamy fine sand	SM, SP-SM
					24–32	Fine sandy loam	SM, SC, SM-SC
					32–84	Sandy clay loam	SC, CL, SM-SC, CL-ML, ML
Kirvin:							
KF	>80	40–60	C	None.	0–10	Fine sandy loam	SM
					10–42	Clay, clay loam	CH, MH, CL
					42–48	Sandy clay loam	CL, SC
					48–65	Soft sandstone that contains layers of shale.	
KP	>80	40–60	C	None.	0–14	Gravelly fine sandy loam.	SM
					14–46	Clay loam	ML, CL, MH, CH
					46–65	Soft sandstone that contains layers of shale.	
Kullit: KU	0–24	>80	B	None.	0–13	Fine sandy loam, loam.	SM, ML, SM-SC, CL-ML
					13–20	Clay loam	CL, ML
					20–65	Clay	CL, ML
Lakeland: LA	>80	>80	A	None.	0–86	Fine sand	SP-SM
Lucy: LU	>80	>80	A	None.	0–22	Loamy fine sand	SM
					22–60	Sandy clay loam	SC, SM, SM-SC
Luverne: LV	>80	21–40	C	None.	0–6	Fine sandy loam	SM
					6–33	Clay, clay loam	MH
					33–37	Sandy clay loam	ML, CL, SC
					37–70	Alternate layers of sandstone and shale.	
Mantachie: MN	0–20	>80	C	Very frequent; brief.	0–60	Clay loam, sandy clay loam.	ML, CL, CL-ML
Marietta: MR	20–30	>80	C	Very frequent; brief.	0–12	Fine sandy loam	CL, SC, ML, CL-ML, SM-SC
					12–62	Sandy clay loam	CL, SC

erties significant to engineering

mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to symbol < means less than; the symbol > means more than]

Classification—Continued	Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential
AASHO	No 4 (4.7 mm)	No 10 (2.0 mm)	No 40 (0.42 mm)	No 200 (0.074 mm)				
					In per hr	*In per in of soil*	*pH*	
A-2-4 A-4	100	95–100	65–85	25–50	2.0–6.3	0.08–0.11	5.6–6.5	Very low.
A-2-4	100	95–100	70–90	30–65	2.0–6.3	0.08–0.13	5.1–6.5	Very low.
A-2-4	100	98–100	95–100	25–35	2.0–6.3	0.10–0.15	5.1–6.5	Low.
A-6	90–100	90–100	85–100	40–55	0.63–2.0	0.15–0.20	4.5–6.0	Low.
A-6	80–95	75–95	70–95	40–55	0.20–0.63	0.15–0.20	4.5–5.5	Low.
A-4	100	95–100	90–100	51–65	2.0–6.3	0.10–0.15	5.1–6.5	Low.
A-4, A-6	95–100	95–100	90–100	55–70	0.63–2.0	0.15–0.18	5.1–6.0	Low.
A-4, A-6	100	100	90–100	60–75	0.20–0.63	0.15–0.18	5.1–6.0	Low.
A-6	100	100	90–100	60–75	0.20–0.63	0.10–0.15	5.1–6.0	Low.
A-4	100	95–100	90–100	51–65	2.0–6.3	0.10–0.15	4.5–6.5	Low.
A-6	100	98–100	90–100	60–75	0.63–2.0	0.10–0.15	4.5–6.5	Low.
A-6	100	100	90–100	70–80	0.20–0.63	0.10–0.15	4.5–6.5	Low.
A-2-4	100	100	50–75	5–35	6.3–20.0	0.07–0.09	5.6–6.5	Low.
A-2-4, A-4	100	100	60–70	30–40	2.0–6.3	0.13–0.15	4.5–6.0	Low.
A-6, A-4	100	100	80–90	36–55	0.06–0.20	0.14–0.16	4.5–5.0	Low.
A-4	90–100	85–95	80–90	36–50	2.0–6.3	0.10–0.15	5.1–6.0	Low.
A-7	95–100	90–100	85–99	51–75	0.20–0.63	0.10–0.15	4.5–5.5	Moderate.
A-7, A-6	100	100	95–100	40–60	0.63–2.0	0.10–0.15	4.5–5.5	Low.
A-2-4 A-4	90–100	50–80	45–70	30–45	2.0–6.3	0.10–0.14	5.1–6.0	Low.
A-7, A-6	90–100	70–95	65–85	51–65	0.20–0.63	0.10–0.14	4.5–5.5	Moderate.
A-2-4, A-4	100	100	90–100	30–60	0.2–6.3	0.09–0.13	5.1–6.5	Low.
A-6	100	100	85–100	51–75	0.20–0.63	0.12–0.15	4.5–5.5	Low.
A-7, A-6	100	100	90–100	75–95	0.20–0.63	0.14–0.18	4.5–5.5	Moderate.
A-3	100	100	70–80	5–10	6.3–20	0.02–0.05	6.1–7.3	Low.
A-2-4	100	95–100	85–90	15–30	6.3–20	0.08–0.12	5.6–6.5	Low.
A-4	100	95–100	85–95	36–45	0.63–2.0	0.12–0.14	4.5–6.0	Low.
A-2-4	95–100	95–100	95–100	25–35	0.63–2.0	0.12–0.16	4.5–7.3	Low.
A-7	95–100	90–95	85–90	75–80	0.20–0.63	0.14–0.17	4.5–5.5	Moderate.
A-6, A-7	95–100	95–100	95–100	40–60	0.20–0.63	0.10–0.15	4.5–5.5	Low.
A-4	100	100	85–95	55–75	0.63–2.0	0.14–0.18	4.5–6.0	Low.
A-4	100	100	75–95	45–60	0.63–2.0	0.14–0.18	5.1–7.3	Low.
A-6	100	100	85–95	45–60	0.63–2.0	0.12–0.14	4.5–6.5	Low.

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Hydrologic group	Frequency and duration of flooding	Depth from surface	Classification	
	Seasonal high water table	Bedrock				USDA texture	Unified
	Inches	*Inches*			*Inches*		
Mollville	>80	>80	D	Frequent; long.	0–11	Loam	CL, ML
Mapped only in a complex with the Bienville series.					11–42	Sandy clay loam	CL
					42–54	Clay loam, sandy clay loam.	CL
					54–65	Loamy fine sand	SM
Nahatche: NC	15–30	>80	C	Very frequent; brief.	0–11	Sandy clay loam	CL, ML
					11–33	Loam, fine sandy loam	CL
					33–60	Clay loam	CL, ML
Ruston: RF	>80	>80	B	None.	0–9	Fine sandy loam	SM, ML
					9–74	Sandy clay loam	SC, CL, ML
Sacul: SAC, SAF	>80	40–64	D	None.	0–7	Fine sandy loam	ML
					7–42	Clay	MH, CH
					42–52	Clay loam	CL, ML
					52–72	Weakly consolidated sandstone and shale.	
Tenaha: TE	>80	40–60	B	None.	0–32	Loamy fine sand	SM
					32–43	Sandy clay loam	SC, CL
					43–60	Weakly consolidated sandstone.	
Thage: TH	24–48	>80	C	None.	0–6	Loam	CL-ML, ML
					6–32	Loam	CL-ML, CL
					32–70	Loam, clay loam	CL, CL-ML
Thenas: TN	15–30	>80	C	Frequent; very brief.	0–62	Fine sandy loam	SM-SC, SM
Troup: TRD, TRF	>80	>80	A	None.	0–53	Loamy fine sand	SM
					53–80	Sandy clay loam	SC
*Urbo: UMX	0–20	>80	D	Very frequent; brief.	0–60	Clay	CL, CH, ML, MH
For Mantachie part, see Mantachie series.							
*Verdun: VC	15–30	>80	D	Frequent; long.	0–16	Very fine sandy loam, loam.	ML, CL-ML, CL
For Cart part, see Cart series.					16–29	Loam	CL
					29–57	Clay loam	CL
*Wrightsville: WR, WT	0–15	>80	D	Frequent; long.	0–16	Loam	ML, CL
For Cart part of WT, see Cart series.					16–65	Clay	MH, CH

