
Soil Survey

Toombs County Georgia

By

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United States Department of Agriculture



UNITED STATES DEPARTMENT OF AGRICULTURE

In cooperation with the

University of Georgia College of Agriculture

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SOIL SURVEY OF TOOMBS COUNTY, GEORGIA

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COUNTY SURVEYED

Toombs County is in the southeastern part of Georgia (fig. 1). Lyons, the county seat, is about 75 miles west of Savannah. Altamaha River forms the southern boundary and Ohoopsee River a part of the eastern boundary. The total area of the county is 367 square miles, or 234,880 acres.

Physiographically, the county constitutes that part of the Atlantic Coastal Plain known as the Hazlehurst terrace (1),¹ the highest and most remote coastal terrace from the Atlantic Ocean. It comprises two distinct topographic divisions—the uplands and the Altamaha River Valley, locally known as low flatwoods.

The general relief of the upland part of the county is that of a comparatively smooth plain which has been dissected by numerous streams and includes many narrow to wide ridges or interstream areas. The tops of these ridges are almost flat or undulating, whereas the sides

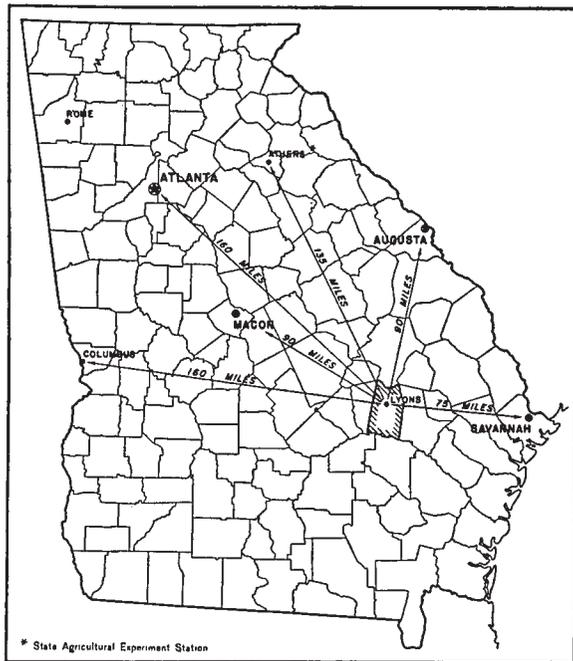


FIGURE 1.—Sketch map showing location of Toombs County, Ga.

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

leading to the drainageways are gently sloping, with grades ranging from about 5 to 10 percent. The general elevation of the upland section ranges from about 215 to 260 feet above sea level. The valleys range in width from about 100 feet to about 5 miles.

The largest areas of almost level or undulating land are in the southeastern part of the county, and extensive areas of flat or almost level land are along Altamaha and Ohoopsee Rivers and Pendleton and Swift Creeks. These areas comprise the first bottoms of the streams which are subject to frequent overflow, also large areas of second bottoms, or terraces, which lie above normal overflow.

Some of the broader ridges are dotted here and there with shallow undrained depressions, the floors of which lie from 2 to 8 feet below the immediately adjacent land. Altamaha River Valley ranges from 2 to 5 miles in width and is well marked by its broad flood plains and two distinct terraces, with remnants of a third higher terrace.

Drainage waters flow southeastward. Those of the southern third of the county empty directly into Altamaha River and the rest into its principal tributary, Ohoopsee River. Probably 75 percent of the land is well drained. The poorly drained areas occur around the heads of branches, in swamps along streams, in small shallow upland depressions, and on lower valley slopes where impervious strata retard the movement of ground water.

In the early agricultural development of Toombs County, it was necessary for the settlers to remove the virgin forest which completely covered the land. A very close relationship exists between the character of the natural forest growth and the soils. On the heavier textured well-drained soils, the forests consist dominantly of longleaf pine, with some slash and loblolly pines, turkey, black-jack, post, and southern red oaks, chinquapin, haw, dogwood, and persimmon. The undergrowth is principally wire grass, with some gallberry and myrtle. On the light-textured well or excessively drained soils, turkey oak, the dominant tree, is associated with black-jack, post, and scrub oaks, and scattered longleaf pine, haw, magnolia, and persimmon. In shallow depressions in the uplands, where the soil consists of Grady clay loam, the trees are pondcypress, baldcypress, slash pine, pitch pine (locally known as black pine), black gum, and sweetgum. On the lower slopes, where the tough impervious clay underlying the Susquehanna soil approaches the surface and provides seepage areas that remain wet for long periods, the tree growth is mainly slash, black, and pond pines, pondcypress, and magnolia, with an undergrowth of gallberry, myrtle, palmetto, and laurel. In swamps along creeks are red maple, water oak, baldcypress, pondcypress, magnolia, bay, and slash, black, loblolly, spruce, and pond pines, sweetgum, black gum (locally called water gum), water ash (locally called swamp ash), river birch, waterlocust, American hornbeam (locally called water beech), winged elm (locally called water-elm), overcup oak, black willow, red cedar, haw, ironwood, and buttonbush. Trees growing in swamps along small streams are slash, loblolly, and pond pines, sweetgum, water gum, water-elm, water beech, water hickory, water oak, magnolia, bay, red maple, pondcypress, baldcypress, and chinquapin; and the undergrowth consists in part of greenbrier (smilax), titi, poison-ivy, gallberry, haw, and sour tupelo gum (locally called Ogeechee lime). In

the Altamaha River swamp the trees include red maple, pondcypress, baldcypress, sweetgum, water gum, water beech, water-elm, slash, loblolly, black, and spruce pines, magnolia, bay, swamp ash, river birch, waterlocust, overcup, willow, swamp white, and water oaks, water hickory, haw, ironwood, and American hornbeam, with an undergrowth consisting in part of smilax, poison-ivy, buttonbush, and Ogeechee lime.²

Toombs County was formed from parts of Emanuel, Montgomery, and Tattnall Counties in 1905. Settlement of the section, of which this county is a part, began in the early part of the nineteenth century at favorable locations near Altamaha and Ochoopee Rivers. Most of the early settlers came from the Carolinas, Virginia, and the older settled parts of Georgia. The present population is largely native born. According to the 1930 census, the population of the county is 17,165, of which 79.1 percent is classed as rural. The density of population is recorded as 34.5 persons a square mile. The rural population is rather evenly distributed.

Lyons, the county seat, and Vidalia, the largest town, are the chief trading and shipping centers. Normantown, Ochoopee, and Cedar Crossing are distributing points of less importance.

This county is fairly well provided with transportation facilities. The Seaboard Air Line Railway crosses the northern part from east to west; the Georgia & Florida Railroad closely follows the Montgomery County line, entering the county in the northern part and crossing into Montgomery County at Petross. United States Highway No. 1 crosses the central part from north to south, and the Vidalia branch joins it south of Pendleton Creek. United States Highway No. 280 extends eastward from Vidalia, passing through Lyons, whence it turns southeastward. In addition, a network of sand-clay roads extends to all sections. Rural mail routes reach almost every home.

CLIMATE

The climate is favorable for the production of general farm crops, tobacco, sweetpotatoes, a large variety of forage, pasture, hay, and soil-building crops, truck crops, and pecans. It is also suitable for the raising of livestock.

The mean annual temperature of 67.2° F., and the average annual rainfall, 49.98 inches, as recorded at the United States Weather Bureau Station at Hazlehurst, Jeff Davis County, according to a 16-year record, is representative of climatic conditions in the western part of Toombs County; whereas, the eastern part approaches the mean annual temperature, as recorded at the Weather Bureau station at Glenville, Tattnall County, which, according to a 31-year record, is 67.1°, and the average annual rainfall is 46.73 inches. In general, the rainfall is well distributed throughout the year but is heaviest in the summer, when the need for moisture for growing crops is greatest, and it is lightest in the fall, thereby favoring the ripening and gathering of crops. The records of the station at Glenville show that excessively wet springs occurred three times when the total pre-

² The common names of plants, largely those used locally, are used in the body of this report. The writer wishes to acknowledge valuable aid in identifying these plants, afforded by a publication of Roland M. Harper (3).

precipitation for April, May, and June, which averages 11.02 inches, exceeded 16 inches, and that severe spring droughts occurred twice, when it was about 6 inches. In a study of drought conditions in Georgia, George W. Mindling, meteorologist of the Weather Bureau in Atlanta (5), stated that, at Dublin, which is 50 miles northwest of Toombs County, during the season from May to September, inclusive, there was no measurable rainfall 70 times in 33 years during periods of 15 days or more; that the rainfall was less than 1 inch 61 times for periods of 20 days or more, 18 times for 40 days or more, 5 times for 90 days or more, and once for more than 100 days.

The average date of the last killing frost, as recorded at Hazlehurst, is March 7, and of the first is November 16, which gives a normal frost-free season of 254 days. Killing frost has been recorded at this station as late as April 6 and as early as November 1. The average frost-free season as recorded at Glenville is a few days longer than at Hazlehurst, extending from March 5 to November 22, a period of 262 days. The latest and earliest frosts at this station occurred on April 10 and October 25. The snowfall at this station is very light.

Such vegetables as cabbage, beets, carrots, collards, lettuce, mustard, onions, English peas, rutabagas, turnips, broccoli, eggplant, and sweetpotatoes generally can be grown successfully during the winter, if they are planted on well-drained southern slopes.

Tables 1 and 2 give the more important climatic data compiled from the records at Hazlehurst and Glenville.

TABLE 1.—Normal monthly, seasonal, and annual temperature and precipitation at Hazlehurst, Jeff Davis County, Ga.

[Elevation, 261 feet]

Month	Temperature (mean)	Precipitation		
		Mean	Total amount for the driest year (1931)	Total amount for the wettest year (1928)
	°F.	Inches	Inches	Inches
December.....	53.3	3.22	2.96	2.00
January.....	51.7	3.67	2.80	.45
February.....	53.2	4.04	2.98	7.79
Winter.....	52.7	10.93	8.74	10.24
March.....	59.7	4.34	2.82	8.98
April.....	67.0	3.05	1.99	10.62
May.....	73.1	3.63	2.81	2.67
Spring.....	66.6	11.02	7.62	22.27
June.....	79.7	5.72	2.13	7.37
July.....	81.4	7.16	6.72	7.20
August.....	80.9	6.16	6.48	9.11
Summer.....	80.7	19.04	15.33	23.68
September.....	78.4	5.04	.27	13.13
October.....	68.7	1.91	.18	.66
November.....	58.6	2.04	.04	.25
Fall.....	68.6	8.99	.49	14.04
Year.....	67.2	49.98	32.18	70.23

TABLE 2.—Normal monthly, seasonal, and annual temperature and precipitation at Glennville, Tattnall County, Ga.

[Elevation, 175 feet]

Month	Temperature			Precipitation		
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1931).	Total amount for the wettest year (1929)
	°F.	°F	°F.	Inches	Inches	Inches
December.....	52.4	85	15	3.30	1.96	3.78
January.....	52.2	84	15	2.74	2.77	3.64
February.....	53.3	90	11	3.55	2.09	4.10
Winter.....	52.6	90	11	9.59	6.82	11.52
March.....	59.6	92	23	3.48	2.20	3.97
April.....	66.8	94	33	2.72	1.24	2.69
May.....	73.9	101	41	3.29	1.16	2.99
Spring.....	66.8	101	23	9.49	4.60	9.65
June.....	79.9	104	48	5.01	2.89	11.31
July.....	81.6	103	59	5.94	5.54	8.21
August.....	81.0	104	62	7.00	7.77	6.14
Summer.....	80.8	104	48	17.95	16.20	20.66
September.....	77.7	100	45	4.95	.49	24.51
October.....	68.2	98	31	2.42	(1)	1.47
November.....	58.6	87	23	2.33	16	2.65
Fall.....	68.2	100	23	9.70	.65	28.63
Year.....	67.1	104	11	46.73	28.27	70.46

¹Trace.

AGRICULTURAL HISTORY AND STATISTICS

During the early settlement of the section, of which Toombs County is a part, small clearings were made in the pine woods, and corn, wheat, and vegetables were grown for home use. Cattle, sheep, and hogs were grazed on the open range. With increase of population, the raising of livestock was replaced by general farming, and, in about 1850, cotton became the principal cash crop, a position that it has since maintained. During the eighties, agriculture was much retarded when capital and labor turned to the development of the turpentine and lumber industries, which rapidly became more important, and not until most of the original timber had been removed did agriculture regain its former place. Until 1920, cotton was practically the only cash crop, but the appearance of the cotton boll weevil, which caused a great reduction in the acreage of cotton, and the introduction of tobacco and sweetpotatoes as cash crops in about 1920, resulted in three cash crops being grown by most of the farmers.

According to the 1935 Federal census, 64.8 percent of the county was included in 1,594 farms, with an average size of 102.2 acres. The average value of land and buildings in that year was \$1,599 a farm, or an average acre value of \$15.64. The farms were operated by 565 owners and part owners and 1,029 tenants.

Of the 162,905 acres of land in farms, 75,045 acres were classed as land available for crops, which included cropland harvested, land on which crops were a failure, idle and fallow land, and plowable pas-

ture. Plowable pasture occupied 2,629 acres; woodland pasture, 48,797 acres; and other pasture, 959 acres; making a total of 52,385 acres of pasture land. Woodland not pastured occupied 30,614 acres; and all other land in farms, 7,490 acres.

Table 3 gives the acreage of the more important farm crops grown, as reported by the census for the years 1909, 1919, 1929, and 1934.

TABLE 3.—*Acreage of the principal crops in Toombs County, Ga., in stated years*

Crop	1909	1919	1929	1934	Crop	1909	1919	1929	1934
	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>		<i>Acres</i>	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>
Corn harvested for grain.....	20,403	32,006	30,796	38,397	Legumes for hay.....	.....	840	670	2,047
Oats cut and fed unthreshed.....	.....	.....	1,808	1,227	Sweetpotatoes.....	643	970	2,008	1,778
Dry peas.....	3,833	441	106	669	Tobacco.....	.....	399	3,198	1,254
Peanuts.....	2,542	100	685	1,342	Cotton.....	18,911	23,556	28,965	18,035
					Sugarcane.....	355	461	350	531

According to the census, 18,911 acres were planted to cotton in 1909 and produced 10,248 bales. The acreage devoted to this crop increased until 1929, when 28,965 acres produced 10,272 bales, but declined to 18,035 acres in 1934 with a production of 6,557 bales. The acreage in corn harvested for grain increased from 20,403 acres in 1909 to 38,397 acres in 1934, but the acre yield has decreased to some extent. The production of sweetpotatoes for northern markets has resulted in a marked increase in acreage since 1909. The census reports a production of 86,332 bushels from the 1,778 acres in sweetpotatoes in 1934. The acreage devoted to tobacco decreased from 3,198 acres in 1929 to 1,254 acres in 1934, and the production decreased from 2,564,020 pounds in 1929 to 607,728 pounds in 1934.

