

Issued October 17, 1913.

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE GEORGIA STATE COLLEGE OF AGRICULTURE,
ANDREW M. SOULE, PRESIDENT; DAVID D. LONG,
IN CHARGE SOIL SURVEY.

SOIL SURVEY OF DOUGHERTY COUNTY,
GEORGIA.

BY

M. EARL CARR, H. JENNINGS, AND THOMAS D. RICE,
OF THE U. S. DEPARTMENT OF AGRICULTURE, AND
DAVID D. LONG, OF THE GEORGIA STATE
COLLEGE OF AGRICULTURE.

HUGH H. BENNETT, INSPECTOR IN CHARGE SOUTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1912.]



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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., April 1, 1913.

SIR: In the extension of the soil survey in the State of Georgia during the field season of 1912 work was undertaken in Dougherty County, Ga. This work was done in cooperation with the Georgia State College of Agriculture. The selection of this area was made at the urgent request of prominent citizens of the county after conference with State officials.

I have the honor to transmit herewith the manuscript report and map covering this area, and to recommend their publication as advance sheets of Field Operations of the Bureau of Soils for 1912, as provided by law.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

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MAP.

Soil map, Dougherty County sheet, Georgia.

SOIL SURVEY OF DOUGHERTY COUNTY, GEORGIA.

By M. EARL CARR, H. JENNINGS, and THOMAS D. RICE, of the U. S. Department of Agriculture, and DAVID D. LONG, of the Georgia State College of Agriculture.

DESCRIPTION OF THE AREA.

Dougherty County is located in the southwestern part of Georgia. It is bounded on the east by Worth County, on the south by Baker and Mitchell Counties, on the west by the Chickasawhatchee Creek, which separates it from Calhoun County, and on the north by Terrell and Lee Counties west of the Flint River and for a short distance east of the river by Worth County. For a short distance in the northeastern corner of the county it is separated from Lee County by the Flint River. The same stream forms the southern boundary for a very short distance, separating Dougherty from Mitchell County. The extreme dimensions of the county east and west and north and south are about 28 miles and 12½ miles, respectively, the total area being 343 square miles, or 219,520 acres.

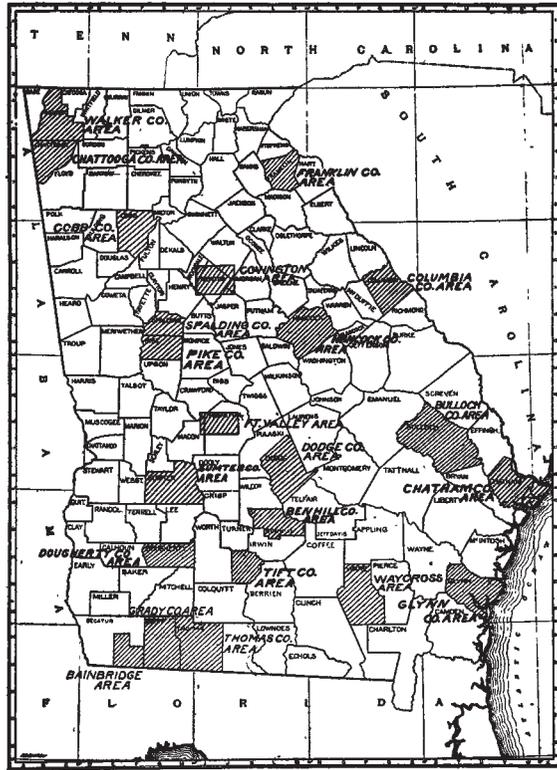


FIG. 1.—Sketch map showing location of areas surveyed in Georgia.

The physiographic features of Dougherty County are quite uniform. The larger part of it lies within the Dougherty Plain, a name given to the smooth country of southwest Georgia by the geological

survey of the State.¹ This physiographic division of the Coastal Plain in Georgia has its eastern border a few miles east of the Flint River, thus including all of the county except the southeastern portion. "It is characterized by very level tracts, and * * * few elevations that may properly be termed hills."² This plain has a general elevation in Dougherty County of 190 to 215 feet above sea level. It is divided into three parts by the drainage depressions occupied by the Flint River and Cooleewahee Creek. The smallest of these lies east of the river, varying from a few to 5 or 6 miles in width. The other two parts, occurring between the Cooleewahee Creek and the river and between the Cooleewahee and Chickasawhachee Creeks, are of about equal size and range in width from 8 to 10 miles. The middle one, lying between the river and Cooleewahee Creek, is divided into two parts by the shallow depression or drainage channel of Percosin Creek. The general surface features of this plain vary from almost level to gently undulating or slightly rolling. Steep slopes are rare. The most conspicuous features of the region are the numerous round or irregularly shaped depressions, or lime sinks, varying from a few rods in diameter to areas covering several hundred acres. Often these depressions, especially in the western portion of the county, merely comprise irregular, sinuous areas of low, swampy land, in many places occupied by sluggish streams having outlets to the main drainage channels. The lime sinks may or may not contain water. Though they have no surface outlet, some of them are practically free of water, particularly in dry seasons, and are under cultivation. Many of them are, however, partially or wholly filled with water during the wet winter months and a few seldom become dry. Those in which water is nearly always present are shown as ponds. Others have more the nature of swamps than ponds, and support a thick growth of cypress, bay, tupelo, and black gum timber, and often a dense undergrowth of switch cane, bamboo vines (smilax), and other water-loving plants.

The creeks of this region flow sluggishly through wide, shallow, swampy valleys, and rarely have high bluffs along their courses. The Flint River, however, has cut a well-defined channel across the county in a winding course. This stream occupies a bottom some 20 to 50 feet below the general level of the uplands. Its course is in many places bounded by steep bluffs and perpendicular cliffs from 10 to 20 feet high. An important but not very conspicuous feature of the valley of the Flint River consists of areas of second bottom or high, level to undulating terraces. These areas are rarely or never subject to inundation. Here and there the terrace merges into the

¹ Geology of the Coastal Plain of Georgia, by Otto Veatch. Bulletin No. 26, Geological Survey of Georgia, p. 30.

² Loc. cit.

first bottoms, but they are usually separated by a sharp escarpment from a few feet to some 15 or 20 feet in height. Similarly the high terraces may grade into the upland plain without a definite boundary, though they generally are defined by a bluff or sharp rise. These terraces vary from a few rods to a mile or more in width, and occur on both sides of the river. The most conspicuous terraces lie on the west side of the river, directly south of the city of Albany.

A comparatively small proportion of the county in the eastern and southeastern parts has a gently rolling topography. The slopes here are smooth and rounded, there being no suggestion of ruggedness. The extreme altitude of this section is approximately 300 feet, or about 100 feet above the more level Dougherty Plain to the west. The lime-sink depressions in this upland are less numerous and not so typically developed as in the remainder of the county.

The entire drainage of Dougherty County is through the Flint River and its tributaries, whose waters reach the Gulf of Mexico through the Apalachicola River at Apalachicola Bay, on the coast of Florida. Piney Woods Creek, Muckafoonee Creek, formed by the confluence of the Kinchafoonee and Muckalee Creeks, Coolee ahee Creek, fed by Blue Spring, Chickasawhatchee Creek, and Dry Creek are the principal tributaries of the Flint River. Blue Spring, about 4 miles south of Albany, is a conspicuous water feature of the county. This is the largest spring in the State.

The first settlement in the county was in 1837, at Albany, the present county seat, at the head of navigation on the Flint River. The country was taken up in large plantations by people from other and older sections of the State and settled largely by the wealthy class of people owning slaves. The county was organized some time between 1850 and 1860. In 1860 the census showed the county to have a population of 8,295, of which 2,207 were whites and 6,088 were negroes. The census of 1910 shows a population of 16,035, of which 3,983 are whites and 12,052 negroes. Many of the leading citizens of the county are descendants of the early settlers.