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

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

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.

significant to engineering—Continued

Classification—Continued	Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential
AASHO	No 4 (4.7 mm)	No 10 (2.0 mm)	No 40 (0.42 mm)	No 200 (0.074 mm)				
					In per hr	*In per in of soil*	*pH*	
A–6	100	100	85–95	60–75	0.20–0.63	0.15–0.20	4.5–6.0	Low.
A–6, A–7	100	100	90–100	60–75	0.06–0.20	0.10–0.15	4.5–6.0	Moderate.
A–6, A–7	100	100	90–100	70–80	0.06–0.20	0.10–0.15	5.1–7.8	Moderate.
A–2–4	100	100	60–75	20–35	0.63–2.0	0.07–0.10	5.6–7.8	Low.
A–6, A–7	100	100	90–100	70–80	0.63–2.0	0.10–0.15	6.1–8.4	Moderate.
A–6	100	100	85–95	60–75	0.63–2.0	0.10–0.15	6.1–8.4	Low.
A–6, A–7	100	100	90–100	70–80	0.63–2.0	0.10–0.15	6.1–8.4	Moderate.
A–4, A–2–4	100	100	70–95	30–60	0.63–2.0	0.14–0.16	5.1–6.5	Low.
A–6	100	100	80–90	36–75	0.63–2.0	0.15–0.17	4.5–5.5	Low.
A–4	100	95–100	85–95	51–70	0.63–2.0	0.10–0.15	5.6–6.5	Low.
A–7–6	100	99–100	98–100	80–95	0.06–0.20	0.15–0.20	4.5–6.0	High.
A–6	100	100	95–100	80–95	0.20–0.63	0.15–0.20	4.5–5.5	Moderate.
A–2–4	100	100	70–85	15–30	6.3–20.0	0.05–0.10	5.1–6.5	Very low.
A–6	100	100	80–90	36–55	0.63–2.0	0.15–0.20	4.5–5.5	Low.
A–4	100	100	85–95	60–75	0.63–2.0	0.15–0.18	5.1–6.0	Low.
A–4, A–6	100	100	85–95	60–75	0.20–0.63	0.15–0.18	4.5–5.0	Low.
A–4, A–6	100	100	85–95	60–75	0.63–2.0	0.15–0.18	4.5–5.5	Low.
A–4	100	100	100	36–45	0.63–2.0	0.15–0.20	4.5–6.5	Low.
A–2–4	100	100	85–95	13–20	6.3–20.0	0.03–0.06	4.5–6.5	Low.
A–4	100	95–100	80–90	36–45	0.63–2.0	0.10–0.13	4.5–5.5	Low.
A–7–6, A–6	100	100	95–100	94–100	<0.06	0.19–0.21	4.5–5.5	High.
A–4	100	100	85–95	60–75	0.20–0.63	0.13–0.17	4.5–6.5	Low.
A–6	100	100	85–95	60–75	0.20–0.63	0.10–0.15	6.6–8.4	Low.
A–6	100	100	90–100	70–80	<0.06	0.05–0.10	6.6–8.4	Moderate.
A–6	100	95–100	95–100	90–100	0.20–0.63	0.18–0.22	4.5–5.5	Low.
A–7	100	100	95–100	90–100	<0.06	0.18–0.21	4.5–6.0	High.

5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

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

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 5 and 6, and it can also be used to make other useful maps. However, this information does not eliminate the need for further investigations at sites selected for engineering works, especially those works

TABLE 6.—*Interpretations of en-*

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

Soil series and map symbols	Suitability as source of—				Degree and kind of limitation for—		
	Road fill	Sand	Gravel	Topsoil	Septic tank absorption fields	Sewage lagoons	Shallow excavations
*Bienville: BE, BM. For Mollville part of BM, see Mollville series.	Good	Probable source.	Improbable source.	Poor: too sandy.	Moderate: wetness.	Severe: seepage.	Severe: too sandy.
Bowie: BO	Fair: Low load-supporting capacity.	Improbable source.	Improbable source.	Fair: thin surface layer.	Severe: restricted permeability.	Moderate: slope.	Slight
*Cart: CE. For the Erno part, see Erno series.	Fair: low load-supporting capacity.	Improbable source.	Improbable source.	Good	Severe: restricted permeability.	Severe: wetness.	Moderate: wetness.
Erno. Mapped only in a complex with the Cart series.	Fair: low load-supporting capacity.	Improbable source.	Improbable source.	Fair; thin surface layer.	Severe: restricted permeability; wetness.	Severe: wetness.	Moderate: wetness.
Fuquay: FU	Good	Probable source.	Improbable source.	Poor: too sandy.	Moderate: restricted permeability.	Severe: seepage.	Slight
Kirvin: KF, KP	Poor: low load-supporting capacity; expansive.	Improbable source.[2]	Improbable source.	Fair: thin surface layer.	Severe: restricted permeability.	Moderate: slope.	Moderate: too clayey.
Kullit: KU	Poor: low load-supporting capacity.	Improbable source.	Improbable source.	Fair: thin surface layer.	Severe: restricted permeability; wetness.	Severe: wetness.	Severe: wetness.
Lakeland: LA	Good	Probable source.	Improbable source.	Poor: too sandy.	Slight	Severe: seepage.	Severe: too sandy.
Lucy: LU	Good	Improbable source.	Improbable source.	Poor: too sandy.	Slight	Moderate: seepage.	Slight
Luverne: LV	Poor: low load-supporting capacity.	Improbable source.	Improbable source.	Poor: thin surface layer.	Severe: restricted permeability.	Severe: slope.	Moderate: too clayey; slope; bedrock at a depth of 21 to 40 inches.