A decided shift from cash crops to corn and forage crops, together with an increase in the number of cattle on farms, has taken place during the last few years. According to the census, the numbers of livestock in the county on January 1, 1935, were as follows: 15,125 swine; 8,231 cattle, of which 2,148 were cows milked during 1934, producing 411,380 gallons of milk; 77 horses; 2,234 mules; 47,876 chickens, which produced 123,609 dozen eggs; 17 sheep; and 3,141 goats. Until the organization of the county in 1905, sheep raising in this section was an important industry, but at present it is almost negligible. In recent years the number of goats raised has increased rapidly.

In years past, according to the reports of old settlers, a comparatively small quantity of commercial fertilizer was used, and cowpenning was the common method of improving the fertility of the land. This consisted of penning the open-range cattle at night on a few acres of land from 2 to 6 weeks prior to planting a crop. According to the census reports, the expenditure for fertilizer in 1909 was \$106,818 on 1,227 farms, an average of \$87.06 for each farm reporting; in 1919, \$232,428 on 1,589 farms, an average of \$146.27; and in 1929, \$268,548 on 1,757 farms, an average of \$152.84.

Most of the farm laborers are Negroes, and the rest are native-born whites. The supply of labor is sufficient. According to the census report of 1930, an average of \$121.35 was spent for wages on each of the 693 farms reporting such expenditure in 1929.

The farms range in size from 10-acre chicken farms to 1,000-acre plantations. They decreased in average size from 129 acres in 1910 to 81.4 acres in 1919, 81.9 acres in 1930, and 102.2 acres in 1935. This decrease was due largely to the destructive invasion of the boll weevil, and to the movement of laborers from the farms to the cities during the World War period and immediately afterward.

Most of the tenant farms are operated on the share basis, in which the landlord pays one-half of the cost of the seed and fertilizer; furnishes the work animals, tools, and machinery; and receives one-half of the income. Cash rent ranges from \$2 to \$4 an acre.

Most of the farm work is done with one-horse implements, although a few farmers use tractors. Because of the mild climate, expensive farm buildings are not needed.

The 1930 census reported the average current value of all property as \$2,853 a farm. Of this amount 67.6 percent represented land, 19.3 percent buildings, 9.4 percent domestic animals, and 3.7 percent implements and machinery.

The average assessed value of land and buildings, as reported by the 1930 census, was \$30.27 an acre; and in 1935 it was \$15.64 an acre. Owing to economic conditions and the reduced acreage of tobacco and cotton, it is estimated by the county agricultural agent and others that the present value of land is from 20 to 30 percent lower than in 1930. Good-quality farming land may be bought at a reasonable price, and forest and grazing lands sell at low prices.

SOIL-SURVEY METHODS AND DEFINITIONS

Soil surveying consists of the examination, classification, and mapping of soils in the field.

The soils are examined systematically in many locations. Test pits are dug, borings are made, and exposures, such as those in road or railroad cuts, are studied. Each excavation exposes a series of distinct soil layers, or horizons, called, collectively, the soil profile. Each horizon of the soil, as well as the parent material beneath the soil, is studied in detail; and the color, structure, porosity, consistence, texture, and content of organic matter, roots, gravel, and stone are noted. The reaction of the soil³ and its content of lime and salts are determined by simple tests.⁴ Drainage, both internal and external, and other external features, such as relief, or lay of the land, are taken into consideration, and the interrelation of soils and vegetation is studied.

The soils are classified according to their characteristics, both internal and external, special emphasis being given to those features influencing the adaptation of the land for the growing of crop plants, grasses, and trees. On the basis of these characteristics, soils are grouped into mapping units. The three principal ones are (1) series, (2) type, and (3) phase. In places, two or more of these principal units may be in such intimate or mixed pattern that they cannot be clearly shown separately on a map but must be mapped as (4) a

³The reaction of the soil is its degree of acidity or alkalinity expressed mathematically as the pH value. A pH value of 7 indicates precise neutrality, higher values indicate alkalinity, and lower values indicate acidity.

⁴The total content of readily soluble salts is determined by the use of the electrolytic bridge. Phenolphthalein solution is used to detect a strong alkaline reaction.

complex. Areas of land, such as coastal beach or bare rocky mountainsides that have no true soil, are called (5) miscellaneous land types.

The most important group is the series which includes soils having the same genetic horizons, similar in their important characteristics and arrangement in the soil profile, and developed from a particular type of parent material. Thus, the series includes soils having essentially the same color, structure, and other important internal characteristics and the same natural drainage conditions, and range in relief. The texture of the upper part of the soil, including that commonly plowed, may vary within a series. The soil series are given names of places or geographic features near which they were first recognized. Thus, Norfolk, Tifton, Kalmia, and Plummer are names of important soil series in this county.

Within a soil series are one or more soil types, defined according to the texture of the upper part of the soil. Thus, the class name of the soil texture, such as sand, loamy sand, sandy loam, loam, silt loam, clay loam, silty clay loam, and clay, is added to the series name to give the complete name of the soil type. For example, Tifton sandy loam and Tifton fine sandy loam are soil types within the Tifton series. Except for the texture of the surface soil, these soil types have approximately the same internal and external characteristics. The soil type is the principal unit of mapping, and because of its specific character it is usually the soil unit to which agronomic data are definitely related.

A phase of a soil type is a variation within the type, which differs from the type in some minor soil characteristic that may have practical significance. Differences in relief, stoniness, and the degree of accelerated erosion frequently are shown as phases. For example, within the normal range of relief for a soil type, there may be areas that are adapted to the use of machinery and the growth of cultivated crops and others that are not. Even though there may be no important difference in the soil itself or in its capability for the growth of native vegetation throughout the range in relief, there may be important differences in respect to the growth of cultivated crops. In such instances, the more sloping parts of the soil type may be segregated on the map as a sloping or hilly phase. Similarly, soils having differences in stoniness may be mapped as phases, even though these differences are not reflected in the character of the soil or in the growth of native plants.

The soil surveyor makes a map of the county or area, showing the location of each of the soil types, phases, complexes, and miscellaneous land types, in relation to roads, houses, streams, lakes, section and township lines, and other local cultural and natural features of the landscape.

SOILS AND CROPS

Toombs County is a comparatively young county agriculturally, as only about 30 percent of it is under cultivation and at least one-half of the land under cultivation has been cleared since the county was formed in 1905. Not more than one-half of the potentially good agricultural land has been cleared, so that a large aggregate acreage of good soils is still in forest. These soils can be brought into cul-

tivation easily and cheaply when the demand for farm land warrants. Most of the mature timber has been removed, and the present forested areas consist of cut-over land which supports a scattered growth of longleaf and slash pines, together with some small oaks.

The relief of the uncleared areas of good soils is favorable for agricultural operations, and the rest of the land includes soils valuable for pastures and forests.

The present agriculture consists of the production of cotton, tobacco, and sweetpotatoes as the dominant cash crops, and of corn, hay, velvetbeans, peanuts, cowpeas, soybeans, oats, sugarcane, and garden vegetables as subsistence crops.

Cotton is the principal cash crop. In 1934, according to the census, 6,557 bales of cotton were produced on 18,035 acres, but the acreage was much larger in 1929 before the policy of crop reduction became effective. Both the climate and soils favor the growth of cotton which has a ready sale for cash, and the farmers understand the handling of this crop under all weather conditions. The economic welfare of the county has depended mainly on cotton since the removal of the timber about 25 years ago. Any wilt-resistant variety may be grown.

Bright tobacco ranks next to cotton as a cash crop. It was introduced in the county about 1920, and in 1934, according to the census report, 1,254 acres were in this crop, with a production of 607,728 pounds. This is less than one-fourth of the quantity produced in 1929.

Owing to an increasing demand for sweetpotatoes in northern markets, the acreage in this crop has shown a marked increase in recent years. In 1934, sweetpotatoes grown on 1,728 acres yielded 86,332 bushels. This was a decrease both in acreage and yield from the crop produced in 1929. The sweetpotatoes are cured, stored in cellars or pits, and most of them are shipped to northern markets. Big-Stem Jersey is the principal commercial variety, and Porto Rico, Nancy Hall, Triumph, and Golden Beauty are grown for consumption in the home.

Corn is grown on a larger acreage and is more widely distributed than any other crop. In 1934, 38,397 acres were devoted to this crop, and the yield was 280,436 bushels. Most of the corn is used to feed work animals, fatten hogs, and supply meal for home use. Whatley Prolific and Hastings Prolific are the most popular varieties.

According to the census, peanuts were grown on 1,342 acres in 1934, and the total yield of nuts was 15,536 bushels. In addition, peanuts are interplanted with corn and are used for hog and cattle pasture after the corn is removed. Spanish and North Carolina are the principal varieties, the Spanish being grown for pasture and the North Carolina being grown alone as a cash crop.

Velvetbeans, soybeans, and cowpeas are grown to more or less extent throughout the county. A small acreage is devoted to oats, and this crop, together with the velvetbeans, soybeans, and cowpeas, constitute the main hay crops.

Watermelons and cantaloups are grown by a few farmers in the vicinities of Lyons and Vidalia for the Savannah market. A small acreage is devoted to sugarcane, and sirup is manufactured for home use and local markets.

Pecans are grown in a few 20- to 40-acre groves and a number of smaller groves. In 1929, according to the census, 9,709 trees yielded 25,015 pounds of nuts. Tifton sandy loam and Norfolk sandy loam are the preferred soils for pecans. The principal varieties are Stuart and Schley.

Pears, peaches, Satsuma oranges, apples, grapes, strawberries, blackberries, and huckleberries are produced, and any excess of those required for consumption in the home are sold locally.

Of the livestock interests, hog raising is the most important. About one-half of the farmers produce hogs for the market, but most of the hogs are raised for home consumption. The principal breeds are Duroc-Jersey and Poland China.

A few small dairies, located near Lyons and Vidalia, supply the local demand for milk and cream. Practically every farm has a few dairy cattle to provide milk for use in the family. Most of the dairy cattle are grade Jerseys. Most farmers have some cattle, mainly of the dairy type, that they sell for beef, but some beef cattle are raised, grade Herefords being the most common. Herds of cattle roam over the large areas of woodland, living the year around without protection or feeding. Their principal food is wire grass.

About 50 percent of the farmers raise goats, most of which are of inferior breeding. They browse on the wire grass, twigs, shrubs, and briars on the open range. When the kids are 3 months old, they are bought at the farms and trucked to northern, as well as southern, city markets.

Most of the farmers have flocks ranging from 25 to 100 chickens, and on some small farms the operators specialize in poultry raising. The special poultry farmers prefer White Leghorns, but most of the general farmers raise Rhode Island Reds or Barred Plymouth Rocks. Most of the eggs and chickens are sold on the farms and are conveyed by truck to the Savannah and Atlanta markets.

Lumbering is followed on a small scale in various parts of the county, and a number of small portable sawmills are in operation. In addition to cutting sawlogs for the mills, some cross ties, poles, and fence posts are trucked out of the county. The production of turpentine is important, and turpentine stills are well distributed.

In this county a direct relationship exists between the agriculture and soils. Tifton sandy loam, Tifton fine sandy loam, Norfolk sandy loam, and Kalmia fine sandy loam are the best soils for the production of cotton, because these soils possess good physical properties and favorable tilth in their surface soils and have friable sandy clay subsoils that allow free circulation of moisture, enabling them to withstand excessively wet or droughty conditions. Norfolk sandy loam, deep phase, and Norfolk loamy sand, because of their better aeration and lower content of organic matter, are particularly suited to the production of bright tobacco, sweetpotatoes, peanuts, and watermelons. Pasture grasses, owing to an almost constant supply of moisture, succeed best on soils of the Plummer, Myatt, Grady, and Portsmouth series.

About 85 percent of the surface soils consist of weakly consolidated or unconsolidated sands, silts, and clays, and the rest are largely materials washed from these and deposited along streams. An exception is in the flood plains of Altamaha River, where much of the fine material has been transported from the red hill lands of northern

Georgia. Where drainage is good, the soil materials of the upland have been modified by soil-forming processes, such as oxidation, leaching, influences of plants and animals, and removal of the fine material from the surface layers downward to be deposited as clay at a depth ranging from 12 to 60 inches. The other soils, in the main, are those on stream terraces and flood plains. They differ from the soils of the upland in their fine textures, freedom from accretions, poor drainage, almost level surface, and in not being subject to erosion. The soils of the flood plain along Altamaha River differ from other soils of the county in color, content of organic matter, and chemical composition throughout.

The soils can be classed, according to their soil characteristics, agricultural uses, and adaptations, into four groups: (1) Gray soils with yellow sandy clay subsoils; (2) gray sands with yellow or pale-yellow sand subsoils; (3) gray or almost black soils with mottled subsoils; and (4) miscellaneous soils and land types.

In the following pages, the soils are described in detail and their agricultural relationships are discussed; their distribution is shown on the accompanying soil map; and table 4 gives their acreage and proportionate extent.

TABLE 4.—*Acreage and proportionate extent of the soils mapped in Toombs County, Ga.*

Soil type	Acres	Per- cent	Soil type	Acres	Per- cent
Tifton sandy loam.....	33, 536	14. 3	Grady clay loam.....	512	0. 2
Tifton sandy loam, eroded phase....	2, 112	. 9	Plummer sandy loam.....	31, 360	13. 4
Tifton fine sandy loam.....	6, 272	2. 7	Portsmouth sandy loam.....	250	. 1
Norfolk sandy loam.....	23, 232	9. 9	Myatt fine sandy loam.....	7, 808	3. 3
Norfolk sandy loam, deep phase.....	51, 200	21. 8	Kalmia-Myatt fine sandy loam.....	2, 432	1. 0
Norfolk fine sandy loam, deep phase.....	2, 044	1. 3	Leaf fine sandy loam.....	2, 432	1. 0
Norfolk loamy sand.....	5, 824	2. 5	Alluvial soils (Congaree soil mate- rial).....	7, 232	3. 1
Kalmia fine sandy loam.....	1, 472	. 6	Norfolk sand, scrub phase.....	2, 176	. 9
Kalmia fine sandy loam, deep phase.....	3, 008	1. 3	Swamp.....	18, 624	7. 9
Norfolk sand.....	22, 272	9. 5			
Blanton sand.....	1, 408	. 6	Total.....	234, 880	
Kalmia fine sand.....	3, 136	1. 3			
Susquehanna-Cuthbert sandy loam.....	5, 632	2. 4			

GRAY SOILS WITH YELLOW SANDY CLAY SUBSOILS

This group includes Tifton sandy loam; Tifton sandy loam, eroded phase; Tifton fine sandy loam; Norfolk sandy loam; Norfolk sandy loam, deep phase; Norfolk fine sandy loam, deep phase; Norfolk loamy sand; Kalmia fine sandy loam; and Kalmia fine sandy loam, deep phase. In this group are practically all of the good soils of the uplands and the best drained soils on the terraces. They dominate the agriculture of the county and comprise by far the largest acreage of any group, covering a total area of 129,600 acres.