Albany, with 8,190 inhabitants, is the largest town of the county. It has a large cotton mill, oil mills, fertilizer plants, a cotton compress, an ice plant, and car and locomotive works. It is an important distributing point for southwest Georgia. The city also has excellent schools, churches, a modern hospital, street railway, good banking facilities, and stores. Other towns are Pretoria, Acree, and Putney. It will be seen from the above figures that over half of the population of the county is urban.

Transportation facilities are excellent throughout the greater part of the county. Albany is an important railroad center, being reached by two lines of the Central of Georgia Railway, the Seaboard Air Line,

two lines of the Atlantic Coast Line, and two local railroads. These systems with their direct connections reach the big markets of the North Atlantic seaboard. The Central of Georgia has direct connections with Chicago, St. Louis, and points in the Middle West. The Georgia Northern extends from Albany through the southeastern portion of the county to local points beyond. The Georgia Southwestern & Gulf Railroad, connecting Albany with Cordele to the northeast has been projected through the southwestern portion of the county to deep water at St. Andrews Bay on the Florida Gulf Coast, but not yet built. Besides the railroad shipping facilities, the Flint River affords water transportation to the port of Apalachicola at Apalachicola Bay on the Gulf of Mexico.

Markets for the produce of the soils of Dougherty County are good. Albany handles not only the county's production of cotton, but also that of much of the surrounding country. The local cotton market and compresses handle annually about 100,000 bales of cotton, valued at over \$5,000,000. Cantaloupes, watermelons, pears, Irish potatoes, etc., find ready markets at distant points. The pecan is becoming a commercial product. The local demand for dairy products, meats, poultry, eggs, forage crops, hay, corn, etc., is greater than the supply, much of these products being imported from outside points. The greater part of this could and should be supplied by the local farms.

CLIMATE.

The climate of southwest Georgia, in which Dougherty County is located, is characterized by long, warm summers and short, mild winters. The summer weather usually begins the latter part of March and continues until late October or early November. The mean temperature for this part of the year ranges from about 60° F. for the months of March and November to slightly above 80° F. for the summer months, June, July, and August. The hottest of these months, July, has a mean temperature of 82.9° F. While the summers are long and hot, the heat is not as oppressive as in some other sections of the same latitude, owing to the relatively low humidity. Although the days during the summer season are usually hot, the temperature often reaching 100° F., the nights are generally moderated by southern and southwestern breezes. The extreme maximum temperature attained in the past 22 years is 106° F., reported during the month of July.

The winters are short and mild. Snow is almost unknown, the average annual snowfall for the region being only three-fourths of an inch. The normal temperature for the winter season is about 50° F. During only one month, January, does it fall below that figure. In the winter months the temperature may go as high as 80° F., and

very rarely to an absolute minimum of -2° F. This latter figure has been reported only once in the past 22 years. During this period and with this exception 12° F. has been the lowest figure. The cold, however, is usually felt more than in areas lying at higher latitudes. Ice, usually thin, forms but a few times each winter. Short spells of cold, bracing weather are followed by warm, balmy days of sunshine. The weather of the region is generally so mild that violets, japonicas, and roses bloom continuously throughout the winter months. Hardy vegetables such as onions, beets, cabbage, spinach, turnips, radishes, lettuce, etc., can be grown often without any or with only slight protection during the winter. The less hardy garden vegetables, such as beans, peas, Irish potatoes, etc., can usually be planted about the middle of February, though a temporary covering of straw, pine needles, or cloth may be needed as a protection against frosts.

On the basis of records covering the past 10 years, the average date of the latest killing frost in spring is March 6 and of the earliest in fall November 11, giving an average growing season free from killing frosts of about 8 months, or 250 days. The date of the latest killing frost in spring is April 15, and the earliest in autumn is October 23, making the shortest season to be expected a little over 6 months, or 192 days. A reasonable estimate of the length of the growing season under ordinary conditions is slightly more than 200 days.

The annual normal rainfall for the region amounts to 49.28 inches. This precipitation is usually well distributed throughout the year, though, as in most sections of the East, periods of excessive rain and of deficiency in precipitation are to be expected at times. It will be seen by the accompanying table that the months of greatest rainfall are during the growing season, when moisture is most needed by the crops, and that the months of least precipitation are during the harvest, or cotton-picking season, when it is least needed. The precipitation for the driest year recorded, 1896, was only about 10 inches less than the normal, or 39.87 inches. Even during this season of least rainfall the precipitation was greater than the normal for some of the best agricultural regions of the East. This, too, was well distributed, though greatest during the winter season. During the wettest season, 1907, the rainfall amounted to over 5 feet, or 64.67 inches. Again it was well distributed during the different seasons of the year, though excessive for one of the cotton-picking months, September.

The following table, compiled from the records of the Weather Bureau station at Albany, shows the normal monthly, seasonal, and annual temperature and precipitation, also absolute maximum and minimum temperatures, and monthly, seasonal, and annual precipitation for the driest and wettest years. The records cover these features for the past 22 years.

Normal monthly, seasonal, and a nual temperature and precipitation at Albany, Ga.

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum	Absolute minimum.	Mean	Total amount for the driest year	Total amount for the wettest year.
	° F.	° F.	° F	Inches.	Inches.	Inches.
December.....	51.6	84	12	3.56	1.78	7.39
January.....	48.5	80	13	3.88	3.66	2.54
February.....	50.2	81	-2	5.53	8.90	3.54
Winter.....	50.1	.....	.....	13.27	14.43	13.47
March.....	61.0	93	27	5.07	4.63	2.19
April.....	66.8	98	34	3.49	.40	7.99
May.....	74.9	103	40	3.63	2.14	3.15
Spring.....	67.6	.....	.....	13.24	7.22	13.33
June.....	81.5	104	52	4.08	1.85	3.36
July.....	82.9	106	61	5.67	7.66	8.90
August.....	81.9	102	61	6.37	2.00	11.64
Summer.....	82.1	.....	.....	16.12	11.51	23.90
September.....	77.7	100	46	3.04	2.43	9.12
October.....	67.4	97	30	2.29	2.10	.19
November.....	57.7	84	23	2.32	2.18	4.66
Fall.....	64.3	.....	.....	7.65	6.71	13.97
Year.....	66.8	106	-2	49.28	39.57	64.67

AGRICULTURE.

The first available figures for agriculture in Dougherty County, appearing in the census of 1860, showed a remarkably prosperous condition. Nearly one-half of its area was classed as improved farm lands valued at approximately \$3,000,000. The total yields of all crops was then as great or greater than in recent years.

The greater part of the farming land in the county is known as "red lands," which as a rule are heavier than those of other regions of southern Georgia. These lands were originally forested with hardwoods, principally oak and hickory, with considerable longleaf yellow pine. Directly to the east are the "gray lands." These lands are much more sandy and support a forest of longleaf yellow pine, with practically no hardwoods. The "gray lands" are also known as "pine barrens" and were formerly considered inferior for farming. These differences were shown in the original survey of the region, in which the "red land" section was divided into "lots" five-eighths of a mile square and the "pine barrens" section into "lots" seven-eighths of a mile square. The small lots of the "red land"

section were for settlement and cropping, while the larger lots of the "pine barrens" section were for the grazing of cattle. Under this plan and with this idea of the relative value of the different classes of soil of the region, Dougherty County was settled, its agricultural lands were developed for crop production, and the lands to the east utilized for grazing purposes. The lands were cleared and developed by slave labor and were taken up in plantations of large size.

Cotton and corn have been staple crops from the early days of settlement. Wheat, rye, oats, sweet potatoes, and vegetables were also grown for home use. In 1860 there were over 30,000 head of cattle, sheep, and swine in the county. The production of cotton in 1859 amounted to 15,664 bales of 500 pounds each. In but one year since (1908) has it been greater, according to the records at hand. The same year 356,812 bushels of corn, the maximum production of that cereal in the county, were grown. Wheat, oats, and rye combined added to the cereal production about 3,000 bushels, and peas some 23,061 bushels. Of sweet potatoes the production reported was 56,310 bushels.