See footnotes at end of table.

gineering properties of the soils

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

Degree and kind of limitation for—Continued							Corrosivity to—	
Dwellings	Sanitary landfill[1]	Local roads and streets	Light industry	Pond reservoir areas	Pond embankments	Excavated pond (aquifer fed)	Uncoated steel	Concrete
Slight	Severe: wetness; seepage.	Slight	Slight	Severe: seepage.	Moderate: susceptible to piping; erodible; seepage.	Severe: no aquifer.	Very low	Moderate.
Slight	Slight	Moderate: low load-supporting capacity.	Slight where slope is 1 to 4 percent. Moderate where slope is 4 to 8 percent.	Moderate: seepage	Slight	Severe: no aquifer.	Moderate	Moderate.
Slight	Severe: wetness.	Moderate: low load-supporting capacity.	Slight	Moderate: seepage.	Moderate: susceptible to piping; erodible.	Severe: no aquifer.	Low	Moderate.
Slight	Severe: wetness.	Moderate: low load-supporting capacity.	Slight	Moderate: seepage.	Moderate: susceptible to piping; erodible.	Severe: no aquifer.	High	Moderate.
Slight	Slight	Slight	Slight where slope is 0 to 4 percent. Moderate where slope is 4 to 8 percent.	Moderate: seepage.	Moderate: susceptible to piping; erodible.	Severe: no aquifer.	Low	High.
Moderate: expansive.	Moderate: too clayey.	Severe: low load-supporting capacity.	Moderate: expansive.	Moderate: seepage.	Moderate: susceptible to piping; erodible.	Severe: no aquifer.	High	Moderate.
Severe: wetness.	Severe: wetness.	Severe: low load-supporting capacity.	Severe: wetness.	Slight	Moderate: susceptible to piping; erodible.	Severe: no aquifer.	Moderate	High.
Slight	Severe: too sandy; seepage.	Slight	Slight where slope is 1 to 4 percent. Moderate where slope is 4 to 8 percent.	Severe: seepage.	Severe: seepage.	Severe: no aquifer.	Low	Low.
Slight	Slight	Slight	Slight	Moderate: seepage.	Moderate: seepage; susceptible to piping; erodible.	Severe: no aquifer.	Low	High.
Moderate: expansive; slope.	Severe: too clayey; bedrock at a depth of 21 to 40 inches.	Severe: low load-supporting capacity.	Severe: slope.	Severe: seepage in fractured sandstone.	Moderate: unstable slopes; susceptible to piping; erodible.	Severe: no aquifer.	Moderate	High.

TABLE 6.—*Interpretations of engineer-*

Soil series and map symbols	Suitability as source of—				Degree and kind of limitation for—		
	Road fill	Sand	Gravel	Topsoil	Septic tank absorption fields	Sewage lagoons	Shallow excavations
Mantachie: MN	Fair: low load-supporting capacity; wetness.	Improbable source.	Improbable source.	Poor: wetness.	Severe: wetness; flooding.	Severe: flooding.	Severe: wetness; flooding.
Marietta: MR	Fair: low load-supporting capacity.	Improbable source.	Improbable source.	Fair: thin surface layer.	Severe: flooding.	Severe: flooding.	Severe: wetness; flooding.
Mollville: Mapped only in a complex with the Bienville soils.	Poor: wetness.	Improbable source.	Improbable source.	Poor: wetness.	Severe: wetness; flooding.	Severe: flooding.	Severe: wetness; flooding.
Nahatche: NC	Fair: low load-supporting capacity; wetness.	Improbable source.	Improbable source.	Poor: wetness.	Severe: wetness; flooding.	Severe: flooding.	Severe: wetness; flooding.
Ruston: RF	Fair: low load-supporting capacity.	Improbable source.	Improbable source.	Fair: thin surface layer.	Slight	Moderate: seepage.	Slight
Sacul: SAC, SAF	Poor: low load-supporting capacity; expansive.	Improbable source.	Improbable source.	Poor: thin surface layer.	Severe: restricted permeability.	Moderate where slope is less than 7 percent. Severe where slope is more than 15 percent.	Severe: too clayey.
Tenaha: TE	Good	Improbable source.	Improbable source.	Poor: too sandy.	Moderate where slope is less than 15 percent. Severe where slope is more than 15 percent.	Severe: slope.	Moderate: slope.
Thage: TH	Fair: wetness; low load-supporting capacity.	Improbable source.	Improbable source.	Poor: wetness.	Severe: restricted permeability; wetness.	Severe: wetness.	Severe: wetness.
Thenas: TN	Good	Improbable source.	Improbable source.	Fair: wetness.	Severe: wetness; flooding.	Severe: flooding.	Severe: wetness; flooding.

See footnotes at end of table.

ing properties of the soils—Continued

Degree and kind of limitation for—Continued							Corrosivity to—	
Dwellings	Sanitary landfill[1]	Local roads and streets	Light industry	Pond reservoir areas	Pond embankments	Excavated pond (aquifer fed)	Uncoated steel	Concrete
Severe: flooding.	Severe: wetness; flooding.	Severe: flooding.	Severe: wetness; flooding.	Moderate: seepage.	Moderate: susceptible to piping; erodible.	Severe: deep to water table.	High	Moderate.
Severe: flooding.	Severe: wetness; flooding.	Severe: flooding.	Severe: flooding.	Moderate: seepage.	Moderate: susceptible to piping; erodible; compressibility.	Severe: deep to water table.	Moderate	Low.
Severe: wetness; flooding.	Severe: wetness; flooding.	Severe: wetness; flooding.	Severe: wetness; flooding.	Moderate: seepage.	Moderate: susceptible to piping; erodible.	Severe: deep to water table.	Very high	Moderate.
Severe: wetness; flooding.	Severe: wetness; flooding.	Severe: wetness; flooding.	Severe: wetness; flooding.	Moderate: seepage.	Moderate: susceptible to piping; erodible.	Severe: deep to water table.	High	Moderate.
Slight	Slight	Slight	Slight where slope is 1 to 4 percent. Moderate where slope is 4 to 8 percent.	Moderate: seepage.	Moderate: susceptible to piping; erodible.	Severe: no aquifer.	Low	Moderate.
Severe: expansive.	Severe: too clayey.	Severe: low load-supporting capacity; expansive.	Severe: expansive.	Slight	Moderate: unstable slopes; compressibility.	Severe: no aquifer.	High	Moderate.
Moderate: slope.	Moderate: bedrock at a depth of 40 to 60 inches.	Moderate: low load-supporting capacity; slope.	Severe: slope.	Moderate: seepage.	Severe: thickness of suitable material.	Severe: no aquifer.	Moderate	Moderate.
Moderate: wetness.	Severe: wetness.	Moderate: wetness; low load-supporting capacity.	Moderate wetness.	Moderate: seepage.	Moderate: susceptible to piping; erodible; unstable slope.	Severe: no aquifer.	High	High.
Severe: wetness; flooding.	Severe: wetness; flooding.	Severe: wetness; flooding.	Severe: wetness; flooding.	Moderate: seepage.	Moderate: susceptible to piping; erodible.	Severe: deep to water table.	Moderate	Moderate.