These soils have gray or light grayish-brown loamy sand or light-textured sandy loam surface soils underlain by yellow, deep-yellow, and faintly reddish yellow sandy clay subsoils. The typical soils are characterized by the presence of a large quantity of small rounded brown or black accretions scattered over the surface, mixed with the surface soils, and, to less extent, mixed with the subsoils. The outstanding difference between Tifton sandy loam and Norfolk sandy loam is that the Tifton soil has a browner surface soil, more fine

material throughout the surface soil and subsoil, a deeper colored subsoil, and contains accretions.

The topographic position of the soils of this group is well defined, as they occur principally on broad flat gently sloping interstream ridges and to less extent on the slopes and on the stream terraces. Practically all of these soils have favorable relief, and all kinds of farm machinery can be operated easily. All are naturally well drained, with the exception of the Kalmia soils, and open ditches will suffice for them.

Practically all of the cotton, tobacco, sweetpotatoes, peanuts, and garden vegetables are grown on these soils. They are easy to till, warm quickly in the spring; and respond readily to the addition of commercial fertilizer and to the incorporation of green-manure crops. These soils can be handled easily with light farming implements and light work animals. The more sloping areas require terracing and contour plowing, to protect them from surface erosion when under cultivation.

The Tifton soils are considered the best agricultural soils in the county. Ranking next to them are Norfolk sandy loam and Norfolk sandy loam, deep phase. The Kalmia soils resemble the Norfolk in color, are developed on terraces or second bottoms, have almost level surfaces, and are not so well drained as the Norfolk soils. The agricultural value of the Kalmia soils for general farm crops is a little lower than that of the corresponding Norfolk soils.

Tifton sandy loam.—The 4- or 5-inch surface layer of Tifton sandy loam, locally known as “pimply” or “red pebbly land,” consists of gray or grayish-brown loamy sand. It is underlain by brownish-yellow or yellow loamy sand which grades, at a depth ranging from 10 to 20 inches, into bright-yellow or faintly reddish yellow friable but slightly sticky sandy clay. At a depth of about 24 inches, the material is faintly mottled with reddish brown and ocher yellow. The mottlings become more abundant with increasing depth. At a depth ranging from 32 to 40 inches is mottled red, gray, yellow, and purple hard brittle sandy clay. This, in turn, at a depth ranging from 40 to 50 inches, rests on the substratum consisting of a multi-colored network of white, gray, purple, purplish-red, red, and yellow hard brittle clay, silt, and sand, more or less cemented together by iron oxide and colloidal clay. On the surface and to a depth of 24 inches, the material contains various quantities of hard smooth rounded brown and dark-brown ferruginous accretions. These pebbles, which constitute from 5 to 20 percent of the soil mass, consist of sand, silt, and clay, cemented by iron oxide, and range in size from $\frac{1}{16}$ to 1 inch in diameter. Below a depth of 24 inches, the accretions are soft. They are not present below a depth ranging from 36 to 40 inches but are replaced by numerous segregations of red or purplish-red iron-oxide material which, on exposure to the air, becomes indurated and ultimately develops into an accretion. Under virgin conditions, the upper 1-inch layer of the surface soil is very dark gray loamy sand with a high content of organic matter. Beneath this is grayish-brown loamy sand containing some organic matter, which, at a depth of 4 or 5 inches, grades into brownish-yellow loamy sand.

As mapped, Tifton sandy loam includes numerous small areas of Norfolk sandy loam and Tifton fine sandy loam. In many places, particularly north of Parker School, the subsoil is heavier than typi-

cal, resembling that of Cuthbert sandy loam. In places where the sandy clay subsoil has been turned to the surface by plowing, it assumes a yellowish-brown or brownish-yellow color. Where the land has been under cultivation for a long time, without restoration of the organic matter, the color of the surface soil is distinctly lighter gray than is typical. Also included are numerous small areas where wash from soils at higher levels on the slope have accumulated, and here the soil differs from the typical soil in that the sandy clay occurs at a depth ranging from 21 to 36 inches, the surface layer is lighter colored, and the content of brown pebbles is less. On the steeper slopes, where oxidation is more complete, the subsoil is reddish yellow.

Tifton sandy loam is agriculturally the most important and one of the most extensive soils in this county. It covers a total area of 52.4 square miles. It occurs principally on ridge crests and upper slopes in the slightly undulating or smooth gently sloping areas in all parts of the county but is most extensive in the east-central and southeastern parts. In most places the surface slope, which ranges from 3 to 5 percent, is conducive to erosion, and, where terracing and contour plowing are not practiced, much of the surface soil is washed away, and gullies soon form. Owing to the favorable structure and consistence of the subsoil, both surface and internal drainage are well established, and the soil is sufficiently retentive of moisture to prevent more than a partial loss of crops during the most severe droughts.

Approximately 70 percent of Tifton sandy loam is cultivated, 27 percent is in woods, 2 percent in permanent pasture, and 1 percent used for buildings and barnyard lots. Of the cultivated soil, according to the county agricultural agent, 45 percent is in corn, 35 percent in cotton, 5 percent in tobacco, 4 percent in oats, 3 percent in hay, 2 percent in peanuts, 2 percent in sweetpotatoes, 1 percent in wheat, and the remaining 3 percent in gardens, sugarcane, orchards, pecan groves, watermelons, cantaloups, and other crops. It is a common practice to interplant velvetbeans, soybeans, Spanish peanuts, and cowpeas with corn. Yields of cotton range from one-third to three-fourths bale an acre, corn from 15 to 25 bushels, tobacco from 500 to 800 pounds, sweetpotatoes from 40 to 150 bushels, peanuts from 30 to 50 bushels, wheat from 6 to 10 bushels, and oats about 30 bushels.

Commercial fertilizers are profitably used. Cotton land commonly receives from 200 to 400 pounds an acre of a 2-9-3, 3-9-5, or 3-8-5¹ mixture. Corn follows cotton and usually receives no fertilizer, but nitrate of soda is applied to corn as a top dressing at the rate of 75 or 100 pounds an acre. An acre application ranging from 600 to 1,000 pounds of a 3-8-5 mixture is used for tobacco, 400 to 800 pounds of a 5-7-5 or 4-8-6 mixture for sweetpotatoes, 200 to 500 pounds of a 3-9-3 or 4-8-4 mixture for peanuts, and 200 to 600 pounds of a 4-8-4 mixture for sugarcane.

This soil is poorly supplied with organic matter, but this deficiency can be overcome by growing winter legumes, as soil builders and plowing them under at least 15 days before planting in the spring. Austrian Winter peas and hairy vetch have proved beneficial for this purpose. In decomposing, these plants furnish nitrogen and make the soil more retentive of moisture during dry periods, thereby

¹ Percentages, respectively, of nitrogen, phosphoric acid, and potash.

greatly improving the physical condition for the preparation of a good seedbed. Probably 90 percent of this soil requires terracing and contour plowing, in order to protect it from washing and gully-ing.

Tifton sandy loam, eroded phase.—Tifton sandy loam, eroded phase, occupies narrow ridges and steep slopes where erosion has removed most of or all the surface soil and in places part of the subsoil. In many small areas of this soil, the bright-yellow or reddish-yellow sandy clay of the subsoil is exposed at the surface, and the accumulation of rounded brown pebbles interferes very materially with cultivation.

Included with this soil in mapping are areas of Norfolk sandy loam that occur on steep slopes. Where tilled, most of the surface soil has been washed away, but where the land has not been cleared, very little of the surface soil has been removed.

Probably 25 percent of this soil is farmed in conjunction with Tifton sandy loam or Norfolk sandy loam, but the absence or very low content of organic matter, together with the impervious character of the subsoil material, causes yields to be decidedly lower than on either of those soils.

Areas of Tifton sandy loam, eroded phase, not in cultivation, should remain in forest or be reforested; but in tilled fields the growing of kudzu, because of its widespreading and deeply penetrating root system, would tend to open up the impervious subsoil, thus providing much better circulation of air and moisture and at the same time supply organic matter and produce excellent pasture.

Tifton fine sandy loam.—In cultivated fields, the surface soil of Tifton fine sandy loam to a depth of 6 or 8 inches is gray or brownish-gray loamy fine sand with a fair content of organic matter and many brown rounded pebbles similar to those in Tifton sandy loam. Underlying this and continuing to a depth of about 10 inches is grayish-yellow loamy fine sand containing numerous pebbles. This material becomes heavier with increasing depth, and grades into bright-yellow or deep-yellow fine sandy clay at a depth ranging from 12 to 20 inches. Below a depth ranging from 24 to 30 inches the material contains some mottlings, streaks, or blotches of red and yellow, and at a depth ranging from 40 to 45 inches it consists of a varicolored lattice pattern of white, gray, purple, purplish-red, and yellow fine sandy clay material containing soft brown rounded accretions. This layer rests on the substratum consisting of a mixture of red, purple, white, and gray fine sand, clay, and silt material, more or less indurated and cemented by iron oxide and colloidal clay. The substratum contains no rounded accretions, but does contain many iron oxide segregations. In wooded areas the soil profile differs somewhat from that in cultivated fields in that the 1- or 2-inch surface layer consists of dark-gray loamy fine sand with a high content of organic matter. This overlies a 4- to 6-inch layer of gray loamy fine sand containing a small amount of organic matter, that grades into grayish-yellow loamy fine sand.

A common variation in Tifton fine sandy loam in the southern part of the county occurs where the surface of the land is flat, resulting in somewhat restricted surface and internal drainage, a grayer color in the surface soil, and more yellow, red, and gray mottlings in the subsoil. In such places small open drainage ditches

are necessary for the best results with crops. As mapped, Tifton fine sandy loam includes many small areas of Tifton sandy loam, and in such areas the surface is sufficiently sloping that terracing and contour plowing are necessary for the prevention of erosion.

Tifton fine sandy loam occurs mainly in the southeastern part of the county, and small bodies are west of Vidalia and south of Cedar Crossing. It occupies areas ranging in size from a few acres to 5 square miles. The relief ranges from almost level to undulating; consequently the soil is practically free from erosion. The loamy surface soil and friable subsoil provide good surface and internal drainage and enable the soil to absorb moisture readily so that it can withstand drought and can retain fertilizers and manures for long periods.

About 80 percent of this soil is cultivated, 15 percent is in woods, 4 percent is in permanent pasture, and 1 percent is occupied by buildings and barnyard lots. All the soil is potentially well adapted to the growing of the crops commonly produced. The same kind of soil was selected by the State for its prison farm in Tattnall County, which adjoins Toombs County on the east. Of the cultivated land, 90 percent is used for general farm crops, such as cotton, corn, peanuts, velvetbeans, soybeans, cowpeas, oats, sugarcane, hairy vetch, Austrian Winter peas, and hay, and 10 percent for special crops, of which tobacco and sweetpotatoes are the more important. Small acreages are devoted to pecans, watermelons, and cantaloups.

The soil is managed and fertilized in practically the same way as is Tifton sandy loam, but yields, because of the higher content of organic matter and other plant nutrients, and a somewhat better water-holding capacity, are a little higher. Under cultivation, the organic-matter content of the soil is soon depleted, and in most places the incorporation of organic matter in the form of barnyard and green manures is much needed.

Norfolk sandy loam.—Norfolk sandy loam, locally known as gray sandy land, resembles Tifton sandy loam in its good surface and internal drainage, resistance to drought, and tendency to erode, but it differs from that soil in its more pronounced gray surface soil, somewhat lower content of organic matter, paler yellow upper subsoil layer, and lower content of silt and clay throughout the soil mass. Brown rounded pebbles are noticeably less numerous, but quartz pebbles and coarse quartz sand are more abundant than in the Tifton soil.

In cultivated fields, the surface soil of Norfolk sandy loam, to a depth of about 6 inches, is gray or grayish-brown slightly loamy sand with a small content of organic matter. Beneath this is pale-yellow or grayish-yellow loamy sand which becomes more loamy with increasing depth and grades, at a depth ranging from 10 to 23 inches, into bright-yellow or deep-yellow friable sandy clay that, in places below a depth of 30 inches, is slightly mottled with shades of brown and red. At a depth ranging from 40 to 45 inches is the substratum, a slightly indurated sandy clay marked with numerous mottlings, streaks, and splotches of gray, yellow, and red. Some smooth brown pebbles occur throughout the profile but are conspicuously less abundant than in Tifton sandy loam.

All areas of Norfolk sandy loam and Norfolk sandy loam, deep phase, contain a small quantity of rounded brown or black accre-

tions. In most places, the subsoils are heavier and have a deeper yellow color than is typical of the Norfolk soils. This is due to the fact that this is a Tifton soil region, and the Norfolk soils show some influence of the underlying formation which gives rise to the Tifton soils.

About 50 percent of Norfolk sandy loam is in woodland, and the forest is largely virgin. Under normal moisture conditions, the virgin soil consists of a 1- or 2-inch layer of dark-gray loamy sand, high in organic matter, overlying a 2- or 3-inch layer of gray loamy sand which rests on grayish-yellow loamy sand.

As mapped, Norfolk sandy loam includes many small areas of its deep phase and of Tifton sandy loam. To a greater or less extent over the entire county, but particularly west and northwest of Oconee Bridge, in the southwestern part, and east of South Thompson Church, in the central part, the subsoil is heavier and slightly plastic, closely resembling that of Cuthbert sandy loam.

Norfolk sandy loam is well distributed over the county, the largest areas being in the southwestern and central parts. Its aggregate area is 36.3 square miles.

This soil occupies undulating to sloping relief, commonly on the lower slopes of interstream areas, where it is associated with Tifton sandy loam which covers the crests and upper slopes. About 98 percent of this soil is sufficiently sloping to be subject to sheet erosion and gulying, and terracing and contour plowing must be a part of any good plan of farm management. Owing to the loamy surface and subsurface soil, together with its friable subsoil, Norfolk sandy loam has excellent surface and internal drainage and in addition readily absorbs and retains moisture, thereby withstanding drought much better than soils with either very pervious or impervious subsoils.