During the half decade following the season for which the above figures stand there was some change in the agricultural production of the county. During this period, that of the Civil War, cotton was difficult to market and there was at the same time a large demand for food crops. This demand was met by Dougherty County and southwest Georgia to such an extent that the region became known as the "Granary of the Confederacy." No statistics are, however, available to show the changes incident to the abnormal conditions prevailing during this period of time.

The change in conditions following the war is shown in the shrinkage of over \$1,000,000 in land values between 1860 and 1870, though the proportion of improved land remained approximately the same. Coincident with the changes in labor conditions, etc., as a result of the war, came the introduction of commercial fertilizers. With the use of these materials as a soil complement, the gray "pine barrens" land gave as good or better yields than the "red lands" and with less labor, the light sandy lands being much easier to work. On this account much of the "red lands" was abandoned, the labor and "overseers" taking up the gray sandy lands of the "pine barrens." This condition has continued to the present time, much of the "red lands" of the county being either untilled or only partially cultivated. In recent years, however, the "red lands" are coming into their own again and being more extensively used for producing crops.

Under these influences land values declined to \$571,690 in 1900, or approximately 20 per cent of their valuation in 1860, though the acreage of improved farm land decreased only about 10 per cent, and the total production of crops remained about the same. The valua-

tion of the farm land had, however, increased to \$1,878,109 in 1910, and is still advancing rapidly with the redevelopment of the county.

There are now 134,235 acres, or 61 per cent of the area of the county, classed as farm land. Of this, 88,821 acres, or 66.2 per cent, is improved. The value of all farm property is given in the last census as \$2,682,207, of which buildings represent \$346,786, implements and machinery \$111,577, and domestic animals \$345,735.

With the development of the lumber and turpentine industries in the South this region became the scene of much activity along those lines. In addition to the sawmills for yellow pine and the turpentine camps, the hardwoods of the western part of the county furnished large quantities of staves and cross ties, and the cypress of the swamps also contributed to the value of forest products. Nearly all of the pine timber of value has now been removed, as well as large quantities of the hardwood, though there still remains considerable cypress, gum, and similar timber, which furnishes some employment to lumbermen.

The agriculture of the county is devoted chiefly to the growing of cotton, with corn for the work stock, winter oats, and forage crops. Considerable attention is also given to the production of cantaloupes, watermelons, Irish potatoes, and other truck crops. A number of pear orchards are found in the county. Cotton is the most important crop of the county. In 1909 from 34,270 acres a yield of 13,164 bales was reported, or about two-fifths of a bale per acre. There were 17,995 acres in corn, yielding a total of 183,585 bushels, or slightly more than 10 bushels per acre. Next in acreage was the oat crop of 2,858 acres, with a yield of 14 bushels per acre, or a total of 40,551 bushels. All forage crops combined occupied 3,476 acres and gave a yield of 2,065 tons. Sweet potatoes were grown on 195 acres, from which 8,725 bushels were harvested. There were also grown 3,178 bushels of cowpeas and 1,902 bushels of peanuts.

As a general practice, the adaptation of soils to crops is not recognized. The colored tenants and many of the white farmers use all the arable soils for all the crops grown. Many of these farmers, however, have learned from experience that cotton, corn, etc., will do much better on certain soils than on others, even with the same fertilization. A number of the planters are coming to recognize this important feature in farming and are paying greater attention to soil adaptation. Cantaloupes, one of the special truck crops of the region, are usually planted on a loamy sand, to which they and similar crops are especially suited. The same is true of most of the truck crops grown to any extent. Cotton and corn, the two principal crops, are, however, planted indiscriminately on all soils, with very poor results in some cases. The credit system in vogue rather discourages and almost prevents the regular practice of selecting different crops for

the different soils. Over 90 per cent of the farms of the county are operated by tenants, of whom less than 4 per cent are white. The system of renting requires that cotton, a cash crop, be grown. Corn is necessary for feeding the work stock and must also be grown, regardless of the adaptability of the soil to such crops. Furthermore, the majority of the tenants do not know how to grow other crops successfully. This fact also prevents the practice of any adequate or regular system of crop rotation. On some of the plantations operated by the owners or by overseers some attention is given to both the adaptation of soils to crops and the rotation of crops, but here again the production of cotton generally predominates and proper systems of cropping are not worked out and adopted.

The general agricultural practices in use over most of the county are only poor to fair. The tenant system of farming rarely works to the betterment of the soil conditions and usually the reverse. The tenant has no thought beyond the present season and even then only poorly cares for the crops or the soil. Land is cheap and plentiful, and it is considered easier to cultivate around stumps, fallen trees, and small, eroded "gall spots" than to clear the fields of such obstacles. The tenant often prepares the soil poorly for his crop and then endeavors to grow it with as little work as possible. Very often low-grade commercial fertilizer is relied upon to bring crops to maturity, when good care and cultivation would do as much, and usually more. Weeds, old cotton and corn stubble, and other roughage are generally burned instead of being plowed under to increase the organic content of the soil, because it makes plowing easier. Another reason for this practice is because the plows and power available are not suitable for plowing under such materials. This practice of burning should never be followed, except to destroy noxious insects, which may hibernate during the winter in the old stubble and weeds. All these practices are reflected in the low average yields of all crops for the county, which are scarcely more than the poorest of the soils should be producing. While some of the plantations of only average soil are making a bale of cotton, 30 to 50 bushels of corn, and 25 to 75 bushels of oats to an acre, the average yields of these crops are only about two-fifths of a bale and 10 and 14 bushels, respectively.

The matter of farm labor presents an important problem. The present population of the county, even if it were all rural, is insufficient to furnish labor to care for the crops that the soils are capable of producing. At present more than half of the population is urban and in addition much of the available labor is unskilled. The last census reports \$106,218 expended in 1909 for labor. It is safe to say that with an adequate supply of labor the production of the county could be doubled almost at once. There is an excellent opportunity for a much larger agricultural population than the county now

contains. Large areas of land are available for rent on easy terms, or for sale at relatively low prices, as much cleared land is lying idle for want of labor and capital.

Land values vary to some extent with the soil, but depend chiefly on location and improvements. The highest priced lands are in close proximity to the city of Albany. For agricultural purposes the highest land values obtain in that portion of the county lying east of the Flint River. This section has better roads and improvements, a larger percentage of cleared land, and better shipping facilities. Even in this section of the county, however, land can be bought for \$25 to \$75 or \$100 an acre, and much of it at nearer the lower than the higher figures. For some distance west of Albany, or between the Flint River and the Coolewahee Creek, the range in prices is from \$10 to \$50 an acre, according to condition and location. In the western end of the county prices range from \$10 to \$40 an acre. Land values have advanced considerably in the last few years, the acreage value in 1900 for the whole county being \$4.37 and in 1910, \$13.99.

There are several salient features in the improvement of the agriculture of Dougherty County. Among these may be mentioned cropping systems, cultivation, fertilization, irrigation, drainage, and the question of growing live stock.

On every plantation and farm in the county the question of the adaptability of crops to soils should receive serious consideration. This practice alone in the cropping systems of the county under normal conditions would prevent many crop failures and thus inure to the benefit of both the tenant and the landlord. In this connection it has been proved that not only some crops but certain varieties are better suited to some soils than to others. Thus the planter not only should plant his cotton on a soil adapted to this crop, but he should plant the variety of cotton to which his soil or soils is best adapted. The same holds true with other crops.

After this feature has been regulated the planter should consider the question of seed improvement. Instead of buying seed in the open market he should select seed from the best and earliest bolls produced by the strongest, most vigorous, prolific, and best individual cotton plants. The seed thus selected should be used separately for establishing a seed bed and the seed secured from such bed used for the general crop. The seed for the following year's seed bed should be secured from the best of the previous year's growth. Such improvement by seed selection should be extended to all the crops grown that will mature seed which will germinate in the region. This method of crop improvement would add very materially to the average and total yields of the different crops of the county.