TABLE 6.—*Interpretations of engineer-*

Soil series and map symbols	Suitability as source of—				Degree and kind of limitation for—		
	Road fill	Sand	Gravel	Topsoil	Septic tank absorption fields	Sewage lagoons	Shallow excavations
Troup: TRD	Good	Probable source.	Improbable source.	Poor: too sandy.	Slight	Severe: seepage.	Severe: too sandy.
TRF	Good	Probable source.	Improbable source.	Poor: too sandy.	Moderate: slope.	Severe: seepage.	Severe: too sandy.
*Urbo: UMX For Mantachie part, see Mantachie series.	Poor: low load-supporting capacity; expansive.	Improbable source.	Improbable source.	Poor: too clayey.	Severe: flooding; restricted permeability.	Severe: flooding.	Severe: wetness; flooding; too clayey.
*Verdun: VC For Cart part, see Cart series.	Poor: low load-supporting capacity; wetness.	Improbable source.	Improbable source.	Poor: excessive salt; wetness.	Severe: restricted permeability; wetness.	Severe: wetness.	Severe: wetness.
*Wrightsville: WR, WT For Cart part of WT, see the Cart series.	Poor: low load-supporting capacity; expansive; wetness.	Improbable source.	Improbable source.	Poor: wetness.	Severe: restricted permeability; wetness.	Severe: wetness.	Severe: wetness; too clayey.

[1] Onsite studies of the underlying strata, water table, and hazards of aquifer pollution and drainage into ground water should be made for land fill deeper than 5 or 6 feet.

that involve heavy loads or that require excavations to depths greater than those shown in the tables. Inspection of sites, especially the small ones, is also needed, because many delineated areas of a given mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

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

Engineering soil classification systems

Two systems that are most commonly used in classifying samples of soils for engineering are the Unified system[6], used by SCS engineers, the Department of Defense, and others, and the AASHO system[7], adopted by the American Association of State Highway Officials.

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

The AASHO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system a soil is placed in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Group A-1 consists of gravelly soils of high shear strength, or the best soils for subgrade (foundation). At the other extreme, group A-7 consists of clay soils that have low strength when wet and are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A-7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. Additionally, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. Table 7 indicates the AASHO classification

[6] UNITED STATES DEPARTMENT OF DEFENSE. UNIFIED SOIL CLASSIFICATION SYSTEM FOR ROADS, AIRFIELDS, EMBANKMENTS, AND FOUNDATIONS. MIL-STD-619B, 30pp., illus. 1968.

[7] AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS. STANDARD SPECIFICATIONS FOR HIGHWAY MATERIALS AND METHODS OF SAMPLING AND TESTING. Ed 8, 2 v., illus. 1961.

ing properties of the soils—Continued

Degree and kind of limitation for—Continued							Corrosivity to—	
Dwellings	Sanitary landfill[1]	Local roads and streets	Light industry	Pond reservoir areas	Pond embankments	Excavated pond (aquifer fed)	Uncoated steel	Concrete
Slight	Moderate: too sandy.	Slight	Moderate: slope.	Severe: seepage.	Severe: seepage.	Severe: no aquifer.	Low	Moderate.
Moderate: slope.	Moderate: too sandy.	Moderate: slope.	Severe: slope.	Severe: seepage.	Severe: seepage.	Severe: no aquifer.	Low	Moderate.
Severe: wetness; flooding.	Severe: wetness; flooding; too clayey.	Severe: wetness; flooding.	Severe: flooding.	Slight	Moderate: compressibility: unstable slopes; susceptible to piping; erodible.	Severe: deep to water table.	High	Moderate.
Severe: wetness.	Severe: wetness.	Severe: low load-supporting capacity; wetness.	Severe: wetness.	Slight	Moderate: susceptible to piping; erodible.	Severe: no aquifer.	High	Low.
Severe: wetness; expansive.	Severe: wetness; too clayey.	Severe: low load-supporting capacity; expansive; wetness.	Severe: wetness; expansive.	Slight	Severe: compressability; unstable slopes.	Severe: no aquifer.	High	High.

[1] Some areas of KP are a source of gravel.

for tested soils. Table 5 indicates the estimated classification for all soils mapped in the survey area.

Estimated engineering properties

Table 5 gives estimates of several soil properties significant in engineering. These estimates are made for typical soil profiles, by layers that vary enough to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Explanations for some of the columns in table 5 are given in the following paragraphs.

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

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

Hydrologic soil groups indicate the potential runoff from rainfall. The soils are classified on the basis of water intake at the end of long storms after prior wetting and opportunity for swelling has occurred, and without the protective effects of vegetation.

There are four major hydrologic soil groups:

Group A consists of soils that have a high infiltration rate even when thoroughly wet. They are mainly deep, well-drained to excessively drained sands or gravels. These soils have a high rate of water transmission and a low runoff potential.

Group B consists of soils that have a moderate infiltration rate when thoroughly wet. They are mainly moderately deep to deep, moderately well drained to well drained soils that are moderately fine textured to moderately coarse textured. These soils have a moderate rate of water transmission.

Group C consists of soils that have a slow infiltration rate when thoroughly wet. Most of these soils have a layer that impedes the downward movement of water or are moderately fine textured to fine textured. These soils have a slow rate of water transmission.

Group D consists of soils that have a very slow infiltration rate when thoroughly wet. Most of these soils are (1) clay soils that have a high shrink-swell potential, (2) soils that have a permanent high water table, (3) soils that have a claypan or clay layer at or near the surface, and (4) soils that are shallow over nearly impenetrable material. These soils have a very slow rate of water transmission and high runoff potential.

TABLE 7.—*Engi-*

[Tests performed by Texas Highway Department, Materials

Soil name and location	Parent material	Texas report No.	Depth	Shrinkage			Mechanical analysis[1]	
							Percentage passing sieve—	
				Limit	Linear	Ratio	⅜-in.	No. 4 (4.7 mm)
			Inches					
Cart fine sandy loam:								
14 miles W. of Carthage on U.S. Highway 79, 2.3 miles S. on Farm Road 1798, 0.9 mile E. on dirt road, 400 feet S. on road. (Modal) Cart member of Cart-Erno complex.	Silty, wind-reworked sediment on terraces.	69–255–R	12–18	17	0.8	1.81	----------	100
		69–256–R	23–30	17	5.1	1.83	100	99
		69–257–R	51–70	18	7.6	1.81	----------	----------
Erno fine sandy loam:								
14 miles W. of Carthage on U.S. Highway 79, 2.3 miles S. on Farm Road 1798, 0.9 mile E. on dirt road, 400 feet S. of road. (Modal) Erno member of Cart-Erno complex.	Silty, wind-reworked sediment on terraces.	69–258–R	21–30	17	10.0	1.84	----------	100
		69–259–R	41–51	18	7.7	1.80	----------	----------
Sacul fine sandy loam:								
14.5 miles E. of Carthage, 2 miles E. of intersection of Farm Road 31 and Farm Road 2517, 50 feet E. of road. (Modal)	Stratified sand and shale.	69–253–R	24–42	15	19.0	1.89	----------	100
Urbo clay:								
11 miles N. of Carthage on U.S. Highway 59, 5 miles S.E. on private road. (Modal)	Alluvial clayey sediment.	69–261–R	10–26	15	15.8	1.89	----------	----------

[1] Mechanical analyses according to the AASHO Designation T 88-57 (see footnote 7, page 44). Results by this procedure may differ somewhat fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material including coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by pipette method and the material suitable for use in naming textural classes for soil.