About 50 percent of the land is cultivated, and the rest supports a growth of longleaf and slash pines, and some scattered oaks. The woodland is used for the production of turpentine and as open range pasture for cattle, hogs, and goats. Of the cultivated soil, about 45 percent is devoted to corn, 35 percent to cotton, 5 percent to tobacco, 4 percent to oats, 2 percent to peanuts, 3 percent to hay, and the rest to velvetbeans, cowpeas, soybeans, sugarcane, pecans, wheat, and permanent pasture.

Most of this soil is farmed in conjunction with Tifton sandy loam, but crop yields, because of a lower content of organic matter in the surface soil and a lighter texture, are slightly lower, although the quality of tobacco and sweetpotatoes is somewhat better. Acre yields of cotton range from one-third to two-thirds of a bale, corn from 10 to 25 bushels, tobacco from 500 to 750 pounds, sweetpotatoes from 40 to 150 bushels, peanuts from 30 to 50 bushels, wheat from 6 to 10 bushels, and oats from 20 to 30 bushels. Land for cotton generally receives an acre application ranging from 200 to 350 pounds of a 2-9-3, 3-9-5, or 3-8-5 fertilizer. Corn follows cotton and receives no fertilizer treatment, but nitrate of soda is used as a top dressing for corn at the rate of 75 to 100 pounds an acre. Tobacco receives an acre application ranging from 600 to 1,000 pounds of a 3-8-5 mixture, sweetpotatoes from 400 to 800 pounds of a 5-7-5 or 4-8-6 mix-

ture, peanuts from 200 to 500 pounds of a 3-9-3 or 4-8-4 mixture, and sugarcane from 200 to 500 pounds of a 4-8-4 mixture.

This soil, because of its favorable texture, can be broken and cultivated over a wide range of moisture conditions. It is readily penetrated by plant roots and rain water, and during dry periods water moves freely within the soil to meet the requirements of growing plants.

In the management of Norfolk sandy loam, one of the most important aims is the increase and maintenance of actively decomposing organic matter. This can best be supplied by growing leguminous crops, including Austrian Winter peas, hairy and smooth vetches in the winter, and velvetbeans, peanuts, cowpeas, and soybeans interplanted with the corn in the summer. The destructive practice of burning vegetation from the fields should be discontinued. Terracing the slopes and contour plowing are necessary to check erosion. The soil on the steeper slopes, which are covered with forest and probably constitute 25 percent of the total area of this soil, can best be devoted to the production of lumber and turpentine and used as grazing land.

Norfolk sandy loam, deep phase.—Norfolk sandy loam, deep phase, differs from typical Norfolk sandy loam in that the surface soil is lighter in color, has a lower content of organic matter, and is less loamy. The surface soil and the upper subsoil layer are more porous than the corresponding layers in the typical soil, and the sandy clay lower subsoil layer occurs at a depth ranging from 24 to 36 inches. This grades downward into heavier and rather hard but brittle sandy clay which contains numerous streaks, splotches, and mottlings of gray, yellow, and red.

In the northern part especially and to greater or less extent throughout the county many small areas of Norfolk coarse sandy loam, deep phase, are included with this soil in mapping. In these areas the topmost 4-inch layer consists of light-gray or brownish-gray coarse sand. This is underlain by pale-yellow rather incoherent coarse sand which, at a depth of about 30 inches, grades into yellow sandy clay, and this, at a depth of about 40 inches, rests on mottled gray, yellow, and reddish-yellow sandy clay. At a depth ranging from 44 to 50 inches, the substratum consists of rather hard white, light-gray, purple, and red sandy clay material. Quartz pebbles, ranging in size from $\frac{1}{16}$ to 1 inch in diameter, are scattered over the surface and are very conspicuous throughout the entire soil mass. This coarse soil, owing to its lower content of organic matter and incoherent character, is less productive than the deep phase of Norfolk sandy loam. Numerous small areas of Norfolk sandy loam, Norfolk loamy sand, and Norfolk fine sandy loam, deep phase, are included with this soil as mapped, especially where large areas of these soils border areas of Norfolk sandy loam, deep phase.

This is the most widely distributed soil and occupies the largest acreage of any soil in the county. It occurs in several comparatively large and numerous small areas. The relief ranges from undulating to smoothly sloping, and the degree of slope ranges from 3 to 8 percent. This soil generally occupies the lower slopes below areas of Norfolk sandy loam or Tifton sandy loam and borders areas of

Plummer sandy loam which occur along the stream courses. Owing to its porous character, natural drainage ranges from good to excessive, and erosion in few places is serious, although terracing is necessary on the steeper slopes.

Probably 45 percent of the deep phase of Norfolk sandy loam has been cleared and farmed, but perhaps 15 percent of the cleared land, owing largely to a depletion of organic matter and other plant nutrients through careless handling, has been abandoned and now is grown over with oaks and scattered longleaf pines. The remaining 55 percent has been cut-over but now supports a merchantable growth of longleaf pine, most of which has been boxed for turpentine.

This deep soil is well adapted to the growing of bright tobacco, sweetpotatoes, and peanuts. Farmers recognize this soil and the deep phase of Norfolk fine sandy loam as the best soils in the county for these crops. Corn, cotton, and velvetbeans do not yield so well as on the typical soil, because of a lower content of organic matter, less inherent fertility, and a more droughty character. Watermelons and cantaloups are grown very successfully, and the soil is well suited to most truck crops. Cotton yields from one-fourth to one-half bale an acre, corn from 10 to 20 bushels, tobacco from 500 to 600 pounds, sweetpotatoes from 50 to 150 bushels, peanuts from 30 to 50 bushels, wheat 7 bushels, and oats 25 bushels. Fertilizer treatments are similar to those used on Norfolk sandy loam.

The greatest need of this soil is the increase and maintenance of actively decomposing organic matter. This can be accomplished by the growing of winter legumes, such as Austrian Winter peas and vetches, and plowing them under at least 15 days before planting the main crop; and the practice of interplanting velvetbeans, peanuts, cowpeas, and soybeans with the corn should be continued. Only the steeper slopes are in need of terracing. Forested areas, which cover many of the steeper slopes, probably can best be used for the production of timber and turpentine and for grazing.

Norfolk fine sandy loam, deep phase.—The 5-inch surface layer of Norfolk fine sandy loam, deep phase, in cultivated fields is light-gray, tinged with brown, loamy fine sand containing some organic matter. Below this is yellow loamy fine sand which becomes increasingly more loamy with depth and shows some gray and ocher-yellow color, owing to incomplete drainage, at a depth of about 24 inches. At a depth of about 30 inches, the material grades into yellow fine sandy loam, with large mottlings of gray and ocher yellow, and this, at a depth ranging from 33 to 40 inches, rests on mottled gray and yellow fine sandy clay. Throughout the entire soil mass are some rounded brown pebbles that are so common in the Tifton soils. The virgin soil differs from the cultivated soil in having a 1- or 2-inch dark-gray surface layer underlain by light-gray or gray loamy fine sand containing some organic matter.

This soil is not uniform as mapped but includes small areas of Norfolk fine sandy loam, Norfolk sandy loam, deep phase, Norfolk loamy sand, and Norfolk loamy fine sand. In some flat areas, the gray and ocher-yellow mottlings appear at a depth ranging from 12 to 18 inches.

The largest areas of Norfolk fine sandy loam, deep phase, are southwest and north of Lyons and northwest of Normantown, and

small isolated areas are south of New Branch School, north of Ohoopee, and southeast and southwest of Vidalia.

Owing to the almost level or very gently sloping relief, this soil is comparatively free from erosion; and both surface and internal drainage are not so good as in Norfolk sandy loam, although drainage ranges from fair to good.

About 30 percent of Norfolk fine sandy loam, deep phase, is under cultivation, and the remainder is cut-over land which supports a scattered growth of slash and longleaf pines and small oaks. Cotton, corn, hay, tobacco, and sweetpotatoes are the principal crops. This soil is particularly suited to the production of high-grade bright tobacco, sweetpotatoes, and peanuts. Yields of general farm crops are comparable to those on Norfolk sandy loam, deep phase, but, owing to the less favorable texture and structure of this soil for holding moisture and fertility, they are somewhat lower than those obtained on typical Norfolk sandy loam.

Cultural methods and fertilization practices are essentially the same as on Norfolk sandy loam. For the improvement of this deep soil, a system of management is needed, whereby the organic-matter content will be greatly increased and maintained. Suggestions offered for the improvement of Norfolk sandy loam, deep phase, apply to this soil. On the flatter areas, where drainage is somewhat retarded, small open ditches would carry off the excess water.

Norfolk loamy sand.—Norfolk loamy sand is closely associated with Norfolk sandy loam, deep phase, and Norfolk sand. It resembles the deep phase of the sandy loam and differs from Norfolk sand in having distinct loaminess throughout. To a depth of about 6 inches it consists of gray or brownish-gray loamy sand with a small content of organic matter. This is underlain by a pale grayish-yellow loamy sand which becomes yellow below a depth of 12 inches and rests on firm but friable yellow sandy loam at a depth ranging from 38 to 48 inches. This material grades downward into a compact yellow sandy clay substratum with red and gray mottlings. Some rounded brown pebbles, like those in Tifton sandy loam, occur throughout the soil mass. As mapped, this soil includes small areas of Norfolk sandy loam, deep phase, Norfolk fine sandy loam, deep phase, Norfolk sand, and Norfolk coarse sand.

Norfolk loamy sand occurs in small areas in the east-central part of the county and to less extent in all other parts. The relief ranges from almost level to gently sloping. Drainage everywhere is adequate and in many places excessive, although only the steeper slopes are subject to serious wash.

About 20 percent of the land is now under cultivation. A considerable acreage has been cultivated in the past but is now grown up to scattered pines, scrub oak, briars, and broomsedge. The land that has never been cultivated supports a growth of longleaf pine and scrub oak.

Essentially the same crops are grown and the same fertilizers used on this soil as on Norfolk sandy loam, but yields are even lower than on Norfolk sandy loam, deep phase, because of a lower content of organic matter and other plant nutrients. The soil is well suited to the growing of bright tobacco and sweetpotatoes, and the quality of these crops compares favorably with that of those grown on Norfolk sandy loam, deep phase. Suggestions offered for the improvement

of Norfolk sandy loam, deep phase, apply equally well to this soil which, in agricultural value, ranks between Norfolk sand and Norfolk sandy loam, deep phase.

Kalmia fine sandy loam.—In a virgin body of Kalmia fine sandy loam the surface layer consists of dark-gray loamy fine sand which, at a depth of about 3 inches, is underlain by light grayish-yellow loamy fine sand. This, at a depth ranging from 8 to 12 inches, grades into light-yellow loamy fine sand with a pronounced gray tinge. Below a depth ranging from 20 to 30 inches is a layer of yellow fine sandy loam or fine sandy clay, with some red, brown, and gray mottlings. This material grades into a thin layer of yellow friable firm sandy clay, with gray, brown, and reddish-yellow mottlings, and this in turn rests on gray plastic clay at a depth ranging from 40 to 45 inches. Under cultivation the surface soil is gray or light-gray loamy fine sand.

As mapped, Kalmia fine sandy loam includes small patches of Myatt fine sandy loam and Leaf fine sandy loam. Much of the included soil has a dark-gray surface soil and a yellow subsoil mottled with gray. In many places the subsoil shows distinct stratification, and layers of very fine sand or fine sand may occur at various depths in the subsoil.

Kalmia fine sandy loam is one of the widely distributed soils developed on the terraces, or second bottoms, of the county. It occupies comparatively small areas along Altamaha and Ochoopee Rivers and their larger tributaries. The lower lying areas are associated with the Leaf soils, but the higher areas are associated with the Myatt soils.

The relief of Kalmia fine sandy loam is almost level or very gently sloping toward the stream. The land lies from 5 to 25 feet above the first bottoms, and most of it is above overflow, although small streams emerging from the uplands inundate small areas for short periods. Although water seldom stands on the surface, run-off is slow, and the subsoil may remain saturated for long periods. Artificial drainage is necessary for the best agricultural utilization of this land.

About 5 percent of the soil is under cultivation, and the remainder supports a scattered growth of longleaf and slash pines, together with many small oaks.

Cotton, corn, tobacco, sweetpotatoes, peanuts, velvetbeans, cowpeas, soybeans, and oats are grown, and yields average a little lower than those obtained on Norfolk sandy loam, because of poorer drainage of the Kalmia soil, but may be higher in dry seasons, owing to a better moisture supply. Cotton yields average about two-fifths bale an acre, corn 15 bushels, tobacco 550 pounds, sweetpotatoes 80 bushels, peanuts 50 bushels, wheat 7 bushels, and oats 28 bushels. Fertilizer treatments are essentially the same as those used on Norfolk sandy loam.

The restoration and maintenance of the supply of organic matter by growing winter legumes, such as Austrian Winter peas and vetches, and plowing these under about 15 days before planting the main crop, is a very important step in the improvement of Kalmia fine sandy loam. Where drainage is not adequate, open ditches could be profitably installed. Where it is not advisable to clear this land, it could be forested with slash pine for the production of turpen-

tine, or by removing the underbrush and thinning out the trees, it could be used as permanent pasture. Bermuda grass and lespedeza grow well on this soil.

Kalmia fine sandy loam, deep phase.—The deep phase of Kalmia fine sandy loam differs from the typical soil in that the fine sand is less loamy and extends to a depth ranging from 24 to 36 inches. The soil is better drained because of its greater degree of porosity. This soil is more extensive than typical Kalmia fine sandy loam, but its relief and general distribution are about the same.

About 2 percent of the land is tilled, and the rest supports a scattered growth of longleaf and slash pines, together with many small oaks. The same crops are grown as on typical Kalmia fine sandy loam, but yields are somewhat lower, owing to the thicker and more sandy layer over the fine sandy clay subsoil. Average acre yields are as follows: Cotton, about one-third bale; corn, 10 bushels; tobacco, 500 pounds; sweetpotatoes, 60 bushels; peanuts, 40 bushels; wheat, 7 bushels; and oats, 27 bushels. These crops receive the same fertilizer treatment that they receive on Norfolk sandy loam.

Increasing and maintaining the supply of actively decomposing organic matter are essential for best results in farming this soil. The deficiency in organic matter can be corrected by growing winter legumes and plowing them under 15 days before planting the main crop. Under present economic conditions it is probably best to use this soil for the production of timber and pasture, yet, potentially, it ranks among the best soils of Toombs County in quality of the tobacco, sweetpotatoes, and peanuts grown.