Regular systems of crop rotation should also be universally practiced. These should not only include legumes (plants taking nitrogen from the air), but sod, or nonclean-culture crops.

In regard to cultivation, plowing, the most important and fundamental operation of tillage, is often the most poorly performed. In most cases the plowing should be deeper. A turning plow should be employed instead of the light "scooter" plow generally in use. This would result in stirring the whole surface and in turning under the refuse now burned. Plowing should never be continued through successive seasons at the same depth. By such practice the plowsole forms a "hardpan" which tends to hold moisture above it in wet weather, supersaturating the surface soil, and makes the land more droughty by holding moisture below it in times of insufficient rainfall. Both of these results were observed more or less throughout the county. Such a "hardpan" also prevents deep root penetration, thus limiting the feeding surface in the soil. On the other hand, the deeper plowing and the plowing at different depths allow more room for root development and tend to make new soil out of the raw subsoil incorporated with the surface portion. Harrowing should be carefully done and a smooth, mellow seed bed obtained to prevent unnecessary loss of moisture by evaporation from the uneven surface. Subsequently frequent cultivation should be practiced, not only to destroy weeds, but also to maintain a loose soil mulch at the surface to prevent excessive evaporation, thus robbing the crops of moisture needed for their development and maturity. This is especially important during seasons of scant rainfall. In this connection also attention is called to the practice of many in plowing around the small, eroded "gall spots," scattered stumps, fallen trees, etc. The improvement in the looks of the field alone would repay all effort expended in removing such obstacles and plowing up the "gall spots," aside from the larger area provided for crops and the greater ease of cultivation in not having to plow and cultivate around such hindrances.

In the matter of fertilization the soils of the county respond readily to organic or natural manures. Care should be exercised to increase the quantity and carefully save the stable manure, which should be returned to the soil. More compost should be made by gathering pine needles or other roughage for bedding. Cover crops should be more universally grown to protect the soil from the leaching effect of the heavy winter rains and also to furnish winter grazing for stock. Such crops would also have a binding effect on the soil particles, not alone from the organic matter thus derived, but also from the mechanical holding of the fibrous root systems. More legumes should be grown, not only for forage but for green manure to increase the needed organic content of the soil. Such practice would also enable the soil to absorb, retain, and deliver to the growing crops more moisture and make them less susceptible to drought. The use of lime in conjunction with the legume crops would increase their growth and assist in their decay to form humus in the soil.

Commercial fertilizers are now used on a comparatively large scale, the expenditures for this article in 1909 amounting to \$112,151 on 665 farms. Much of this could have been saved by the natural methods of fertilization outlined above, and much of it was used without regard to the kind or condition of the soil or the character of the crop to be grown. The greater part of this fertilizer was of the cheaper grades, consisting of phosphoric acid, nitrogen, and potash, in the ratio of 8-2-2. Such a quality of fertilizer often carries a large quantity of filler which must be handled without any additional benefit. Most of the progressive planters, however, use fertilizers of higher grade, better suited to their soils and to their crops. Experience and experimentation alone will enable the farmer to adapt his fertilizer practice to meet the need of his individual soils and crops. It is believed that such practice would greatly augment crop production without increase in the total expenditure for fertilizers.

Irrigation is often an important adjunct to the natural supply of moisture for growing crops. In the growing of the special truck crops suited to the soils and climate of the region it is often especially important that they receive an adequate supply of water at stated periods. At times there have been complete and partial failures of certain of these crops which need not have occurred if water had been available by irrigation. This can be supplied by flowing artesian wells in most parts of the county, water being secured at depths varying from 750 to 1,200 feet. One such system of irrigation is already in operation north of Walker Station. The water flows into a reservoir on an elevated part of the land and is conducted to the lower fields through pipes and applied to the crops as needed by the subsurface method. The reservoir is made to hold water simply by giving it a lining of the natural sandy clay found almost everywhere in the county. Another system of irrigation in operation is that known as the Skinner system, which consists of perforated iron pipes, placed on supports at various distances apart, the water being sprayed over the surface. Where water can not be obtained from flowing wells, it can be obtained in sufficient quantities from the "deep wells" of the region by pumping with small gasoline engines. These wells are of the same character as the artesian wells, except that they are more shallow, varying from 150 to 300 feet in depth, the water usually coming nearly to the surface and the supply being apparently inexhaustible.

Much of the swamp land and low places can be permanently reclaimed by ditching or by sinking "drainage wells" and the use of tile. Such reclaimed areas in many instances can be used for a number of profitable crops.

More live stock should be kept in the county. The native grasses, crab grass, Johnson grass, Japan clover, etc., furnish good summer

grazing for cattle and sheep, and the swampy areas make excellent pasture for hogs and cattle. Winter grazing can be easily and inexpensively supplied with oats and rye. In addition, an excellent quality of hay can be easily supplied by growing cowpeas, velvet beans, oats, etc. There would also be more stable manure available for use in growing the intertilled crops. The development of this industry would result in a much larger income from dairy products, beef, mutton, wool, and pork products, for most of which there is an excellent local market, now supplied from other regions. It would also be reflected in better crops from the increased supply of stable manure. In addition to the larger number of cattle, sheep, and hogs, more fowls should be kept, the demand for eggs and poultry products now being in excess of the local supply.

Another important feature in the future agricultural development of the county lies in the tenure of the lands. At present most of the farm lands are held in large bodies, varying from a few hundred to several thousand acres. These large plantations should be subdivided and farmed in much smaller units. Good farmers located on tracts of 40 to 100 acres, through more complete occupation of the land, would make more intensive cultivation possible, thus augmenting crop production.

Considerable interest is being taken in pecan growing in Dougherty County and in the surrounding territory. Trees of selected varieties purchased in part from local nurseries are being used in establishing the groves. Among the varieties set may be mentioned the Schley, Stuart, Frotscher, Van Deman, Delmas, Pabst, Ally, Russell, Mobile, Tesche, and Nelson.

The soils of the county most used for the setting of pecan groves are the sandy loams and loamy sands of the Orangeburg and Greenville series. Some orchards are found on the Norfolk sand and sandy loam, and on low-lying areas of the Grady sandy loam.

SOILS.

The soils of Dougherty County and surrounding portions of southwest Georgia vary somewhat in characteristics from those of other sections of the State. The county lies in a belt of red soils which differ from the red hill soils of middle and north Georgia. The county is situated about halfway between the "fall line," the inner edge of the Coastal Plain, and its outer edge along the Gulf of Mexico, thus lying wholly within the Coastal Plain soil province. Although all of the soils of the county belong in the Coastal Plain province, most of them differ materially from the dominant soils of that province. All but two are of a sandy character. They range in texture from light, loose deposits of sand to a sandy clay loam and sticky,

plastic clay only slightly sandy at the surface. While most of the soils are very sandy at the surface, all but a few grade into a friable, sandy clay subsoil either within the 3-foot soil section or just below. Generally this sandy clay in turn grades into a compact, heavy, mottled clay also carrying some sand. Only occasionally is the original soil-forming material of a coarse texture. Waterworn gravel is almost entirely absent. The sand content of many of the soils, however, ranges toward coarse in texture. Much of the sand is sharp and angular rather than rounded, this being especially true of the sand content of the friable clay subsoils.

Several soil types, besides being sandy, also contain considerable quantities of small concretionary gravel. These soils are found most extensively in the eastern and western sections of the county, and occasionally for a considerable distance on each side of the Flint River through the central part of the county. These gravels or pebbles are aggregations of limonite, iron oxide, with sand and clay impurities. They are rounded in shape and reddish to ochreous yellow internally, and are a noticeable surface feature, and the soils containing them are generally recognized as being more productive than the sandy lands where they are absent. They vary from the size of small shot to some 8 or 10 inches in diameter, but the smaller ones are by far the most common. Probably 90 per cent or more of them are not over one-quarter to one-half inch in diameter. They are apparently the result of weathering within the mass of soil material.