Hazard of flooding is described in terms of the frequency of flood occurrence and the duration. *None* indicates no flooding; *very frequent*, more than once every year; and *frequent*, once in 5 years. A duration of *very brief* is 2 to 7 days; *brief*, 7 days to 1 month; *long*, 1 to 6 months; and *very long*, longer than 6 months.

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

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

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

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

Shrink-swell potential is the change in volume expected of the soil material when the moisture content changes; that is, the amount that the soil contracts when it is dry or expands when it is wet. The extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils causes much damage to build-

neering test data

and Testing Division, Camp Hubbard, Austin, Texas]

Mechanical analysis[1]—Continued							Liquid limit	Plasticity index	Classification[2]	
Percentage passing sieve—Continued				Percentage smaller than—						
No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 60 (0.25 mm)	No. 200 (0.074 mm)	0.05 mm	0.005 mm	0.002 mm			AASHO[3]	Unified[4]
99	99	96	52	38	9	6	17	2	A–4	ML
99	98	96	57	47	20	17	27	11	A–6	CL
----------	100	98	63	52	24	21	32	17	A–6	CL
99	97	95	65	58	31	27	37	18	A–6	CL
----------	100	99	74	63	28	23	33	17	A–6	CL
99	98	98	83	79	60	54	63	40	A–7–6	CH
----------	----------	100	99	95	62	53	52	30	A–7–6	CH

[2] Unified and AASHO classification made by SCS personnel.
[3] Based on AASHO Designation M 145–49 (see footnote 7, page 44).
[4] Based on Unified soil classification system (see footnote 6, page 44).

ing foundations, roads, and other structures. A high shrink-swell potential indicates a hazard to maintenance of structures built in, on, or of material having this rating.

Engineering interpretations

The estimated interpretations given in table 6 are based on the engineering properties of soils shown in table 5, test data for soils in this survey area and others nearby or adjoining, and the experience of engineers and soil scientists with the soils of Panola County. The ratings in table 6 are used to summarize the limitations or suitability of the soils for all listed purposes.

Soil limitations are indicated by ratings of slight, moderate, and severe. *Slight* indicates soil properties that are generally favorable for the rated use, or limitations that are minor and easily overcome. *Moderate* indicates soil properties that are unfavorable but can be overcome or modified by special planning and design. *Severe* indicates soil properties so unfavorable and so difficult to correct or overcome that they require major soil reclamation and special designs.

Soil suitability is indicated by ratings of *good*, *fair*, and *poor*, which have meanings approximately parallel to the soil limitation ratings of slight, moderate, and severe.

Some of the columns in table 6 are explained in the following paragraphs.

Road fill is soil material used in embankments for roads. The suitability ratings reflect (1) the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and (2) the relative ease of excavating the material at borrow areas.

Sand and gravel are used in great quantities in many kinds of construction. The ratings indicate where to look for probable sources. A soil rated as a probable source of sand or gravel generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do

not take into consideration thickness of overburden, location of the water table, or other factors that affect mining of the materials, nor do they indicate quality of the deposit.

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

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

Sewage lagoons are shallow ponds 2 to 5 feet deep that are constructed to hold sewage long enough for bacteria to decompose the solids. Sewage lagoons have nearly level floors and sides, or embankments, of compacted soil material. The assumption is made that the embankment is compacted to medium density and that the pond is protected from flooding. Properties are considered that affect the pond floor and the embankment. The properties that affect the pond floor are permeability, organic-matter content, and slope. If the floor needs to be leveled, depth to bedrock is important. The soil properties that effect the embankment are the engineering properties of the embankment material, as interpreted from the Unified classification, and the amount of stones, which influences the ease of excavation and compaction of the embankment material.

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

Dwellings, as rated in table 6, are not more than three stories high and are supported by foundation footings placed in undisturbed soil. The features that affect the rating of soils for dwellings are the capacity to support load and resist settlement under load and the ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

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

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

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

Ratings for light industry are for undisturbed soils that are used to support building foundations. Emphasis of the ratings is placed on foundations, ease of excavation for underground utilities, and corrosion potential of uncoated steel pipe. The undisturbed soil is rated for spread footing foundations for buildings less than three stories high or for foundation loads not in excess of that weight. Features affecting load-supporting capacity and settlement under load are wetness, flooding, texture, plasticity, density, and shrink-swell behavior. Features affecting excavation are wetness, flooding, slope, and depth to bedrock. Features affecting corrosion of buried uncoated steel pipe are wetness, texture, total acidity, and electrical resistivity.

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

Pond embankments are raised structures of soil material constructed across drainageways in order to impound water. These embankments are generally less than 20 feet high, constructed of homogeneous soil material, and compacted to medium density. Embankments that have core and shell construction are not rated in this table. Embankment foundation, reservoir area, and slope are assumed to be suitable for pond construction. Soil properties that affect the embankment and the availabilty of borrow material are considered. The best soils have good slope stability, low permeability, slight compressibility under load, and good resistance to piping and erosion. The best borrow material is free of stones or rocks and thick enough for easy excavation.

An aquifer-fed excavated pond is a body of water created by excavating a pit or dugout into a ground-water aquifer. Excluded are ponds fed by runoff and embankment-type ponds where the depth of water exceeds 3 feet. Assumptions are made that the pond is properly designed, located, and constructed, and that the water is of good quality. Properties affecting aquifer-fed ponds are the existence of a permanent water table, permeability of the aquifer, and properties that interfere with excavation, such as stoniness and rockiness.

Corrosivity pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete.

TABLE 8.—*Degree and kind of limitations affecting recreational development*

[An asterisk in the first column indicates at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column of this table]

Soil series and map symbols	Camp areas	Picnic areas	Playgrounds	Paths and trials
*Bienville: BE, BM For Mollville part of BM, see Mollville series.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Bowie: BO	Slight	Slight	Moderate: slope	Slight.
*Cart: CE For Erno part, see Erno series.	Moderate: restricted permeability.	Slight	Moderate: restricted permeability.	Slight.
Erno Mapped only in a complex with the Cart soils.	Moderate: restricted permeability.	Slight	Moderate: restricted permeability.	Slight.
Fuquay: FU	Moderate: too sandy.	Moderate: too sandy.	Severe: too sandy	Moderate: too sandy.
Kirvin: KF, KP	Moderate: restricted permeability.	Slight	Moderate: slope	Slight.
Kullit: KU	Moderate: wetness	Slight	Moderate: restricted permeability.	Slight.
Lakeland: LA	Severe: too sandy	Severe: too sandy	Severe: too sandy	Severe: too sandy.
Lucy: LU	Moderate: too sandy.	Moderate: too sandy.	Severe: too sandy	Moderate: too sandy.
Luverne: LV	Moderate: slope; restricted permeability.	Moderate: slope	Severe: slope	Slight.
Mantachie: MN	Severe: flooding; wetness.	Moderate: flooding; wetness.	Severe: flooding; wetness.	Moderate: flooding; wetness.
Marietta: MR	Severe: flooding	Moderate: flooding; wetness.	Severe: flooding	Moderate: flooding.
Mollville Mapped only in a complex with Bienville soils.	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness.
Nahatche: NC	Severe: flooding; wetness.	Moderate: flooding	Severe: flooding	Moderate: flooding; wetness.
Ruston: RF	Slight	Slight	Moderate: slope	Slight.
Sacul:				
SAC	Moderate: restricted permeability.	Slight	Moderate: slope	Slight.
SAF	Moderate where slopes are less than 15 percent: restricted permeability. Severe where slopes are 15 to 20 percent.	Moderate where slopes are less than 15 percent; severe where slopes are 15 to 20 percent.	Severe: slope	
Tenaha: TE	Moderate where slopes are 5 to 15 percent: too sandy. Severe where slopes are 15 to 20 percent.	Moderate where slopes are 5 to 15 percent: too sandy. Severe where slopes are 15 to 20 percent.	Severe: slope	Moderate: too sandy.
Thage: TH	Moderate: wetness; restricted permeability.	Moderate: wetness	Severe: wetness	Moderate: wetness.
Thenas: TN	Severe: flooding	Moderate: flooding	Moderate: flooding	Slight.