GRAY SANDS WITH YELLOW OR PALE-YELLOW SAND SUBSOILS

This group includes Norfolk sand, Blanton sand, and Kalmia fine sand. Norfolk sand and Blanton sand are developed on the uplands, whereas Kalmia fine sand occurs on the terraces, or second bottoms. These sands occupy almost level, undulating, or gently sloping relief and are naturally well drained. They are inherently poor, that is, they contain only a small amount of the mineral plant nutrients and, in general, only a low content of organic matter.

Only small areas of these sands are cultivated. The yields obtained depend largely on the amount of organic matter that has been incorporated with the soil, the quantity of fertilizer applied, and moisture conditions. These soils are difficult to build up to a productive state because both the mineral plant nutrients and organic matter leach readily, not only from the soil, but also from the subsoil. They are best suited for growing longleaf, loblolly, and slash pines.

Norfolk sand.—The surface soil of Norfolk sand, to a depth of about 4 or 6 inches, is gray or light-gray incoherent sand with a very small content of organic matter. Below this is dingy-yellow incoherent sand that grades, at a depth of about 12 inches, into yellow or pale-yellow loose sand which continues to a depth of more than 40 inches, where indurated sandy clay material is reached. Mapped areas of Norfolk sand include many small patches of Norfolk loamy sand; Norfolk sand, scrub phase; Norfolk sandy loam, deep phase; and Blanton sand. In cultivated fields, the surface soil has been blown from many spots, and the dingy-yellow subsoil is exposed.

Norfolk sand occupies areas contiguous to creeks and swamps in all parts of the county and covers a total area of 34.8 square miles. The relief ranges from gently sloping to sloping or hummocky, and the drainage, because of the high degree of porosity of the soil material, ranges from good to excessive.

Probably 10 percent of this soil at some time has been cleared and tilled, but, owing to a depletion of the small quantity of organic matter, these areas have been partly abandoned and are now covered with small oaks. The remainder supports a scrubby growth of turkey, post, and blackjack oaks and scattered longleaf pine.

Where cultivated, this soil is used for the production of cotton, corn, peanuts, velvetbeans, cowpeas, tobacco, sweetpotatoes, and sugarcane, but yields are lower than those obtained on Norfolk loamy sand or Norfolk sandy loam, deep phase. This land is handled and fertilized in much the same manner as is Norfolk sandy loam, except that very little terracing or contour plowing is practiced.

Although it is possible to grow many of the common crops on this soil, owing to its very leachy and droughty character, the best use for it is for the production of timber.

Blanton sand.—The cultivated surface soil of Blanton sand consists of light-gray or gray incoherent sand with a slight brown tint. At a depth of about 6 inches, this is underlain by loose grayish-yellow sand with splotches of gray and pale yellow. Below a depth of 16 inches, the light-gray splotches are more numerous, and, at a depth of 36 inches, they are large and very conspicuous. At a depth of about 60 inches, this material rests on mottled yellow and gray sandy clay. Under virgin conditions the surface soil differs, in that it has a 1-inch surface layer of dark-gray sand containing considerable loose organic matter, below which is gray incoherent sand. The relief ranges from flat to sloping, and drainage from good to excessive.

Mapped areas of Blanton sand include numerous small areas of Norfolk sand and some of Norfolk sandy loam, deep phase, and Norfolk loamy sand. In places in cultivated fields, where the surface soil has blown away, the grayish-yellow subsoil material is exposed or lies near the surface.

Blanton sand occupies small scattered bodies between areas of Norfolk sandy loam and Plummer sandy loam. It is well distributed over the county, but most of it is in the northern part. In places it extends to the top of or over stream divides. Its aggregate area is small.

Probably 10 percent of Blanton sand has been cleared, but, owing to the loss of organic matter and fertility, at least one-half of the cleared land has been abandoned and is now covered with small oaks and scattered pines. The remaining 90 percent consists of cut-over land which supports a growth of longleaf pine and turkey, post, blackjack, and evergreen oaks. Crops and fertilization practices are essentially like those on Norfolk sand. Because of its low content of actively decomposing organic matter and plant nutrients, its incoherence and openness throughout, and its consequent leachy and droughty character, yields are very low. The average acre yield of cotton is about one-fourth bale, corn 9 bushels, tobacco 450 pounds, sweetpotatoes 30 bushels, peanuts 25 bushels, wheat 6 bushels, and oats 20 bushels.

Where this soil is used for the production of crops, much better yields can be obtained by increasing and maintaining the supply of organic matter through the growing of winter legumes, such as Austrian Winter peas and vetches, and plowing them under about 15 days before planting the main crop. Probably the land can be more profitably used for the growing of slash and longleaf pines and for pasture.

Kalmia fine sand.—The 4-inch surface layer of Kalmia fine sand is gray slightly loamy fine sand containing a small amount of organic matter. Underlying this is pale-yellow somewhat loamy fine sand which shows faint mottlings or splotches of gray and yellow below a depth ranging from 30 to 36 inches. This material continues to a depth ranging from 40 to 60 inches, where yellow sandy clay, with mottlings of gray, brown and reddish yellow, is reached.

Kalmia fine sand occupies small areas in association with Kalmia fine sandy loam and its deep phase on the terraces of Altamaha and Ochoopee Rivers and their tributaries. Its total area is not large. The relief ranges from almost level to gently sloping toward the streams. The open character of the material throughout the entire soil mass provides good natural surface and internal drainage.

This soil is not farmed but is covered with an open growth of longleaf and loblolly pines and small oaks. Its present use is for the production of turpentine and as an open range for cattle, hogs, and goats. Probably the best use for the land would be the planting of slash pine for turpentine or of longleaf pine for lumber and turpentine. Better pasture than that provided by the present growth of wire grass could be obtained by removing the underbrush, thinning the trees so that the sunshine could reach the ground, and afterward sowing a mixture of Bermuda grass and lespedeza.

GRAY OR ALMOST BLACK SOILS WITH MOTTLED SUBSOILS

The gray or almost black soils with mottled subsoils are almost entirely covered with a tree growth consisting mainly of cypress, bay, or gums, in the lower situations, and slash pine elsewhere. The combined area of the soils of this group is 78.8 square miles. The gray soils included in the group are Susquehanna-Cuthbert sandy loam, Plummer sandy loam, and Leaf fine sandy loam; and the almost black soils are Myatt fine sandy loam, Kalmia-Myatt fine sandy loam, Grady clay loam, and Portsmouth sandy loam. The Plummer, Portsmouth, and Grady soils are in the upland, the Plummer soil occurring at the heads of and along small streams, on lower slopes, and in shallow basins; the Portsmouth soil in shallow depressions at the heads of small streams; and the Grady soil in shallow basins on broad ridges. The Myatt and Leaf soils are developed on stream terraces.

The relief of the soils of this group, with the exception of Susquehanna-Cuthbert sandy loam, ranges from almost level areas in shallow depressions to very gently sloping areas suitable for the use of all kinds of farm machinery and under cultivation comparatively free from erosion. With the exception of small areas where drainage has been established, however, poor drainage hinders the production of general farm crops.

All these soils are potentially capable of producing farm crops, but under present economic conditions their best use is for forestry and permanent pasture. The Portsmouth, Grady, and Myatt soils have a higher content of organic matter and plant nutrients than the Plummer and Leaf soils. Under cultivation, with adequate drainage, they, together with alluvial soils (Congaree soil material) of the Altamaha River flood plains, would be the best soils for the production of corn and vegetables. Portsmouth sandy loam differs from Myatt fine sandy loam and Grady clay loam in having a thicker surface layer of organic matter and a more friable subsoil. Grady clay loam is better supplied with organic matter than Myatt fine sandy loam and has a heavier subsoil.

After thinning the trees, removing the undergrowth, and digging ditches to carry away the excess water, excellent lowland pastures can be established on all the soils of this group, by sowing a mixture of carpet grass and Dallis grass, but the grasses probably would turn brown sooner during dry periods and suffer from excess moisture longer during wet periods on Leaf fine sandy loam, because of its heavy impervious subsoil which greatly retards absorption and movement of moisture. Where 1½- to 2-year-old slash pines are reset on the better drained areas of these soils, they attain a diameter of 9 or 10 inches at a height of 4 feet above the ground within 14 or 15 years and are then ready to be boxed for turpentine.

Susquehanna-Cuthbert sandy loam.—Susquehanna-Cuthbert sandy loam constitutes a soil complex, or mixture of soils, and comprises areas of poorly drained Susquehanna sandy loam and Cuthbert sandy loam, together with small areas of Norfolk sandy loam, Norfolk sandy loam, deep phase, Norfolk sand, Norfolk loamy sand, and Blanton sand.

The soil material in areas of Susquehanna sandy loam, to a depth of 4 inches, is dark-gray loamy sand with small white quartz gravel strewn over the surface. Below this is grayish-yellow loamy sand which, at a depth of about 6 inches, grades into heavy plastic clay mottled dull red, gray, and yellow. With increase in depth, this material has more of the gray color and rests, at a depth ranging from 15 to 40 inches, on a highly indurated formation composed of sand, silt, and clay materials cemented by colloidal clay. This formation is dominantly white or gray with red, purple, and yellow streaks, and outcrops of it are common on lower slopes contiguous to creek swamps, especially along Rocky Creek.

The soil material in areas of Cuthbert sandy loam has essentially the same color as Norfolk sandy loam, but it is decidedly heavy, tough, and compact in the subsoil, and not plastic like the subsoil of Susquehanna sandy loam.

The topmost layers of included spots consist of coarse gray sand containing much quartz gravel and a few brown pebbles. Underlying this, at a depth of about 4 inches, is pale-yellow incoherent coarse sand which, at a depth ranging from 15 to 30 inches, grades into yellow sandy loam, and this, at a depth ranging from 20 to 40 inches, into mottled gray, yellow, and dull-red plastic clay.

Susquehanna-Cuthbert sandy loam occupies lower slopes, steep escarpments, and knolls adjacent to stream swamps, where seepage water finds its way to the surface. It occurs in all parts of the county, especially the western part.

Practically none of this soil is cultivated, but it supports a scattered growth of slash and longleaf pines and an undergrowth of wire grass and is used as open range pasture for cattle, hogs, and goats. Transplanting slash pine for the production of turpentine has already proved profitable on this soil. Because of an almost constant moisture supply through seepage, this soil, with some ditching, cutting of the underbrush, and thinning of the trees, so that the sunshine can reach the ground, would be well adapted to such lowland pasture grasses as Dallis grass and carpet grass. Longleaf pine and slash pine do well. The best use for this soil complex is forestry and pasture.

Grady clay loam.—Grady clay loam consists of very dark gray or almost black clay loam or mucky clay loam, with a large content of organic matter. At a depth ranging from 6 to 10 inches, this is underlain by light-gray silty clay which, at a depth of about 24 inches, grades into light-gray silty clay with red and ocher-yellow mottlings. At a depth of about 30 inches, this rests on gray plastic clay containing yellow mottlings.

Practically all areas of Grady clay loam are surrounded by a fringe of Grady fine sandy loam, ranging from 50 to 150 feet in width, and where the area is small this may be the dominant soil. As mapped, these fringes of Grady fine sandy loam are included with Grady clay loam. Grady fine sandy loam consists of very dark gray or almost black sandy loam, with a very high content of organic matter, grading into light-gray loamy sand at a depth ranging from 8 to 12 inches. Below a depth of 18 inches, the texture is sandy loam, and, at a depth of about 24 inches, this is underlain by light-gray sandy clay which rests on gray plastic clay at a depth ranging from 28 to 36 inches.

Most of the areas of Grady clay loam are in the southeastern quarter of the county, and small bodies are southeast of Vidalia and south of Lyons. This soil is developed in shallow isolated basins or saucerlike depressions where water stands during most of the year.

Less than 1 percent of this soil has been drained, cleared, and put under cultivation, but on the cultivated areas some of the best corn and sugarcane crops in the county are produced, and carpet grass and Dallis grass afford excellent pasture. The soil in the wetter situations supports an almost pure stand of cypress, and the normally moist areas are covered with cypress, slash pine, black pine, and pond pine, interspersed with bay, swamp white oak, water oak, sweetgum, black gum, and red maple.

When economic conditions warrant clearing, draining, and preparing this soil for cultivation, it will rank among the best soils in the county for the production of corn, sugarcane, garden vegetables, and lowland pasture grasses, such as carpet grass, Dallis grass, lespedeza, and white clover.

Plummer sandy loam.—Plummer sandy loam, to a depth of 4 inches, is gray or light brownish-gray rather loose sand. Below this depth the soil contains specks or mottlings of gray or ocher yellow, indicative of a waterlogged condition. At a depth of about 12 inches the material is gray or brownish-gray loamy sand with gray mottlings. This becomes heavier with increasing depth and rests, at a depth ranging from 22 to 30 inches, on heavy plastic gray sandy clay with ocher-yellow, whitish-gray, brown, and red spots.

Along drainage courses this soil is wetter, less uniform in color and texture, and includes some recently deposited alluvial material which may range from gray or grayish-brown to dark-gray or dark grayish-brown fine sandy loam, loam, or silty clay loam. In areas where the soil extends far up the slopes, it has some of the characteristics of Blanton sand. Also included are numerous small areas of Susquehanna-Cuthbert sandy loam.

Plummer sandy loam occurs in all parts of the county around streamheads, along branches, on lower slopes, and in basins where seepage waters ooze out at the surface. Its total area is 49 square miles. The relief ranges from gently sloping to basinlike. Seepage waters from the higher lying soils keep the land wet during a large part of the year.

Less than 1 percent of this land on the higher lying areas is cleared. The areas along the lower slopes and on flats are covered mainly with a scattered growth of slash pine, together with some longleaf pine and black pine, but in the swamps along small streams the cover consists of a heavy growth of slash, black, and pond pines, black gum, sweetgum, water, willow, and laurel oaks, pondcypress, water-elm, bay, magnolia, cypress, red maple, sycamore, poplar, and Ogechee lime, together with an undergrowth of titi, myrtle, smilax, gallberry, saw palmetto, briers, and laurel.

With adequate drainage, where cultivated, this soil returns good yields of sugarcane, oats, and late corn. Because of its constantly moist condition and freedom from disease, it is invariably selected for tobacco plant beds. Such pasture grasses as carpet grass, Dallis grass, lespedeza, and white clover do well in places where the trees have been thinned and the sunshine can reach the ground, the undergrowth has been cut, and drainage has been installed. The most profitable use for this soil is for permanent pasture and forestry. Small slash pines, from 1½ to 2 years old, are, in places, reset for the production of turpentine on Plummer sandy loam. After 14 or 15 years they measure 9 or 10 inches in diameter at a height of 4 feet above ground and are then ready to be boxed for turpentine.