Bedrock is found all over the county at no great depth. This consists chiefly of limestone. The partially weathered product of these limestones is always encountered in digging wells in all parts of the county, and small outcrops from the same source are often found scattered over the surface, in some cases in such profusion as to justify the separation of a stony loam type. Solution of the limestone and the sinking down of the overlying materials into "lime sinks" has formed one of the most conspicuous topographic features of the region and has an important influence on the derivation and formation of some of the soils of the county.

The materials from which the soils of the county have been derived are of comparatively recent geological origin. Much, if not all, of the surface sandy material of the uplands, especially in the eastern part of the county, is very likely from the unconsolidated marine deposits of the Altamaha formation of Pliocene age.¹ Along the Flint River and some of the other streams the soil-forming material of both the first bottoms and terraces, where not residual from the underlying rocks, consists of old and recent alluvium. Over much of the county the basal limestones (of Oligocene time) have either formed the soils by residual decomposition or strongly influenced

them by contributing to the subsoil or substratum. These limestones are of three different formations—the Vicksburg, the Chattahoochee, and the Alum Bluff. The first named is by far the most extensive. It underlies the whole county except in the extreme eastern and southeastern parts. Along the eastern boundary the latter two formations are found, with the Altamaha or Lafayette in the extreme southeastern corner. Differences in the origin of the soil-forming material, in the processes involved in changing the materials into soils, and in the topographical position of the various types have given rise to wide type differences.

Ten series are represented: The Greenville, Orangeburg, Norfolk, Grady, Tifton, Henderson, Cahaba, Kalmia, Susquehanna, and Thompson. These series are in turn subdivided into types upon a basis of textural difference, as, for instance, stony loam, gravelly sandy loam, sand, fine sand, coarse sandy loam, loamy sand, coarse sandy loam, sandy loam, fine sandy loam, silt loam, clay loam, and clay. In some of these soil types one or two phases are shown.

The soils of the Greenville series have reddish-brown to red surface soils and bright-red subsoils. They are widely developed throughout the western half of the county and are of rather extensive occurrence in many of the counties of southwest Georgia. In Dougherty County the material seems to be derived from or influenced by the Vicksburg limestone. Six types of the series were recognized and mapped, ranging in texture from gravelly sandy loam to clay loam. Of the types in this series the sandy loam and clay loam are the most extensive and important agriculturally.

The Orangeburg series is characterized by gray to grayish-brown surface soils and bright-red subsoils. The series is of considerable extent, occurring widely on both sides of the Flint River. These soils are more general in their occurrence than are the Greenville soils, being found in all of the Gulf Coast States and in Georgia, Florida, and South Carolina. They are derived from the weathering of sandy marine sediments, modified somewhat in this county by the underlying limestones, especially in the lower depths of the soil section. Four types were recognized and mapped, the gravelly sandy loam, sand, loamy sand, and sandy loam. The last named of these is of the greatest areal extent and agricultural importance of all the soils of the county.

In both the Greenville and Orangeburg series of soils chemical changes in the weathering of the original soil-forming material has developed the distinctive bright-red subsoils. This is due to the higher state of oxidation of the iron content. Such changes in the processes of their formation accounts for their wide variation in character and generally higher agricultural value as compared with the dominant soils of other sections of the Coastal Plain. They also account for the designation of the soils of the region as "red lands."

The soils of the Norfolk series differ from those of the Greenville and Orangeburg series principally in having yellow subsoils. The surface soils are gray to light brown. The Norfolk is not extensively developed in this county, though in the Coastal Plain in general it is of greater extent than any other series. The Norfolk soils are derived from the weathering and washing of unconsolidated sandy marine sediments in which the iron salts have assumed forms having a yellow rather than red color. The rolling phase of the sand type of this series probably represents a modification of these deposits by aeolian agencies. Only two types of the Norfolk soils are found, a sand with a rolling phase and a sandy loam with a deep and a flat phase. The sand is the most largely developed.

The Grady soils are ashy gray at the surface and overlie material of mottled gray, bluish-gray, and red colors. They are confined to the region of the Gulf Coastal Plain, where the younger limestones approach the surface and are instrumental in the formation of soils. They represent the residual product from these limestones modified by contributions from the lighter unconsolidated deposits. They occur in the lime-sink depressions of the upland, along some of the stream depressions, and in many places on the high terraces along the Flint River, where water action has removed the superficial deposits. Three soil types of the series are represented, the gravelly sandy loam, the sandy loam with a flat phase, and the clay, the sandy loam being the most extensive.

The Henderson and Susquehanna soils are of residual origin, apparently from brown clay beds or possibly from rocks of the Chattahoochee formation. They have gray surface soils and mottled, sticky, plastic subsoils. Their extent is small.

The Tifton sandy loam is the only representative of this series occurring in the county. It is of considerable extent and agricultural importance in the eastern part of the county. Directly to the east of the county a much more extensive body of the Tifton soils is found. The members are characterized by a high content of small iron grave, gray to grayish-brown surface soils, and subsoils of a greenish-yellow color.

On the high, level terraces along the Flint River and some of the other streams the Cahaba and the Kalmia soils are found. The Cahaba represents old alluvium laid down when the larger streams flowed at higher levels than now, the soils occurring on terraces. They are characterized by their topographic position and by grayish-brown to brown surface soils and brown to red subsoils. They are rarely subject to inundation. Four soil types of the series are mapped, the sand, fine sand, sandy loam, and fine sandy loam. The last of these, the fine sandy loam, is the most extensively developed for farming.

The *Kalmia* series, of which only the sandy loam type occurs in this county, differs from the *Cahaba* soils only in having a yellow subsoil.

In the first bottom or overflow lands one soil series and two miscellaneous types occur, the Thompson sandy loam and Meadow (Ocklocknee material) and Swamp. The most extensive of these bottom soils is Meadow (Ocklocknee material). It has a dark-brown surface soil and brown to light-brown subsoil. It occurs to a greater or less extent throughout the whole Coastal Plain along streams which have their sources in the Piedmont Plateau. No differentiation is made, but the greater part of the material is a silt loam. There are included some small areas of fine sand and fine sandy loam. The Meadow (Ocklocknee material) is frequently overflowed, each inundation adding its share to the formation of the soil, which is alluvial in origin.

The Thompson series of first-bottom soils, having yellow subsoils, is represented by only one type, the sandy loam. It is probably of alluvial or modified marine origin. The type is often overflowed by local flood waters carrying little or no sediment.

Swamp represents the wet bottoms along some of the secondary streams. Soil conditions are somewhat variable, though the surface soil is always dark colored and the subsoils gray to bluish in color. The texture varies from a sandy loam to a plastic clay. The type is covered with water much of the time. It is of wide extent, being found throughout the Coastal Plain.

The following outline shows the origin and the chief color characteristics of the various soils of the county:

Origin.	Color.	Type.	
Upland: From unconsolidated sedimentary materials and consolidated material (rock) of sedimentary origin.	Gray soils, yellow subsoils . . .	{ Norfolk sand. Norfolk sandy loam.	
	Gray to brown soils, yellow subsoils, iron concretions.	{ Tifton sandy loam.	
	Gray to brown soils, bright red subsoils.	Red soils, bright red subsoils (residual from or influenced by underlying limestone).	{ Orangeburg gravelly sandy loam.
			{ Orangeburg sand.
			{ Orangeburg loamy sand.
			{ Orangeburg sandy loam.
			{ Greenville gravelly sandy loam.
			{ Greenville coarse loamy sand.
			{ Greenville loamy sand.
			{ Greenville coarse sandy loam.
Terrace—alluvium . . .	Gray soils, mottled subsoils (residual from underlying limestone).	{ Greenville sandy loam.	
		{ Greenville clay loam.	
		{ Henderson stony loam.	
		{ Susquehanna sandy loam.	
		{ Grady gravelly sandy loam.	
		{ Grady sandy loam.	
First bottom—alluvium.	Gray soils, yellow subsoils . . .	{ Grady clay.	
		{ Cahaba sand.	
		{ Cahaba fine sand.	
		{ Cahaba sandy loam.	
First bottom—alluvium.	Gray soils, yellow subsoils . . .	{ Cahaba fine sandy loam.	
		{ Kalmia sandy loam.	
		{ Thompson sandy loam.	
First bottom—alluvium.	Dark-brown soils, brown subsoils.	{ Meadow (Ocklocknee material).	
		{ Swamp.	
First bottom—alluvium.	Dark soils, light subsoils	{ Thompson sandy loam.	
		{ Meadow (Ocklocknee material).	