TABLE 8.—*Degree and kind of limitations affecting recreational development*—Continued

Soil series and map symbols	Camp areas	Picnic areas	Playgrounds	Paths and trails
Troup: TRD	Moderate: too sandy.	Moderate: too sandy.	Severe: too sandy	Moderate: too sandy.
TRF	Moderate: too sandy.	Moderate: too sandy.	Severe: too sandy	Moderate: too sandy.
*Urbo: UMX For Mantachie part, see Mantachie series.	Severe: flooding; too clayey.	Severe: too clayey	Severe: flooding; too clayey.	Severe: too clayey.
*Verdun: VC For Cart part, see Cart series.	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness.
*Wrightsville: WR, WT For Cart part of WT, see Cart series.	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness.

Rate of corrosion of uncoated steel is related to such soil properties as drainage, texture, total acidity, and electrical conductivity of the soil material. Corrosivity of concrete is influenced not only by the content of sodium or magnesium sulfate, but also by soil texture and acidity. Installations of uncoated steel that intersect soil boundaries or horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil horizon. A corrosivity rating of *low* means there is a low probability of soil-induced corrosion damage. A rating of *high* means there is a high probability of damage, and protective measures for steel and more resistant concrete should be used to avoid or minimize damage.

Engineering test data

Table 7 gives engineering test data for four of the major soils in Panola County. The tests were performed to help evaluate the soils for engineering purposes. The engineering classifications given are based on data obtained by mechanical analyses and by tests to determine liquid limits and plastic limits. The mechanical analyses were made by combined sieve and hydrometer methods.

Shrinkage limit is the percentage of moisture contained in the soil when shrinkage of the soil material stops.

Linear shrinkage is the decrease of the soil mass in one dimension when the moisture content is reduced from a given value to the shrinkage limit. This decrease is expressed as a percentage of the original dimension.

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

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

Recreation

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

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

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

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

Playgrounds are areas used intensively for baseball, football, badminton, and similar organized games. Soils suitable for these uses should withstand intensive foot traffic. The best soils have nearly level surface areas free of coarse fragments and rock outcrops; good drainage;

TABLE 9.—*Classification of soil series*

Series	Family	Subgroups	Order
Bienville	Sandy, siliceous, thermic	Psammentic Paleudalfs	Alfisols.
Bowie	Fine-loamy, siliceous, thermic	Plinthic Paleudults	Ultisols.
Cart	Coarse-loamy, siliceous, thermic	Typic Glossudalfs	Alfisols.
Erno	Fine-loamy, siliceous, thermic	Typic Fragiudalfs	Alfisols.
Fuquay	Loamy, siliceous, thermic	Arenic Plinthic Paleudults	Ultisols.
Kirvin	Clayey, mixed, thermic	Typic Hapludults	Ultisols.
Kullit	Fine-loamy, siliceous, thermic	Aquic Paleudults	Ultisols.
Lakeland	Siliceous, thermic, coated	Typic Quatrzipsamments	Entisols.
Lucy	Loamy, siliceous, thermic	Arenic Paleudults	Ultisols.
Luverne	Clayey, mixed, thermic	Typic Hapludults	Ultisols.
Mantachie	Fine-loamy, siliceous, acid, thermic	Aeric Fluvaquents	Entisols.
Marietta[1]	Fine-loamy, mixed, thermic	Fluvaquentic Eutrochrepts	Inceptisols.
Mollville	Fine-loamy, mixed, thermic	Aeric Glossaqualfs	Alfisols.
Nahatche	Fine-loamy, mixed, nonacid, thermic	Aeric Fluvaquents	Entisols.
Ruston	Fine-loamy, siliceous, thermic	Typic Paleudults	Ultisols.
Sacul	Clayey, mixed, thermic	Aquic Hapludults	Ultisols.
Tenaha	Loamy, siliceous, thermic	Arenic Hapludults	Ultisols.
Thage	Fine-loamy, siliceous, thermic	Aquic Fragiudalfs	Alfisols.
Thenas[2]	Coarse-loamy, mixed, thermic	Fluvaquentic Eutrochrepts	Inceptisols.
Troup	Loamy, siliceous, thermic	Grossarenic Paleudults	Ultisols.
Urbo	Fine, mixed, acid, thermic	Aeric Haplaquepts	Inceptisols.
Verdun	Fine-silty, mixed, thermic	Glossic Natraqualfs	Alfisols.
Wrightsville[3]	Fine, mixed, thermic	Typic Glossaqualfs	Alfisols.

[1] This soil is a taxadjunct to the Marietta series because it is slightly more acid in the lower part of the control section than is defined as within the range for the series. Use and behavior are similar.

[2] This soil is a taxadjunct to the Thenas series because the lower part of the profile is slightly more acid than is defined as within the range for the series. Use and behavior are similar.

[3] The Wrightsville part of the Wrightsville-Cart complex is a taxadjunct to the Wrightsville series because it is less acid than is defined as within the range for the series. Use and behavior are similar.

freedom from flooding during periods of heavy use; and a surface that is firm after rains but not dusty when dry. If grading and leveling are required, depth to bedrock is important.

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

Formation and Classification of the Soils

In this section, the effects of major factors of soil formation on the development of soils in Panola County are discussed and important processes in the differentiation of soil horizons are described. Also, the system of soil classification is explained, and each soil series represented in the county is placed in some of the categories of that system.

Factors of Soil Formation

Soil is the product of the five major factors that determine soil formation. These factors are climate; living organisms, especially plants; parent material; topography; and time. Variations of soil formation are determined by variations of the five factors, such as duration of the soil-forming activity or the kind of parent material.

Climate

The climate of Panola County is subtropical and permanently humid. Summers are hot. The humid climate has resulted in moderately rapid soil formation. Climate is uniform throughout the area, although its effect on the formation of soils is modified locally by runoff. Therefore, the differences in the soils of the survey area are probably not due to climate.

Living organisms

Plants, insects, animals, bacteria, and fungi are important in the formation of soils. Some of the effects of living organisms on soil formation are gains in organic matter and nitrogen, gains and losses in plant nutrients, and changes in structure and porosity.