Portsmouth sandy loam.—Portsmouth sandy loam, to a depth ranging from 12 to 24 inches, consists of very dark gray or almost black loamy or mucky sand, very high in organic matter. This grades downward into gray sticky sandy loam. Underlying this, at a depth ranging from 40 to 60 inches, is mottled gray and yellow rather plastic clay.

The largest area is southwest of Ohoopee, and smaller bodies are near Normantown. This is the least extensive soil in the county.

Areas of this soil are flat or slightly depressed, and the slope is not sufficient for run-off of rain water; consequently the land remains in a waterlogged condition during most of the year.

This soil has never been cleared. It is covered with a heavy stand of bay, with some magnolia, sweetgum, black gum, water oak, slash pine, and black pine, together with an undergrowth of smilax, myrtle, laurel, huckleberries, and briers. Its use as open range for cattle, hogs, and goats, for turpentine, and for lumber is probably the best under present economic conditions. When drained and cleared, however, this soil will produce good yields of corn, sugarcane, and most of the truck crops commonly grown; and carpet grass, lespedeza, and white clover will afford excellent pasture.

Myatt fine sandy loam.—The 5- or 7-inch surface layer of Myatt fine sandy loam is dark-gray or gray loamy fine sand which contains much organic matter. Under this is gray fine sand which is loamy below a depth of 12 or 14 inches and grades into gray fine sandy loam mottled with yellow at a depth ranging from 15 to 30 inches. This material becomes heavier with increasing depth and rests on rather heavy clay, mottled yellow, gray, and brown, at a depth ranging from 20 to 36 inches.

Variations from the typical soil are common. In some places Myatt fine sandy loam grades toward Kalmia fine sandy loam, the proportion of yellow mottling increasing in the subsoil, and, in other places it grades toward Okenee fine sandy loam, and the dark-gray or almost black surface layer attains a thickness of 8 or 10 inches. In places on the terraces along Altamaha River the texture of the surface soil and upper part of the subsoil is medium sand; whereas in other places it may be very fine sandy loam or loam. As mapped, the Myatt soil includes numerous small areas of Kalmia fine sandy loam and Leaf fine sandy loam.

Myatt fine sandy loam occurs on the terraces along Altamaha and Ochoopee Rivers and their main tributaries, in association with Kalmia fine sandy loam. It is the most extensive soil developed on the stream terraces and covers a total area of 12.2 square miles. The relief is featured by sloughs, shallow basins, and flats, where waters from short upland drainageways collect and maintain the soil in a wet condition during most of the year.

This soil is not cultivated but is forested with a scattered growth of slash pine and black pine, with bay, red maple, water oak, swamp white oak, sweetgum, black gum, and cypress in the wetter places. The frequent burning of the forest and the use of the land for open range for hogs and goats destroy the young pine trees which, within 15 years if not disturbed would attain sufficient size for the production of turpentine.

At present the best use for this land is pasture and forestry. By cutting the underbrush and thinning the trees so that the sunshine may reach the ground, much better pasture than the present wire grass can be obtained by sowing a mixture of carpet grass and Dallis grass. This is potentially a good soil for the growing of corn and sugarcane and, with artificial drainage, could be used for these crops, provided future demand would warrant such use.

Kalmia-Myatt fine sandy loam.—Kalmia-Myatt fine sandy loam consists of a very intimate mixture of areas and narrow strips of Kalmia fine sandy loam and Myatt fine sandy loam, the Kalmia soil predominating in most places. It covers a small total area on the terraces along Altamaha and Ochoopee Rivers and their principal tributaries. The relief ranges from that of the Kalmia fine sandy loam areas gently sloping toward the streams to the flat or basinlike areas of Myatt fine sandy loam. Both surface and internal drainage of the Kalmia soil are fair or good, but drainage of the Myatt soil is very poor.

Land of this kind is not cultivated but supports a scattered growth of pines and small oaks, together with an undergrowth of wire grass. It is used as open range pasture for cattle, hogs, and goats. Much more profitable pasture could be obtained by cutting the underbrush, thinning the trees so that the sunshine could reach the ground, and

sowing a mixture of carpet grass and Dallis grass. This soil is well adapted to the growing of slash pine, for the production of turpentine, and longleaf pine for lumber.

Leaf fine sandy loam.—In wooded areas of Leaf fine sandy loam a 1-inch organic layer, having a dark-gray color, overlies the mineral soil. This is underlain by gray or brownish-gray loamy fine sand which passes abruptly, at a depth ranging from 10 to 18 inches, into a 2- or 3-inch layer of yellow plastic clay with gray mottlings. This material rests on mottled or streaked grayish-brown, gray, yellowish-gray, and reddish-brown plastic clay which continues to a depth of more than 40 inches.

Leaf fine sandy loam is not uniform throughout, as in places the soil material includes layers of very fine sand or silt at almost any depth below the surface. As mapped, this soil includes many small areas of Myatt fine sandy loam and Kalmia fine sandy loam.

Most of the Leaf fine sandy loam areas are on the terraces of Altamaha and Ochopee Rivers, and a few small bodies are on the terraces along Pendleton Creek. The total area is not large. This soil lies from 10 to 25 feet above the normal level of the streams, and the lower parts are overflowed during very high water. The land is almost level. This feature, together with the impervious subsoil, results in very restricted drainage.

This soil is not cultivated. It is covered largely with an open forest growth of slash pine and black pine. Its present use for the production of turpentine and lumber, and for open range grazing, is probably the best. Many more slash pines for the production of turpentine could be planted with profit, and where this soil is near farms or is easily accessible it might pay to cut the underbrush and thin the trees for a permanent pasture of carpet grass and Dallis grass. Grasses tend to dry more rapidly during droughts, because of the impervious subsoil, than do those grown on the Plummer and Myatt soils.

MISCELLANEOUS SOILS AND LAND TYPES

This group comprises alluvial soils (Congaree soil material), Norfolk sand, scrub phase, and swamp, which, at present, are not used for agricultural purposes, except for the scant pasture they provide and for the production of trees. Norfolk sand, scrub phase, is inherently poor and unfit for the production of general farm crops, and its best use is for forestry. Alluvial soils (Congaree soil material) are inherently the most fertile soils in the county. They are developed from sediments brought down largely from the Piedmont Plateau section and deposited along Altamaha River. They are subject to frequent and deep overflows. The areas of swamp are saturated or covered with water the greater part of the year. The members of this group are best suited for summer and fall pasture and for forestry.

Alluvial soils (Congaree soil material).—Alluvial soils (Congaree soil material), to a depth of 8 or 12 inches, are brown fine or medium sandy loam, loam, or clay loam, and in many places the color has a pronounced red tinge. Below this, the brown color is modified with rust-brown and gray mottlings, although in many places the subsoil is yellow with a red tinge at lower depths. The texture of the subsoil is variable, ranging from fine sandy loam

to heavy plastic clay, but silty clay loam and sandy clay seem to dominate. The lighter textured soil occurs in the natural levees and on the higher elevations along Altamaha River, bayous, and sloughs. Much of the finer material originated in the Piedmont Plateau, whereas the coarser deposits probably are largely of Coastal Plain origin.

Included with and intimately interspersed throughout much of this Congaree soil material are small depressed areas of Wehadkee soils which have gray silty clay loam and silty clay surface soils underlain by light-gray silty clay with ocher-yellow mottlings.

Alluvial soils (Congaree soil material) occur only in the flood plains of Altamaha River. This land has an almost level surface dissected by numerous deep sloughs and bayous. Both surface and internal drainage range from fair to poor, and complete inundation by water from Altamaha River is of almost annual occurrence.

None of this land is cultivated, but it supports a heavy growth of vegetation consisting of water oak, swamp white oak, overcup oak, slash pine, spruce pine, swamp ash, red maple, river birch, black willow, water-elm, magnolia, sweetgum, black gum, water gum, red cedar, waterlocust, ironwood, hornbeam, Ogeechee lime, red haw, parsley haw, and, in the wetter places, cypress and bay.

Inherently, this Congaree soil material is the most fertile and the most equally balanced in plant nutrients of any soil in the county. If adequately drained and protected from overflow, this land will produce excellent yields of corn, hay crops, and sugarcane. If the underbrush were cut and the stand of trees thinned so that the sunshine could reach the ground, it would be possible to obtain very good stands of carpet grass and Dallis grass for permanent pastures. The best use at present is for summer pasture and forestry.

Norfolk sand, scrub phase.—Norfolk sand, scrub phase, resembles Norfolk sand in the color of its surface soil and subsoil, but it has a lower content of organic matter, is more incoherent, more porous, and the sandy clay material is at a greater depth. Because of these unfavorable characteristics, this soil is very sterile and unretentive of moisture.

Norfolk sand, scrub phase, occupies small bodies between areas of Norfolk sand and swamp along stream courses. The larger developments are along Pendleton and Tiger Creeks, and smaller areas are along Rocky and Cobb Creeks. Its aggregate extent is small. The relief ranges from gently sloping to somewhat hummocky and dune-like in places. Drainage is excessive.

This soil is not cleared. The tree growth, known as scrub, consists mainly of small turkey oak trees, with some blackjack and post oaks and scattered pine trees. Owing to its lack of organic matter, low content of potassium and phosphorus, and extreme porosity, soil of this phase should be used only for forestry. If protected from fires, hogs, and goats, slash and longleaf pines would grow well.

Swamp.—The areas classed as swamp comprise flood plains along streams that are subject to frequent inundation and remain wet during a large part of the year. Because of the intermingling of soils, the dense undergrowth, and the wet condition it was impractical to attempt to make proper type and series separations. The soil material has been washed mainly from local upland soils. The soils present include Johnston fine sandy loam, loam, and clay loam, all which

have dark-gray surface soils and gray subsoils; Thompson fine sandy loam, having a gray sand or loamy sand surface soil and a pale-yellow sandy loam or sandy clay subsoil, with gray mottlings below a depth of 20 inches; and Chastain fine sandy loam, having a grayish-yellow or dark-gray fine sandy loam surface soil underlain by a light-gray or pale-yellow fine sandy loam upper subsoil layer which, at a depth of about 26 inches, rests on mottled red, gray, and yellow plastic impervious clay. Considering the material as a whole, it is not uniform in color, texture, or consistence.

Swamp is not cleared, but it affords fair range for cattle, hogs, and goats during the driest part of the year. It is covered with a heavy growth of vegetation consisting of slash pine, black pine, red maple, sweetgum, black gum, bay, sycamore, water oak, water-elm, and cypress, together with an undergrowth of titi, jessamine, smilax, myrtle, saw palmetto, gallberries, and briers. Most of the good timber has been removed. The best use of this land is for the production of timber and for summer and fall grazing.

LAND USES AND AGRICULTURAL METHODS

The farmers of Toombs County recognize that the soils on their farms and throughout the county differ greatly in respect to their adaptation to crops and other agricultural uses. Practically all of the cultivated soils, particularly those that have been clean cultivated for a long time, are very deficient in organic matter. Their greatest need is a system of management that will include the increase and maintenance of organic matter. Organic matter in soil tends to increase the moisture-holding capacity, retards loss of moisture by surface evaporation, aids in warming the soil by the absorption of heat, helps to overcome the tendency to run together or puddle, in holding the soil in place tends to control erosion, gives better tilth, and in decomposing supplies nitrogen and liberates other plant nutrients. Organic matter can best be supplied by growing and turning under legumes, including velvetbeans, cowpeas, crotalaria, lespedeza, Austrian Winter peas, vetches, peanuts, soybeans, and kudzu.

Many of the better farmers supply the soil with organic matter by planting velvetbeans, cowpeas, peanuts, and soybeans in the cornfields. After the corn ears have been snapped off, hogs and cattle are pastured on the beans, peas, and peanuts, and the organic matter remaining is turned under before the land is prepared for cotton. This method is very helpful in maintaining a supply of actively decomposing organic matter in the soil but is insufficient for increasing the amount. A winter cover crop seems most efficacious for increasing organic matter in the soil, as it reduces leaching during the winter, helps to prevent erosion, and does not interfere with the summer crop. If cotton or corn follows the winter cover crop, the latter should be plowed under at least 15 days before corn or cotton is planted.

An experiment carried on from 1931 to 1933 at Albany, Ga., by E. D. Fowler and R. D. Lewis, of the Division of Soil Fertility Investigations, Bureau of Chemistry and Soils, to determine how the supply of organic matter, total nitrogen, and nitrate nitrogen could be increased, showed the highest average nitrate nitrogen and moisture content of the soil in 1933 where Norfolk sandy loam was seeded to Austrian Winter peas or Monantha vetch, or a combination of these.

The winter cover crop was disked into the soil and the soil cultivated during the summer. In places where this cover crop was allowed to die and remain on the ground undisturbed during the summer, the total increase in nitrogen was greater than where the green cover crop was turned under. Where velvetbeans were planted in the summer, the soil showed the greatest increase of nitrogen. The results of this experiment are especially applicable to the soils of Toombs County, as one-third of them consists of Norfolk sandy loam and its deep phase.

To increase and maintain organic matter in Tifton sandy loam (7), experiments with winter cover crops, followed by cotton or corn, were conducted from 1926 to 1933 on the farm of the Georgia Coastal Plain Experiment Station near Tifton, Ga. The rotation consisted of corn, a winter cover crop, and cotton. No fertilizer was applied to the cover crop. The results of the experiments are given in table 5.

TABLE 5.—Fertilizers used and yields of cotton and corn following green-manure cover crops

Cover crop	Fertilizer for cotton ¹	Average acre yield of seed cotton	Fertilizer for corn ²	Average acre yield of shelled corn
		<i>Pounds</i>		<i>Bushels</i>
Austrian Winter peas.....	0-9-5	1,346	0-10-4	56.5
	3-9-5	1,331	2-10-4	52.7
Monantha vetch.....	0-9-5	1,166	0-10-4	50.0
	3-9-5	1,441	2-10-4	52.5
Hairy vetch.....	0-9-5	1,140	0-10-4	47.7
	3-9-5	1,391	2-10-4	51.1
None.....	0-9-5	744	0-10-4	37.6
	3-9-5	1,018	2-10-4	39.7

¹ 1,000 pounds per acre.

² 500 pounds per acre.

Seeding of winter cover crops should be made in October. A mixture of peas, vetch, or oats for hay or grazing has the advantage of giving variety for grazing and makes the cutting and curing of hay easier. Austrian Winter peas furnish all the nitrogen needed for cotton or corn, hence an 0-9-5 for cotton or an 0-10-4 for corn is recommended.

As this experiment was on Tifton sandy loam under similar climatic conditions as those prevailing in Toombs County, it seems that comparable results might be obtained on Tifton sandy loam in this county. Norfolk sandy loam also would respond very favorably to such treatment.