These characteristics and the agricultural value of each type are described in detail in the subsequent pages of this report.

The table given below shows the relative and actual extent of each soil described in the report and shown on the accompanying soil map:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Orangeburg sandy loam.....	39,040	17.8	Meadow (Ocklocknee material).....	2,880	1.3
Greenville sandy loam.....	26,560	12.1	Orangeburg sand.....	1,920	.9
Grady sandy loam.....	23,680	11.2	Orangeburg gravelly sandy loam.....	1,920	.9
Flat phase.....	960		Cahaba fine sand.....	1,920	.9
Greenville clay loam.....	21,440	9.8	Thompson sandy loam.....	1,920	.9
Swamp.....	20,480	9.3	Greenville coarse loamy sand..	1,600	.7
Norfolk sand.....	14,720	7.0	Kalmia sandy loam.....	1,600	.7
Rolling phase.....	640		Cahaba sandy loam.....	960	.4
Tifton sandy loam.....	12,160	5.5	Greenville coarse sandy loam..	640	.3
Norfolk sandy loam.....	9,920	5.2	Cahaba sand.....	640	.3
Deep phase.....	960		Henderson stony loam.....	640	.3
Flat phase.....	640	4.2	Grady gravelly sandy loam...	320	.2
Greenville gravelly sandy loam.....	9,280	4.2	Susquehanna sandy loam.....	320	.2
Orangeburg loamy sand.....	7,360	3.4			
Cahaba fine sandy loam.....	6,400	2.9	Total.....	219,520	.....
Greenville loamy sand.....	4,160	1.9			
Grady clay.....	3,840	1.7			

GREENVILLE GRAVELLY SANDY LOAM.

The soil of the Greenville gravelly sandy loam consists of a reddish-brown to red heavy sandy loam from 5 to 6 inches deep, containing numerous small iron concretions or pebbles. The subsoil is a bright-red friable clay loam to sandy clay which also contains a varying but usually large percentage of ironstone gravel. The surface soil is generally rather shallow, especially west of the Cooleewahee Creek. The concretions are roundish to irregular in outline and usually small, the greater number ranging from a quarter of an inch to a half inch in diameter. In a few instances they attain a much larger size but are never large or plentiful enough to prevent cultivation, though occasionally they make deep plowing somewhat more difficult than on the less gravelly lands. In color they are black to brown on the smooth surface and reddish brown to ochereous yellow internally. The rounding is not supposed to be due to their being water-worn but to their formation around a nucleus. The smooth surface is attributed to the wearing effect of rain water. This gravel often occurs in bands or beds within the soil section. Again it may be especially abundant in the subsoil and almost absent at the surface, or more abundant at the surface, leaving the subsoil practically free from it. However, as a usual thing the surface of the type is thickly

strewn with the gravel, it being especially prominent and noticeable after heavy rains and in uncultivated fields where the rain waters have washed out the fine earth material.

This soil is not difficult to till, though somewhat more power is required than with the sandy loam. An excellent seed bed can generally be obtained. The gravel prevents to a certain extent the compacting and baking of the soil, which insures a better tilth through the growing season with a minimum of cultivation.

The Greenville gravelly sandy loam is extensively and typically developed along the county line north of Locketts and at the head of the Coolewahee Creek. A considerable area is found northeast of Locketts.

The topography is undulating to rolling wherever the type is found, giving excellent natural surface drainage. In places, however, there are small depressions having no outlets where water collects after heavy rains, with no means of escape other than through surface evaporation and downward seepage to subterranean outlets. Drainage in such places should be aided by drainage wells to the underground channels of escape. Besides having good surface drainage over most of its area, the gravel content makes the section more open and enables the soil to quickly absorb any ordinary rainfall. This permits the type to be worked under a wide range of moisture conditions. On the other hand, the heavy character of the subsoil materials prevents rapid seepage of the moisture to depths beyond the reach of the growing crops. With proper management to conserve the natural rainfall but little danger should be experienced with drought on this soil unless it be of unusual severity.

The origin of the Greenville gravelly sandy loam is somewhat doubtful. There seems to be evidence, such as the bands of gravel, that it is derived from water-laid sediments. On the other hand, the transition of the surface materials to the underlying residual limestone material, which in turn grades into the unweathered limestone, together with frequent occurrences of limestone fragments on the surface and scattered through the soil section, apparently indicate that it is largely at least residual from the Vicksburg limestone of the region. Probably both factors have contributed to the formation of the type as it now exists.

The type is found only in the hardwood section of the county. The forest growth consists largely of oak, hickory, and longleaf yellow pine, with some locust, cedar, dogwood, persimmon, and elm. The uncleared portion carries wire grass, and cleared but uncultivated fields support a thick growth of broom sedge. The entire native vegetation differs greatly from that section of the Coastal Plain occupied by soils other than the "red lands," being more like the limestone regions of the northern part of the country.

This soil type is one of the best in the county. It is especially well adapted to the production of cotton, corn, oats, and forage crops. Yields are limited by lack of tillage and organic fertilizers. Organic matter should be supplied by the more extensive growing of cowpeas and velvet beans, both for hay and for plowing under as green manure. Vetch or crimson clover could be grown, the seed sown early in the fall, to be turned under the following spring on land to be used for either corn or cotton. At present too much dependence is placed upon commercial fertilizers for growing crops. While they can be used discriminately, more dependence should be placed upon the legumes, upon deeper plowing and more thorough and frequent cultivation, and upon some regular system of crop rotation. A good rotation for cotton lands is cotton followed by corn, then oats, the latter being followed the same season with cowpeas for hay. This gives four crops in three years and still leaves an opportunity to grow vetch or crimson clover to turn under for the corn. Such a system of cropping would eliminate the necessity for the use of much nitrogenous fertilizer, the most costly of those purchased.

It is believed that alfalfa would succeed on the Greenville gravelly sandy loam. To grow this legume the soil should be limed and also inoculated with the bacteria which thrive on alfalfa roots. The introduction of this crop would do much toward the betterment of the type.

The Greenville gravelly sandy loam gives good yields where well farmed and cared for. Cotton will yield from $\frac{1}{2}$ to 1 bale or more; corn from 20 to 40 bushels, oats from 25 to 60 bushels, and cowpeas from $\frac{3}{4}$ to $1\frac{1}{4}$ tons of hay per acre. The present average yields incline to the smaller of the figures given, as much of the type is farmed indifferently by colored tenants. With improved methods the average could easily be brought up to the higher figures.

The agricultural condition of the type is fair to good and is improving each year.

GREENVILLE COARSE LOAMY SAND.

The soil of the Greenville coarse loamy sand to a depth of 5 or 6 inches is a reddish-brown to red sand of medium to coarse texture. Below this to a depth of about 36 inches the subsoil consists of a coarse to medium sand with enough fine material to make it decidedly loamy. Close examination shows the sand grains to be coated with fine soil particles, imparting the loamy character. At about 3 feet the subsoil grades into a substratum of coarse sandy loam to friable sandy clay. The structure of the surface soil and subsoil is fairly open and loose, although the fine soil, silt, and clay make it fairly compact, the soil standing perpendicular in exposed cuts. For the same reason it bakes and clods, but these unfavorable structural condi-

tions are easily corrected by plowing and harrowing at the proper time before the surface crusts or clods. On the other hand, the texture and structure favor the movement of moisture, both in the removal of excess water and in bringing needed water to the growing crops from below in times of drought.