Vegetation, dominantly trees, has affected soil formation in the survey area more than living organisms. Soils that form under trees are generally low in organic-matter content.

Parent material

Parent material is the unconsolidated soil mass in which a soil forms. It determines the limits of the chemical and mineralogical composition of the soil. The soils of Panola County formed in material of the Wilcox Group, Carrizo Sand, fluviatile terraces, and the Sabine River alluvium.

The Wilcox Group, of Eocene age, covers most of Panola County. It consists of alternate layers of shale and soft sandstone. Bowie, Kirvin, and Sacul soils are the main soils of this formation.

Carrizo Sand, of Eocene age, occurs east of Tatum, northwest of Beckville, and south of Lake Murvaul. Fuquay, Troup, and Lakeland soils are the main soils of this formation.

TABLE 10.—*Tempera-*

[All data from Carthage; elevation, 282 feet;

Month	Temperature[1]				Precipitation			
	Average daily maximum	Average maximum	Average daily minimum	Average minimum	Average total[1]	Probability of receiving—		
						None or trace	0.5 inch or more	1 inch or more
	°F	°F	°F	°F	*Inches*	*Percent*	*Percent*	*Percent*
January	59.8	77.1	37.1	18.5	3.70	[3] <1	[3] >99	96
February	63.4	78.5	40.5	24.2	4.05	<1	>99	96
March	69.4	83.6	45.3	27.4	4.10	<1	>99	99
April	78.2	87.4	54.6	37.5	4.33	<1	>99	97
May	85.1	92.8	62.3	47.2	4.75	<1	>99	97
June	91.3	96.9	68.3	58.9	3.59	3	95	88
July	94.8	99.9	71.2	64.4	2.28	<1	95	90
August	94.9	101.6	69.8	60.3	2.34	<1	90	79
September	89.6	98.3	63.8	49.6	3.37	<1	91	80
October	80.4	91.2	52.2	34.9	2.60	5	89	89
November	68.7	83.2	43.7	26.6	4.04	<1	99	91
December	60.4	77.1	38.0	19.7	4.72	<1	99	96
Year	78.0	----------	53.9	----------	43.87	----------	----------	----------

[1] Average length of record, 14 years.
[3] Average length of record, 12 years.

Fluviatile terraces, of Pleistocene age, occur on both sides of the bottom lands along the Sabine River. They consist of windblown and alluvial sediment that is high in content of silt and very fine sand. Cart, Erno, and Bienville soils are the main soils of this formation.

Soils that formed in Recent alluvium occur on bottom lands along streams throughout the county. Urbo, Mantachie, and Nahatche soils are the main soils of this group.

Topography

Topography affects soil formation through its influence on drainage, erosion, plant cover, and soil temperature. The topography of the survey area ranges from a flat, featureless plain in the eastern part of the county to broad interstream divides in the northwestern part. The divides have strongly sloping and moderately steep side slopes and numerous, small, intermittent drainageways.

The soils that formed on the plain range from somewhat poorly drained soils, such as the Thage soils, to somewhat excessively drained soils, such as the sandy Bienville soils. The soils that formed on slightly convex ridges are thick and sandy, and they have more distinct horizonation. An example is the Fuquay soils. The soils that formed on the broad interstream divides have very distinct horizonation. An example is the Sacul soils.

Time

Usually a long period of time is required for the formation of soils that have distinct horizons. The differences in the length of time that the parent material has been in place are commonly reflected in the degree of development of soil horizons. Young soils have very little horizon development, and old soils have well-expressed horizons. In the survey area Urbo soils are an example of young soils that have little development. Except for a slight accumulation of organic matter and a darkening of the surface layer, Urbo soils retain most of the characteristics of their clayey parent material. Sacul soils are an example of older soils that have well-developed horizons. In Sacul soils, distinct A and Bt horizons have formed that bear little resemblance to the original parent material.

Processes of Soil Horizon Differentiation

Several processes were involved in the formation of soil horizons in Panola County. The three main processes were (1) the accumulation of organic matter, (2) the leaching of calcium carbonates and bases, and (3) the formation and translocation of silicate clay minerals. In most soils, more than one of these processes have been active in the development of horizons.

Accumulation of organic matter in the upper part of the profile to form an A1 horizon has been important in the county. The organic-matter content of soils in the area ranges from low to medium.

Leaching of carbonates and bases has occurred in most of the soils. The amount of rainfall has been great enough to leach the carbonates from the soils in the area. Most soils in the area are well leached, and this condition contributes to the formation of horizons. These soils have relatively low acidity. The leaching of bases in soils normally precedes translocation of silicate clay materials.

In many soils of the survey area, the downward translocation of clay minerals has contributed to horizon development. The Bt horizon contains appreciably more silicate clay than the A horizon.

Prior to the downward movement of silicate clays, the parent materials were leached of some carbonates and soluble salts. The leaching and movement of these materials are among the more important processes responsible for the development of horizons in the soils of the survey area. Fuquay, Bowie, and Sacul soils are examples of soils that have translocated silicate clays in the Bt horizon.

ture and precipitation

based on data for the period 1952–1965]

Precipitation—Continued									
Probability of receiving—Continued					Average number of days with[2]—			Snow and sleet[2]	
2 inches or more	3 inches or more	4 inches or more	5 inches or more	6 inches or more	0.1 inch or more	0.5 inch or more	1 inch or more	Average total	Maximum
Percent	*Percent*	*Percent*	*Percent*	*Percent*				*Inches*	*Inches*
82	70	51	31	22	6	3	1	0.5	5.0
81	60	41	30	19	6	3	1	.3	4.0
90	70	50	30	20	6	3	1	.3	4.0
91	72	58	41	30	6	3	2	0	0
85	73	60	43	31	5	3	2	0	0
68	48	38	20	19	5	3	2	0	0
70	50	35	25	15	4	2	1	0	0
50	39	28	18	10	4	2	4	0	0
55	39	29	19	10	5	2	1	0	0
56	40	29	19	11	4	2	1	0	0
72	62	43	33	20	6	3	1	4	.2
90	80	60	41	31	6	3	2	.1	1.4
					63	32	15	1.2	5.0

[3] The symbol < means less than; the symbol > means more than.
[4] Less than one-half.

Classification of Soils

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

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

The system of soil classification was adopted by the National Cooperative Soil Survey in 1965.[8] Because this system is under continual study, readers interested in developments of the current system should search the latest literature available.[9]

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

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

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

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

SUBGROUP: Great groups are divided into subgroups, one representing the central (typic) segment of the group and others, called intergrades, that have both the properties of the group and one or more properties of another great group,

[8] SIMONSON, ROY W. SOIL CLASSIFICATION IN THE UNITED STATES. Sci. 137: 1027–1034. 1962.
[9] UNITED STATES DEPARTMENT OF AGRICULTURE. SOIL CLASSIFICATION, A COMPREHENSIVE SYSTEM, 7TH APPOXIMATION. 265 pp, illus. 1960. [Supplements issued in March 1967 and September 1968]

suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Typic Hapludults (a typical Hapludult).