Based on the results of the above-described experiment, together with facts gained locally by experimenting with various cover crops, the county agricultural agent recommends Austrian Winter peas and hairy vetch as winter cover crops to be rotated with cotton and corn. Both hairy and smooth vetches are recommended by the Georgia Coastal Plain Experiment Station. Both the county agricultural agent and the experiment station recommend that, on well-cultivated Tifton sandy loam or Norfolk sandy loam, an acre application ranging from 600 to 800 pounds of a 3-9-5 fertilizer should be used for cotton, but on poorly cultivated land such large quantities would not give satisfactory results. On the deep phases of well-cultivated Norfolk sandy loam, Norfolk fine sandy loam, and Kalmia fine sandy

loam; and on Norfolk loamy sand, the preferred soils of this county for tobacco, sweetpotatoes, and commercial peanuts, it is recommended that from 1,000 to 1,200 pounds per acre of a 3-8-5 or 3-8-8 fertilizer be applied for tobacco, 600 to 800 pounds of a 4-8-8 or 4-8-10 for sweetpotatoes, and 400 pounds of a 2-10-4 for commercial peanuts.

For a soil-building legume to be grown in the summer (6), velvetbeans are recommended for Tifton sandy loam and Norfolk sandy loam, and *Crotalaria spectabilis* for the deep phase of Norfolk sandy loam and Norfolk sand. The beans are valuable feed for livestock, but crotalaria is used only as a green-manure crop. The Otootan variety of soybean is recommended for hay, as it is a heavy yielder, has slender stems suitable for curing, is disease-resistant, and holds its leaves well during rainy periods when cutting may be delayed.

Possibly second in importance as a requirement for maintaining the fertility of the agricultural soils is proper terracing, contour plowing, ditching, and the growing of cover crops to counteract erosion. Under cultivation, at least 90 percent of these soils are subject to more or less detrimental washing. Forest lands are damaged by fires. On rolling land, the grass, in many places, has been so completely burned that almost nothing has been left to check the run-off, so that sheet erosion and gullying have ensued.

The average farmer could very profitably devote more attention to his subsistence garden (9). Records show that the area used in planting a home garden, if properly handled, will give greater returns than any other area of equal size on the farm. Fully 80 percent of the soils, with drainage provided where needed, are well adapted for gardens. The Georgia Coastal Plain Experiment Station advises an application, at least 2 weeks before planting, ranging from 30 to 60 pounds of well-rotted manure and 5 to 10 pounds of a high-grade commercial fertilizer to each 100-foot row. It has been proved, by setting aside perhaps three-fourths of an acre for a family of five and following a 3-year rotation, that nematode injury may be held in check and much trouble from other diseases and insects eliminated. Crops, such as corn, oats, velvetbeans, and North Carolina peanuts are recommended for this rotation.

In addition to better gardens, a much larger variety of fruits and nuts could be grown for home use (6). With proper spraying and cultural practices, peaches, of the Imperial, Late Crawford, Taber, Early Rose III, and Victoria varieties, succeed well on the heavier Norfolk soils. Chinese Sand and Pineapple pears also do well on these soils. The muscadine type of grape is preferable. The Hunt gives the highest yield, but the Stuckey leads in quality. Figs, jujubes, Satsuma oranges, and blueberries succeed well on soils such as those in Toombs County.

Tifton and Norfolk, the dominant agricultural soils of this county, are numbered among the eight soil series on which 99 percent or more of the pecans of southeastern United States are grown. To succeed with pecans, the growing of leguminous crops for green manure and proper fertilization are imperative. Fowler and Lewis (2) state:

* * * it is encouraging to note what a consistent effort to maintain fertility has done in our experimental plots and in those orchards where soils are naturally more fertile or where a good soil-maintenance program has been continued over

a period of years. Trees are more vigorous through the year and are less affected by critical droughts than poorly nourished trees. The sets of nuts have been greater, the yields more, and the grades and quality better than those of the same variety grown under less favorable conditions.

Today about one-half of the farmers raise hogs, cattle, and goats for the market. Almost all of the goats, and many hogs and cattle, depend on the open range for their subsistence, finding wire-grass pasture and mast on both well drained and poorly drained soils. Hogs are finished by allowing them to feed in fields of sweetpotatoes and peanuts, and both hogs and cattle by turning them into fields of velvetbeans, peanuts, cowpeas, and soybeans after the corn is harvested. Duroc-Jersey and Poland China are the more important breeds of hogs. Jersey grades comprise most of the dairy cattle. Most of the cattle sold for beef are of the dairy type, but some Herefords and a few Shorthorns are raised on some farms.

The production of livestock could be profitably extended, provided suitable pastures were developed (6). For lowland permanent pastures, poorly drained Plummer sandy loam was selected on the farm of the Georgia Coastal Plain Experiment Station near Tifton. The underbrush was removed and the trees thinned, so that the sunshine could reach the ground. A ditch was dug for the main drainage and small lateral ditches, more or less parallel, extended from the main ditch to drain the seepage waters from the hillsides and lower the ground water level. After this, the land was thoroughly cut with a disk harrow, in order to destroy wire grass and sedges and thereby furnish a good seedbed. A mixture of carpet grass, Dallis grass, lespedeza, and white clover proved the most suitable for permanent lowland pastures. Grasses, lespedeza, and white clover can be mixed and sown in late February or March. Lespedeza will furnish grazing the first year, but carpet grass and Dallis grass will not offer much grazing before the second year. There is a total area of 49 square miles of Plummer sandy loam, principally along the many small streams, in this county. The soil is essentially like that in the above-described area, and comparable pastures could be similarly obtained. In addition, about 25 square miles of other poorly drained land, including alluvial soils (Congaree soil material), Myatt fine sandy loam, Grady clay loam, and Portsmouth sandy loam, probably would give equally good returns if properly drained and the tree growth thinned. Leaf fine sandy loam and Susquehanna-Cuthbert sandy loam could also be utilized in a similar manner.

The most satisfactory upland permanent pasture on the farm of the Georgia Coastal Plain Experiment Station near Tifton was obtained by seeding Tifton sandy loam with a mixture of lespedeza and Bermuda grass. As a temporary pasture, kudzu provided grazing for one steer per acre from April 4 to November 14, with a gain of 257 pounds an animal. Another good temporary pasture was obtained by seeding lespedeza broadcast on oats in early March, and a third excellent temporary pasture on Tifton sandy loam consisted of a combination of Austrian Winter peas, hairy vetch, and oats, which were turned under about June 1, after which the land was seeded broadcast to Sudan grass. The above-mentioned experiments indicate that Toombs County has a reserve, now in upland forest,

of excellent potential pasture land, represented by about 25 square miles of Tifton sandy loam and Tifton fine sandy loam, and 25 square miles of Norfolk sandy loam.

MORPHOLOGY AND GENESIS OF SOILS

Toombs County is situated in the pine-forest section of the Red and Yellow soils region of the United States. About 75 percent of the soils in this county have grayish-brown or brownish-gray surface soils and have been formed under the normal regional moisture conditions under a cover of pine forest which is unfavorable to the accumulation of much organic matter. With a temperate climate and a rainfall sufficiently heavy to cause the downward movement of moisture for a large part of the year, soil eluviation and leaching have ensued. About 22 percent of the soils have gray or dark-gray surface soils. The soil material originated under wet conditions, where free water existed during long periods, to the point of soil saturation, thus inhibiting the action of the normal soil-developing forces. The remaining 3 percent of the county is in the flood plain of Altamaha River, where the surface soils are brown.

The surface configuration of the upland part of the county is the result of stream erosion, except in a very small total of flat and basin-like areas that occupy higher elevations where streams have not yet developed. The county consists of a comparatively smooth plain with shallow valleys along streams. The substrata are unconsolidated irregularly bedded sands, clays, and gravel of the Altamaha formation (8, pp. 58 and 59). These comprise marine terrace deposits of the Atlantic Coastal Plain. Hazlehurst terrace, which includes all of Toombs County, is the highest and most remote from the Atlantic Ocean of the marine coastal-plain terraces. Its altitude ranges from 215 to 260 feet above sea level.

The relative position of this county on the Hazlehurst terrace, together with its relief and the character of its soil materials, has determined the drainage which, in turn, has been the dominant factor in determining the distribution of the soils. Mature soil development has taken place on the smooth gentle slopes of ridges composed of fairly pervious friable materials, in which the movement of water and air has been comparatively free. Soil formation on the broad flat ridges and stream terraces has been intensive, but, as drainage ranges from fair to good, a distinct solum has formed. The minimum soil development of the upland soils is in shallow depressions of broad interstream areas, on seepage slopes, around the heads of streams and along their courses; and also on stream flood plains and on flats and in depressions on stream terraces, where drainage conditions have been continuously restricted.

Drainage, relief, and character of parent material, named in the order of their importance, have been the principal controlling factors in determining the stage of soil development. Immediately subsequent to the recession of the sea, parent materials were the dominant factors in soil genesis, and to a considerable depth the textures and consistencies of the materials were fairly uniform. As time went on, stream systems developed, and the soil materials left at higher elevations, where drainage conditions were normal for the general region, were subjected to leaching and a downward move-

ment of fine material. These processes continued until a podzolic solum developed on ridges and stream terraces.

Due to drainage conditions, two groups of light-colored soils have resulted—(1) well-drained soils and (2) imperfectly drained soils. Tifton sandy loam is typical of the group of well-drained soils which best present the essential soil features of the normally developed Yellow soil profile of the region. This soil is both podzolic and lateritic. There has been an increase of silica in the A horizon, a translocation of colloids and of sesquioxides to the B horizon, and a leaching of carbonates from the solum.

The soils range from medium to strongly acid. Table 6 gives the results of pH determinations on samples of five soils from this county. These determinations were made by E. H. Bailey, in the laboratories of the Bureau of Chemistry and Soils by the hydrogen-electrode method.

TABLE 6.—pH determinations of five soils from Toombs County, Ga.

Soil type and sample No.	Depth	pH	Soil type and sample No.	Depth	pH
Tifton sandy loam:	<i>Inches</i>		Grady clay loam—Contd.	<i>Inches</i>	
259301.....	0 - 1½	5.8	259343.....	15-25	4.4
259302.....	1½- 2½	5.2	259344.....	25-40	4.4
259303.....	2½-14	5.6	Kalmia fine sandy loam:		
259304.....	14 -25	5.8	259307.....	0- 3	5.6
259305.....	25 -55	4.9	259308.....	3-10	5.1
259306.....	55 -80+	4.5	259309.....	10-16	5.1
Norfolk sandy loam:			259310.....	16-19	5.0
259334.....	0 - 4	5.2	259311.....	19-30	4.3
259335.....	4 -20	5.6	259312.....	30-39	4.1
259336.....	20 -26	4.6	259313.....	39-50	4.8
259337.....	26 -40	4.7	Leaf fine sandy loam:		
259338.....	40 -54	4.6	259314.....	0- 5	4.3
259339.....	54 -60	4.6	259315.....	5-10	4.4
Grady clay loam:			259316.....	10-14	4.4
259340.....	0 - 5	5.0	259317.....	14-19	4.3
259341.....	5 -10	4.9	259318.....	19-44+	4.5
259342.....	10 -15	4.5			

Tables 7 and 8 (4) give the results of the chemical and mechanical analyses of Tifton sandy loam from Irwin County, Ga., and of Norfolk sandy loam from Mitchell County, Ga. It is believed that these analyses represent the conditions of these two soils in Toombs County.

TABLE 7.—Composition of Tifton sandy loam from Ocilla, Irwin County, Ga.¹CHEMICAL²

Depth (inches)	SiO ₂	TiO ₂	Fe ₂ O ₃	Al ₂ O ₃	MnO	CaO	MgO	K ₂ O	Na ₂ O	P ₂ O ₅	SO ₂	Ignition loss	Total	N	CO ₂ from carbonates
	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>
3-10.....	a 92.09 b 94.01	0.44 .45	1.15 1.17	3.71 3.79	0.029 .030	(³) (³)	(³) (³)	0.15 .15	0.17 .17	0.01 .01	0.03 .03	2.06	99.84 99.81	0.014	0 0
11-22.....	a 79.67 b 83.66	.57 .60	3.47 3.64	11.39 11.97	.010 .010	(³) (³)	0.11 .12	.13 .14	.21 .22	(³) (³)	.01 .01	4.77	100.34 100.37	.019	0 0
22-36.....	a 73.40 b 78.29	.68 .72	4.93 5.23	14.70 15.67	.013 .014	(³) (³)	.12 .13	.17 .18	.14 .15	.01 .01	.09 .10	6.15	100.40 100.49	.021	0 0
37-54.....	a 52.14 b 58.37	1.34 1.50	9.92 11.10	25.24 28.25	(³) (³)	(³) (³)	.12 .13	.55 .62	.32 .36	.16 .18	.10 .11	10.65	100.54 100.62	.006	0 0
55-70.....	a 62.36 b 67.61	1.01 1.09	8.97 9.72	19.45 21.08	.008 .009	(³) (³)	.06 .07	.57 .62	.38 .41	.10 .11	.07 .08	7.77	100.74 100.80	.000	0 0

MECHANICAL

Depth (inches)	Fine gravel (2-1 mm)	Coarse sand (1-0.5 mm)	Medium sand (0.5-0.25 mm)	Fine sand (0.25-0.1 mm)	Very fine sand (0.1-0.05 mm)	Silt (0.05-0.005 mm)	Clay (0.005-0.000 mm)	Total mineral constituents
	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>
3-10.....	4.1	18.6	9.0	24.4	4.4	32.2	7.0	99.7
11-22.....	2.3	13.7	8.6	20.3	4.6	26.6	23.8	99.9
22-36.....	1.6	10.8	5.8	15.4	6.3	23.7	36.4	100.0
37-54.....	.4	3.9	2.6	6.6	3.0	25.7	57.7	99.9
55-70.....	2.6	6.2	3.4	14.8	10.0	18.6	44.5	100.1

¹ Collected by Mark Baldwin and E. D. Fowler.² Analyzed by G. Edgington and G. J. Hough.³ Trace.⁴ Analyzed by J. B. Spencer.

NOTE.—a Indicates whole soil, oven-dried at 110° C.; b, whole soil calculated to mineral constituents only.