This soil type is easily tilled and can be worked under a wide range of moisture conditions, even after heavy rains. A seed bed of any depth can be easily prepared and a good tilth maintained by cultivation with a minimum expenditure of time and labor.

The principal and most typical occurrence of the Greenville coarse loamy sand is found between the Newton-Albany and Pretoria Roads about 7 miles southwest of Albany. Another area occurs on the River Road some 5 miles south of the same town. Other small tracts are found in the western part of the county. The topography is nearly level to slightly undulating and the natural drainage good to excessive.

The Greenville coarse loamy sand is probably derived from the weathering of unconsolidated Coastal Plain sediments of marine origin. The coarseness of the soil-forming materials is doubtless due to the sorting effect of wave action, much of the finer particles having been rinsed out and deposited in the deeper waters existing at the time the material was laid down.

The natural forest growth of the type consisted of oak, hickory, and longleaf pine. This, however, has been removed and the greater proportion of its area is now in cultivation. Broom sedge and wire grass are indigenous and thrive wherever the type is not cultivated. Another characteristic plant is the Spanish dagger.

The loamy character of the Greenville coarse loamy sand gives it a somewhat wider adaptation to crops than is usually the case with a sand soil. It is primarily an early soil, its texture and structure being such that it warms up early in the spring. It is best adapted to truck growing, such crops as watermelons, cantaloupes, early cabbage, cucumbers, early Irish potatoes, and strawberries being especially well suited to it. Some of these crops are grown to a limited extent and produce good yields. In the second place, the fine earth content of the subsoil makes the type also adapted to the general farm crops of the region, corn, cotton, hay, and oats. It is largely used for these crops, which usually give satisfactory results. Some fields of this soil are reputed to yield a bale of cotton to the acre. These are generally the well-farmed and judiciously fertilized areas. Yields of cotton range from about one-half bale to 1 bale or more, of corn from 20 to 50 bushels, of oats from 25 to 65 bushels, and pea-vine hay from three-fourths to 1 ton per acre. With careful management, this soil should produce average yields of not less than 1 bale of cotton, 45 bushels of corn, 40 bushels of oats, and 1 ton of hay per acre.

In considering the improvement of the Greenville coarse loamy sand the prime requisite is the increase and maintenance of the organic content of the soil. Fortunately inexpensive means of doing this are within the reach of everyone farming the soil. Velvet beans and cowpeas can be grown for hay and the stubble and roots, rich in nitrogen, the most costly of the fertilizer constituents purchased, plowed under. It would be well to turn under the entire growth of these crops once in every three to five years, at the same time applying about one-half ton of lime per acre. This hastens the decomposition of the green manure to form humus, and would also aid in binding the soil particles and enable the soil to hold moisture better. Crimson clover or vetch could also be grown during the winter months, thus losing no time or crop in growing manuring crops. Pecan trees can be grown successfully on this soil.

The conditions prevailing over most of the area of the Greenville coarse loamy sand are good. The excellence of the soil and ease with which it is tilled make it a desirable soil for cultivation, and most of the type is cleared and in cultivation. Land values are only nominal when the producing power of the soil is considered. They are advancing, however, as the agricultural importance of the soil becomes better recognized and its condition improved.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of this type:

Mechanical analyses of Greenville coarse loamy sand.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
252137.....	Soil.....	9.9	25.9	17.6	18.9	8.7	7.4	11.8
252138.....	Subsoil.....	8.2	27.1	15.2	17.8	8.1	7.2	16.5

GREENVILLE COARSE SANDY LOAM.

The soil of the Greenville coarse sandy loam consists of a reddish-brown to dull-red coarse to medium sandy loam, varying from a few inches to a foot in depth. The subsoil is a bright-red, heavy coarse sandy loam to sandy clay, extending to a considerable depth, beneath which is found a mottled whitish, gray, red, and yellow substratum. The sand grains are largely of white quartz and are rounded to subangular in shape, apparently having been subjected to considerable attrition by water action. The cultivation of this soil is not difficult, though the more shallow areas are likely to bake and clod unless plowed under favorable moisture conditions. In fact, the fine material even of the more sandy portion of the section is such that, where not shaded by a growing crop, it bakes and forms a crust if not stirred soon after each rainfall.

Only small areas of the Greenville coarse sandy loam are found in the county. The most important and typical of these occur near the outer margin of the upland along the River Road from 4 to 9 miles south of Albany. The surface is undulating to gently rolling, and drainage is good. The type is slightly more susceptible to drought than the sandy loam, owing to its coarser texture. Its origin is due to the weathering, oxidation, and washing of old marine sediments of rather coarse texture.

The virgin timber growth of the Greenville coarse sandy loam consisted of a mixture of longleaf pine, oak, hickory, and other hardwoods. Wire grass is indigenous and broom sedge thrives in old fields.

The type is suited to the general farm crops of the region—cotton, corn, oats, cowpeas, sorghum, etc. It is also well adapted to the production of special crops, such as watermelons, cantaloupes, etc., and to pecan culture. These crops do best on the deeper areas, the shallower portions being less well suited unless they are plowed deeply, well pulverized, and allowed to oxidize and aerate thoroughly before being planted. The shallow areas must also be better supplied with organic matter, either from compost or such green crops as cowpeas, vetch, velvet beans, and soy beans. These areas are in reality outcrops of the subsoil, and a surface soil must be worked up by increasing the humus content. Such areas now have a low productive capacity and are usually left untilled. This green manuring treatment should also be extended to better areas of the type, as it would result in increasing the moisture-holding capacity, with a consequent increase in productiveness.

The agricultural condition of the type is poor. It has been farmed by tenants, and little, if any, attempt made to maintain its productiveness. There is at present a tendency toward better farming and consequently better conditions. Much of the type is included in a large pecan plantation and is being set to improved varieties of this nut.

GREENVILLE LOAMY SAND.

The soil of the Greenville loamy sand is a dark reddish-brown to red medium to coarse sand, from 5 to 6 inches deep, and frequently slightly loamy. It grades into a subsoil of red loamy sand or coarse loamy sand which extends to a depth of 36 inches or more. But little difference in texture is noted in the 3-foot section, though a substratum of red to mottled yellow, red, and gray sandy clay is found at the lower depths. As a rule, the surface sands have been washed clean of fine material by the rain, but below the influence of such action each sand grain is coated with a film of fine particles, silt and clay, giving the loamy character to the type. The sand itself consists

largely of rounded particles of quartz. Other minerals are more abundant in the fine soil material, and some of these give the characteristic bright-red color to the soil.

The structure of this loamy sand is open, allowing free movement of soil water. The fine soil particles are sufficient to cause it to crust. The soil in road cuts stands perpendicular, owing to the binding effect of the fine material. Tillage is easy and efficacious. Heavy rains are quickly absorbed, thus permitting cultivation under a wide range of moisture conditions.

The type is extensively developed in Dougherty County. It occurs west and southwest of Albany and in the vicinity of the pond at the confluence of the Kinchafoonee and Muckalee Creeks north of Albany. The topography is nearly level to slightly undulating and the natural drainage is good. While somewhat susceptible to drought, the loamy character of the type gives it a fair to good water-holding capacity, which under proper management enables crops to resist ordinary periods of scant rainfall.

The Greenville loamy sand represents a comparatively light-textured deposit of marine sediments over the country rock of limestone. The deep mottled subsoil or substratum is probably derived from the upper layers of the rock, while the more sandy surface portion apparently represents the weathered remains of a marine mantle. The type once supported a good stand of yellow pine, with some oak and hickory.