FAMILY: Soil families are separated within a subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and so on, that are used as family differentiae. An example is the clayey, mixed, thermic family of Typic Hapludults.

Climate[10]

The climate of Panola County is subtropical and humid. Summers are hot. Rainfall, which averages 43.87 inches per year, is fairly evenly distributed throughout the year. Prevailing winds are from the southeast; consequently, the Gulf of Mexico dominates the weather in the region. The Gulf tempers the extremes of both summer heat and winter cold. It also is the source of the abundant rainfall. Table 10 summarizes temperatures and precipitation for Panola County.

The summer months are quite warm, and the average daily high temperature is near 95° F in both July and August. Winter temperatures are mild, and there is only about 1 day during each year, on an average, when the temperature fails to go above freezing. Low temperatures at night are freezing or below about 1 day in 3. Temperature changes suddenly, either when cold, dry, polar air replaces the warm, moist, tropical air from the Gulf, or when the reverse occurs. The occasional cold spells are short. The temperature generally turns cold one day, reaches the lowest temperature at night on the second day, and then warms up again on the third day. Subtropical vegetation and flowers fare well in winter. Roses often bloom as late as December and begin blooming again by late in March.

Rainfall is heaviest from November through May. July and August are the driest months. Rainfall late in spring, in summer, and early in fall consists almost entirely of local showers and thunderstorms. Rainfall late in fall, in winter, and early in spring is more general in nature and is associated with airmass changes.

Snowfall averages a little more than 1 inch a year; however, average values are misleading. A snowfall of 3 to 4 inches may be followed by several years of no measurable snow. Snow usually melts almost as rapidly as it falls and is an unimportant source of moisture. More troublesome than snowfall are the occasional ice and sleet storms, which cause a considerable amount of damage to trees, shrubs, and utility lines and make travel difficult. They occur during brief periods in winter.

Spring and fall are the most delightful seasons. Temperatures are neither too hot nor too cold, and there are sufficient changes to make the weather interesting.

The growing season, or freeze-free period, in Panola County averages 240 days. The average date of the last freeze in spring is March 16, and the average date of the first freeze in fall is November 11.

Average annual relative humidity is approximately 85 percent at 6:00 a.m. and between 55 and 60 percent both at noon and at 6:00 p.m. Relative humidity is usually highest shortly before sunrise and lowest in midafternoon. The area receives about 65 percent of the total possible sunshine each year. Average annual lake evaporation is estimated at 50 inches.

Glossary

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

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

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

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

Claypan. A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

[10] By ROBERT B. ORTON, climatologist for Texas, National Weather Service, U.S. Department of Commerce.

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

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

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

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

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

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

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

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

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

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

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

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

Plinthite. The sesquioxide-rich, humus-poor, highly weathered mixture of clay with quartz and other diluents that commonly shows as red mottles, usually in platy, polygonal, or reticulate patterns. Plinthite changes irreversibly to hardpan or to irregular aggregates upon repeated wetting and drying, or it is the hardened relicts of the soft, red mottles. It is a form of laterite.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

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

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

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

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

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

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

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

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

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

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

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing 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.

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GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and the description of the soil series to which the mapping unit belongs. In referring to a capability unit, read the introduction to the section it is in for general information about its management. Other information is given in tables as follows:

Acreage and extent, table 1, page 7.
Predicted yields, table 2, page 27.
Suitability of soils for woodland, table 3, page 28.
Suitability of soils for wildlife, table 4, page 34.
Engineering uses of the soils, tables 5, 6, and 7, pages 36 through 47.
Recreational uses of soils, table 8, page 49.

Map symbol	Mapping unit	Page	Capability unit	Woodland suitability group		Woodland grazing group
			Symbol	Symbol	Page	Name
BE	Bienville loamy fine sand, 0 to 5 percent slopes---	7	IIIs-1	3s2	31	Sandy
BM	Bienville-Mollville complex----------	8	IVw-1	---	--	--------
	Bienville part----------	--	-----	3s2	31	Sandy
	Mollville part----------	--	-----	3w9	31	Flatwood
BO	Bowie fine sandy loam, 1 to 8 percent slopes-------	9	IIIe-3	3o1	31	Sandy Loam
CE	Cart-Erno complex----------	10	IIs-1	2o7	31	Sandy Loam
FU	Fuquay loamy fine sand, 1 to 8 percent slopes------	12	IIIe-1	3s2	31	Sandy
KF	Kirvin fine sandy loam, 1 to 8 percent slopes------	12	IIIe-2	3o1	31	Sandy Loam
KP	Kirvin complex, 1 to 8 percent slopes----------	12	IVe-2	3o1	31	Sandy Loam
KU	Kullit fine sandy loam, 1 to 3 percent slopes------	13	IIe-1	2w8	31	Sandy Loam
LA	Lakeland fine sand, 1 to 8 percent slopes----------	13	IVs-1	5s3	32	Deep Sand
LU	Lucy loamy fine sand, 2 to 5 percent slopes--------	14	IIIe-1	3s2	31	Sandy
LV	Luverne fine sandy loam, 5 to 20 percent slopes----	14	VIe-1	3c2	31	Sandy Loam
MN	Mantachie clay loam----------	15	Vw-1	1w9	30	Loamy Bottomland
MR	Marietta fine sandy loam----------	16	Vw-1	1w8	30	Loamy Bottomland
NC	Nahatche complex----------	17	Vw-1	1w6	30	Loamy Bottomland
RF	Ruston fine sandy loam, 1 to 8 percent slopes------	18	IIIe-3	3o1	31	Sandy Loam
SAC	Sacul fine sandy loam, 1 to 5 percent slopes-------	18	IVe-1	3c2	31	Tight Sandy Loam
SAF	Sacul fine sandy loam, 5 to 20 percent slopes------	18	VIe-1	3c2	31	Tight Sandy Loam
TE	Tenaha loamy fine sand, 5 to 20 percent slopes-----	19	VIe-2	3s2	31	Sandy
TH	Thage loam----------	20	IIw-1	2w8	31	Sandy Loam
TN	Thenas fine sandy loam----------	20	IIw-2	1w8	30	Loamy Bottomland
TRD	Troup loamy fine sand, 1 to 8 percent slopes-------	21	IIIs-1	3s3	31	Sandy
TRF	Troup loamy fine sand, 8 to 20 percent slopes------	21	VIe-3	3s3	31	Sandy
UMX	Urbo-Mantachie association----------	22	VIw-1	1w9	30	--------
	Urbo part----------	--	-----	---	--	Clayey Bottomland
	Mantachie part----------	--	-----	---	--	Loamy Bottomland
VC	Verdun-Cart complex----------	23	IVs-2	---	--	--------
	Verdun part----------	--	-----	5t0	32	Flatwood
	Cart part----------	--	-----	2o7	31	Sandy Loam
WR	Wrightsville loam----------	23	IVw-1	3w9	31	Flatwood
WT	Wrightsville-Cart complex----------	24	IVw-1	---	31	--------
	Wrightsville part----------	--	-----	3w9	--	Flatwood
	Cart part----------	--	-----	2o7	--	Sandy Loam

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