TABLE 8.—Composition of Norfolk sandy loam from Raiford, Mitchell County, Ga.¹

CHEMICAL²

Depth (inches)	SiO ₂	TiO ₂	Fe ₂ O ₃	Al ₂ O ₃	MnO	CaO	MgO	K ₂ O	Na ₂ O	P ₂ O ₅	SO ₃	Ignition loss	Total	N	CO ₂ from carbonates
	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>
0-7	a 93.07 b 95.03	0.34 .35	1.10 1.12	2.27 2.32	0.050 .050	0.60 .61	0.14 .14	0.16 .16	0.24 .25	0.09 .09	0.01 .01	2.07 2.46	100.14 100.13	0.030 .020	0 0
8-12	a 89.44 b 91.71	.44 .45	2.07 2.12	4.97 5.10	.030 .030	.30 .31	.06 .06	.23 .24	.30 .31	.05 .05	.00 .00	2.46 3.80	100.35 100.38	.020 .020	0 0
13-18	a 83.28 b 86.60	.53 .55	3.20 3.33	8.35 8.68	.010 .010	.60 .62	.08 .08	.16 .17	.31 .32	.06 .06	.00 .00	3.80 4.22	101.38 100.42	.020 .020	0 0
19-30	a 80.08 b 83.61	.65 .68	4.00 4.18	11.35 11.83	.005 .005	.36 .38	.08 .08	.20 .21	.31 .32	.05 .05	.02 .02	4.22 4.54	101.32 101.37	.020 .010	0 0
31-70	a 79.85 b 83.68	.71 .74	3.20 3.35	10.42 10.92	.005 .005	.30 .31	.12 .13	.25 .26	.39 .41	.07 .07	.00 .00	4.54 99.88	99.88 99.88	.010 0	0 0

MECHANICAL³

Depth (inches)	Fine gravel (2-1 mm)	Coarse sand (1-0.5 mm)	Medium sand (0.5-0.25 mm)	Fine sand (0.25-0.1 mm)	Very fine sand (0.1-0.05 mm)	Silt (0.05-0.005 mm)	Clay (0.005-0.000 mm)	Total mineral constituents
	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>
0-7	1.6	10.5	15.3	33.0	22.6	8.7	8.2	99.9
8-12	.9	8.7	13.4	32.3	20.2	8.4	16.2	100.1
13-18	.6	6.8	11.9	36.4	10.1	8.3	25.7	99.8
19-30	.9	5.9	9.2	30.3	16.4	7.6	29.6	99.9
31-70	.9	6.6	8.8	27.9	15.7	8.8	31.2	99.9
71-82	2.8	13.6	14.2	22.6	11.3	9.5	26.1	100.1

¹ Collected by Mark Baldwin.

² Analyzed by G. J. Hough.

³ Analyzed by A. A. White.

NOTE.—a Indicates whole soil, oven-dried at 110° C.; b, whole soil calculated to mineral constituents only.

Following is a description of a profile of Tifton sandy loam as observed $2\frac{1}{2}$ miles south of Gainy Ford Bridge and west of United States Highway No. 1:

The A horizon consists of loamy sand about 14 inches thick. The upper 1-inch layer (A_1) is very dark gray loamy sand. The dark color has been imparted largely by the finely divided organic matter derived mainly from the decay of wire grass roots and intimately intermixed with the mineral constituents of the soil. The underlying layer ($A_{1,1}$), to a depth of 2 inches, is grayish-brown loamy sand, in which is admixed a small amount of organic matter. The lower layer (A_2), in which the maximum degree of leaching has taken place resulting in the lightest color in the profile, is light brownish-yellow loamy sand. Scattered over the surface and distributed throughout this horizon are numerous brown, reddish-brown, or almost black rounded and smoothly angular hard ferruginous accretions, ranging in diameter from one-tenth of an inch to more than 3 inches. Between the A and B horizons is a transitional layer, about 2 inches thick, in which the material, with increase in depth, becomes rapidly heavier. The texture is sandy loam and the color is bright, deep yellowish brown. The material under pressure falls apart into small irregularly shaped lumps.

The B horizon is friable sandy clay, about 30 inches thick, of which the upper 9-inch layer (B_1) exhibits a bright, deep yellowish-brown color, a sandy clay texture, a large number of hard ferruginous accretions, and a tendency, when subjected to pressure, to break down to a friable mass. The lower layer (B_2) is brownish-yellow sandy clay with dim mottlings or streaks of reddish yellow, reddish brown, and gray. The reddish-brown streaks are incipient ferruginous accretions.

In all parts of the A and B horizons, small pores are present in great numbers. Small roots, some living and others in various stages of decomposition, are present in many of the pores. Through this process of decomposition the iron oxide on the walls is reduced, and a very thin gray coating results. In other pores and channels, especially in the B_2 layer, the walls are, in many places, coated with iron oxide which seemingly has been deposited from solution.

The C horizon consists of streaked, mottled, or splotted red, brown, gray, reddish-brown, yellowish-brown, purplish-red, or purplish-brown sandy clay. The iron accretions, which consist of sand, silt, and clay cemented by iron oxide and colloidal clay, are softer than in the B horizon, and, at a depth of 60 inches, are represented only by reddish-brown ferruginous segregations. Coatings of gray claylike material are conspicuous along bedding and joint planes and cover the walls of pores or old root channels.

Below a depth of 60 inches, the substratum is a complex or multi-colored reddish-brown, reddish-yellow, red, and gray, indurated formation composed of clay, silt, and sand, cemented by iron oxide and colloidal clay material.

Table 9 gives the results of mechanical analyses of samples of Tifton sandy loam.

TABLE 9.—*Mechanical analyses of Tifton sandy loam from Toombs County, Ga.*

Sample No.	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Percent	Percent	Percent	Percent	Percent	Percent	Percent
259301	Surface soil, 0 to 1½ inches.....	2.9	16.0	18.1	32.5	10.4	11.4	8.8
259302	Subsurface soil, 1½ to 2½ inches.....	2.8	3.9	16.9	35.3	12.6	16.8	11.6
259303	Subsoil, 2½ to 14 inches.....	4.4	14.1	15.9	35.6	12.9	9.7	7.5
259304	Subsoil, 14 to 25 inches.....	1.8	6.7	9.6	23.8	8.9	7.8	41.5
259305	Subsoil, 25 to 55 inches.....	2.0	7.9	10.1	19.8	7.1	7.1	45.9
259306	Subsoil, 55 to 80 inches+.....	6.6	22.4	14.7	10.9	3.0	3.9	38.4

The eroded phase of Tifton sandy loam differs from the typical soil in that a large part of its A horizon has been eroded. Tifton fine sandy loam has a profile much like Tifton sandy loam, but, owing to somewhat poor drainage conditions in the lower part of the B horizon and in the C horizon, gray mottlings are common; and, owing to its comparative freedom from surface washing and because of its occurrence on level surfaces, more of the fine material has remained than in Tifton sandy loam, thus accounting in part, at least, for its finer texture.

Norfolk sandy loam is closely associated with Tifton sandy loam. In its major soil characteristics, such as distinct A, B, and C horizons, it resembles Tifton sandy loam but is unlike that soil in that its solum has a much lower content of iron oxide, more silica, less of the brown ferruginous accretions, more gray in the A₁ horizon, and paler yellow in the A₂ and B₁ horizons. The deep phase of Norfolk sandy loam differs from the typical soil only in having a thicker loamy sand layer which extends to a depth ranging from 24 to 36 inches, where it grades into sandy clay. Norfolk loamy sand differs from the deep phase of Norfolk sandy loam only in its greater depth to the sandy clay layer. Norfolk sand is rather incoherent to a depth ranging from 4 to 5 feet, where it rests on sandy clay. The scrub phase of Norfolk sand differs from the typical soil in having less organic matter in the A₁ horizon and in consisting of loose incoherent sand to a depth ranging from 6 to 10 feet. Norfolk fine sandy loam, deep phase, is unlike Norfolk sandy loam, deep phase, in that it has a finer texture, flat to gently sloping relief, and more of the gray mottlings in the lower part of the B horizon and in the C horizon, owing to somewhat restricted drainage and a little more organic matter in the A horizon. As in Tifton fine sandy loam, its freedom from erosion may account for its greater content of fine material, which gives it the fine sandy loam texture.

Blanton sand is unlike Norfolk sand in that it is more gray and incoherent throughout, has been subject to greater leaching, has gray splotches in its B and C horizons, and has less organic matter in its A horizon.

Susquehanna-Cuthbert sandy loam is a complex rather than a definite soil type. It differs from the associated upland soils in having a tough heavy compact subsoil.

Well-drained soils occurring on stream terraces are represented by members of the *Kalmia* series and the poorly drained soils by members of the *Myatt* and *Leaf* series. In many places where these soils occur, there is no noticeable escarpment between the terraces and the flood plains along the streams.

Kalmia fine sandy loam is well drained, has level relief, and has been subjected to the same processes of soil development as have members of the *Norfolk* and *Tifton* series, but its period of development has been considerably shorter, resulting in a thinner B horizon. In many places, gray mottlings, indicative of retarded development in the presence of excess moisture, are in the lower part of this horizon. The deep phase of this soil differs from the typical soil in its thicker loamy sand layer overlying the fine sandy clay layer, and it differs from *Kalmia* fine sand in having an even thicker layer of loamy fine sand over the fine sandy clay.

Under almost continuously poor drainage, soil-making processes, such as eluviation, leaching, oxidation, and aeration, are greatly restricted. Because of more or less alternate wetting and drying, together with the high temperature and heavy rainfall, decomposition of organic matter is too rapid for the accumulation of a great amount in the soil. The poorly drained soils in this county include *Grady* clay loam, *Portsmouth* sandy loam, *Plummer* sandy loam, *Myatt* fine sandy loam, and *Leaf* fine sandy loam on the stream terraces, and alluvial soils (*Congaree* soil material) on the *Altamaha* River flood plains.

Grady clay loam occupies shallow depressions or sinks. The surface soil, to a depth of 10 inches, is dark-gray clay loam, the top-most few inches being almost black, due to organic matter. The underlying material begins as mottled yellow and gray clay and passes into mottled purplish-red, brown, gray, and ochre-yellow heavy clay which is hard and smooth.

The *Portsmouth* soils resemble the *Grady* soils in their very dark color and high content of organic matter in the A horizon but differ in having a more friable C horizon.

The *Plummer* soils differ from the *Grady* soils in having a gray A horizon, with a much lower content of organic matter, and a more friable C horizon.

The A horizon of *Myatt* fine sandy loam is gray or dark-gray loamy fine sand with a fair content of organic matter but not so much as in *Grady* clay loam. The C horizon of the *Myatt* soil is much more friable than that of the *Grady* soil.

Leaf fine sandy loam is like *Susquehanna-Cuthbert* sandy loam, in that its A horizon is light colored and its C horizon contains a very impervious heavy layer, but it differs from the complex, in that it occupies flat areas on stream terraces and has developed from stream sediments.

Alluvial soils (*Congaree* soil material) occupy the flood plains of *Altamaha* River. They are composed of an admixture of fine material transported from the *Piedmont Plateau* and coarser materials from the local upland soils.

The swampland consists of such an intimate mixture of alluvial materials that no definite soil type designation can be given to it.

SUMMARY

Toombs County is located on the highest of the coastal terraces in southeastern Georgia, and the landscape presented is that of a smooth plain modified by shallow valleys. Altamaha River forms its southern boundary and Ochoopee River a part of its eastern boundary. The underlying formation, from which the parent materials of all the upland soils have been derived, consists of an intimate mixture of unconsolidated sands, silts, and clays.

Before clearing, the upland soils were covered with a growth of longleaf, loblolly, and slash pines, together with some oaks and other deciduous trees. Wire grass was the principal undergrowth.

The climate is characterized by long growing seasons, short open winters, and an average annual rainfall of about 49 inches, well distributed throughout the year; all which are conducive to the diversified system of farming in common practice. Farming is based largely on the production of cotton, tobacco, sweetpotatoes, and peanuts as cash crops; and corn, velvetbeans, cowpeas, soybeans, peanuts, and oats as feed crops for livestock.

The high precipitation has leached the soils to great depths, and the warm temperature prevailing throughout the long summer has aided in the decomposition of the vegetation; therefore, very little organic matter has accumulated in any of the well-drained soils.

The well-drained soils are members of the Tifton, Norfolk, Blanton, and Kalmia series. Along branches, on lower slopes, in numerous shallow depressions of the upland, and on flood plains and terraces along streams are gray or dark-gray poorly drained soils. The dark-gray soils are members of the Portsmouth, Myatt, and Grady series, and the gray soils are members of the Plummer and Leaf series. The fairly well or poorly drained brown soils of the flood plain of Altamaha River are classed as alluvial soils (Congaree soil material), and the poorly drained soils along creeks as swamp.

Agricultural adaptations are dependent, for the most part, on drainage, relief, and textural differences. Well-drained soils, such as Tifton sandy loam, Tifton fine sandy loam, Norfolk sandy loam, and Kalmia fine sandy loam, are naturally the best for cotton and are good for corn; but the deep phases of Norfolk sandy loam, Norfolk fine sandy loam, and Kalmia fine sandy loam, together with Norfolk loamy sand produce a brighter tobacco leaf and a higher quality of sweetpotatoes and peanuts. With proper drainage, Grady clay loam, owing to less leaching and a higher content of actively decomposing organic matter, gives the highest yields of corn and sugarcane; and the poorly drained soils, such as Plummer sandy loam, Portsmouth sandy loam, Leaf fine sandy loam, and Myatt fine sandy loam, are particularly adapted to lowland pasture grasses, such as carpet grass, Dallis grass, lespedeza, and white clover.

The greatest need of the soils of this county is actively decomposing organic matter. Many of the farmers restore some organic matter and nitrogen by interplanting velvetbeans, cowpeas, soybeans, and peanuts with corn. After the corn is harvested, cattle and hogs are turned into the field to pasture, and the residue, after pasturing, is turned under for soil improvement, but the residue turned under is

insufficient either to restore or to maintain the fertility of the soil. An adequate amount of organic matter and nitrogen may be supplied, according to experiments carried on by the Georgia Coastal Plain Experiment Station at Tifton, Ga., and the United States Department of Agriculture at Albany, Ga., by rotating cotton and corn with a winter cover legume, such as Austrian Winter peas, hairy vetch, Monantha vetch, or smooth vetch, which is plowed under at least 15 days before planting the main crop.

Terracing, contour plowing, and other preventive measures to check erosion; better subsistence gardens; the growing of more fruits for home use; and the improvement of livestock are other ways in which agriculture may be improved in Toombs County. Systematic planting of slash pine for the production of turpentine has proved profitable.

Practically all farms, as well as the open range, support cattle, hogs, and goats. Probably 90 percent of the feed for the livestock is produced within the county. Grade Jerseys predominate among the cattle, and Duroc-Jersey and Poland China are the leading breeds of hogs.

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This soil survey is a contribution from

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