This is an excellent soil for all of the truck crops of the region. Cantaloupes, watermelons, cabbage, cucumbers, garden peas, beans, radishes, and onions do well if given moderate fertilization and reasonable care. It is quite extensively devoted to some of these crops, especially cantaloupes, which yield an average of 80 crates an acre, with maximum crops running as high as 125 crates to the acre. Early Irish potatoes do well, and can be grown and marketed by the last of May or early in June. The yield varies from 100 to 200 bushels per acre. Bermuda onions give excellent yields of fine quality. Pecan trees also thrive on this soil and come into bearing at an early age. Many of the truck crops can be grown during the winter season, as the soil is warm and early and the climate usually favorable.

In growing truck crops liberal applications of fertilizer are made. For the cantaloupe crop from 1,000 to 1,200 pounds of fertilizer is used per acre. This ordinarily analyzes: Phosphoric acid, 8 per cent; potash, 6 per cent; nitrogen, $3\frac{1}{2}$ per cent. The potash is in the form of sulphate, the phosphoric acid in acid rock, and the nitrogen is chiefly blood, though a small amount of it is in nitrate of soda to start the plants. Later about 75 pounds of nitrate of soda is applied around the growing vines.

Sweet potatoes are often set after Irish potatoes are harvested, and without additional fertilization give yields of 200 to 300 bushels an acre. Crab grass comes in after the cantaloupes are picked and gives a yield of one-half ton to 1 ton of hay to the acre. About the same or a little greater yield is obtained if the cantaloupe fields are planted to cowpeas for hay after the harvesting of the crop. The cowpea hay is of higher feeding value than the crab-grass hay. Corn, oats, cotton, and forage crops are also grown on this soil and give excellent results, providing a good supply of organic matter is maintained in the soil. Following cowpeas or velvet beans these areas will yield as follows: Corn, 25 to 50 bushels; cotton, one-half bale to 1 bale; and oats, 40 to 60 bushels per acre. If the soil is in good condition no difficulty is experienced in securing these yields, and they can be maintained by growing cowpeas for hay in rotation. This crop can be grown the same season following the crop of oats.

The chief factors to be considered in the improvement of the Greenville loamy sand is maintaining a high content of organic matter. This can be done easily by growing cowpeas, velvet beans, or some other legumes. Vetch and crimson clover may be used as winter cover crops and plowed under the following spring in time to plant cotton or corn. Lime should be used at intervals of a few years to aid in the decomposition of these green manures, to sweeten the soil, and to help maintain favorable tilth. Such treatment would also result in greater benefits from the use of the commercial fertilizers.

The agricultural condition of the Greenville loamy sand is good to excellent. Where utilized in producing cantaloupes it represents the highest and most intensive form of agriculture practiced, not only in the county but in the whole region. Land values for this type are not unreasonably high, though consistently advancing as its intrinsic worth becomes recognized.

GREENVILLE SANDY LOAM.

The soil of the Greenville sandy loam consists of a reddish-brown to red sandy loam from 6 to 10 inches deep. The subsoil is invariably a red to bright-red, friable sandy clay, becoming heavier with depth and showing mottlings of white, pink, gray, red, and yellowish-brown at depths varying from 3 to 6 feet. It grades below into the solid or partially weathered limestone rock.

The sand grains of the surface soil range from medium to coarse in size and are rounded to subangular in shape. The immediate surface color is often gray, the white quartz sand being partially washed clear while freshly cultivated areas have a decidedly reddish-brown to brown or red color. The sand content of the subsoil consists of subangular to sharp, angular grains of white quartz. In places

irregular fragments of insoluble, cherty limestone are scattered over the surface and throughout the soil mass.

Occasional small areas of the Greenville gravelly sandy loam, too small to map, are included with the type, while in places the soil mantle is shallow and the soil essentially the Greenville clay loam, the separation of the three materials being more or less arbitrary.

The type is easily cultivated, though care must be exercised in its management, as it is liable to clod if plowed too wet or too dry, the range in moisture conditions under which it may be handled being narrowed by its heavy subsoil. Often heavy rains will completely saturate the surface sandy soil, the subsoil checking the downward movement of the water. This condition can be remedied to a large degree by deeper plowing, which will give more space for holding surface moisture. Usually, however, no difficulty is experienced in the preparation of an adequate seed bed or in subsequent cultivation. The soil covering should be gradually made deeper in any event to enlarge the feeding zone for the plants.

The Greenville sandy loam is one of the most important soils of the county. It is typically and extensively developed throughout the western half of the county, with smaller areas in the eastern portion. The topography is undulating to slightly rolling, with no steep slopes, and consequently only a very small proportion of its area can be classed as waste land. The slightly rolling surface insures excellent surface drainage. The internal drainage of the type is also favorable except for the occasional saturation of the surface previously mentioned. Ordinary rains are quickly absorbed by the lighter soil and stored by the subsoil for later use. It is not difficult to maintain a favorable moisture content by frequent and shallow cultivation. The surface soil should be stirred after every rain to prevent the formation of a crust and consequent excessive loss of moisture by evaporation. Such management, together with the deepening of the soil itself by deeper plowing, would almost entirely prevent damage from drought, unless this be of extreme severity and long duration. It is also desirable to increase the moisture-holding capacity by incorporating organic matter in the surface soil.

The origin of the Greenville sandy loam has not been positively determined. Those areas in the eastern portion of the county appear to be derived largely from sandy marine sediments which upon weathering have taken on a reddish color. In the western or "red-land" section of the county the type seems to be residual, or at least partially so, from the Vicksburg limestone.¹

Mineralogically this red soil is somewhat complex. The sand grains are almost entirely of quartz, but the finer particles which give it its red color carry many different minerals.

¹ Geology of the Coastal Plain of Georgia, by Otto Veatch, Bul. No. 26, Geological Survey of Georgia, pp. 308 and 309.

The Greenville sandy loam occurs most extensively in the "oaky woods" section of the county. The tree growth is predominantly of hardwoods, consisting of several varieties of oak, black walnut, hickory, dogwood, persimmon, and other deciduous species, with a good many longleaf yellow pine, slash pine, shortleaf pine, and cedar. Wire grass flourishes and broom sedge comes in voluntarily in old fields. Most of the merchantable timber has been removed, though some timber suitable for milling, crossties, and staves still remains.

The type has a high agricultural value. It is well adapted to cotton, corn, oats, cowpeas, velvet beans, sorghum, and other general farm crops. These are the crops usually grown, cotton leading all others in acreage. With good care and cultivation and applications of 250 to 500 pounds of a complete fertilizer, yields of 1 bale or more of cotton, 30 to 40 bushels of corn, 30 to 60 bushels of oats, and 1 ton or more of cowpea hay per acre are easily obtained. The ordinary yields of these crops, however, can not be more than one-third to one-half bale of cotton, 15 to 25 bushels of corn, 15 to 30 bushels of oats, and three-fourths of a ton per acre of pea-vine hay. Wheat has been grown to a considerable extent on this soil with good results, yielding from 12 to 20 bushels per acre, but it has been superseded by cotton. Rye is grown to a small extent, and does well.

It is believed that alfalfa would do well on the Greenville sandy loam. In attempting the culture of this legume the soil should be well supplied with organic matter, preferably from the turning under of a crop of cowpeas, vetch, or crimson clover. Lime should also be used at the rate of at least one-half ton per acre, and the proper bacteria supplied by inoculation. The soil should be well drained, deeply and thoroughly prepared, and as free from weed seeds as possible. Cultivation should be given the field to be planted from early spring to conserve moisture and to kill the weeds as the seeds germinate, and the seed sown about September, after danger from smothering by crab grass is past. About 25 pounds of seed per acre should be used.¹

This soil type is not so well adapted to the truck crops as the lighter soils of the county, although they can be grown successfully upon it. Irish potatoes, sweet potatoes, cantaloupes, watermelons, tomatoes, and onions usually do well, and could be grown to a much larger extent than they are now. Peaches, pears, figs, and strawberries and other small fruits produce large returns. The type is fairly well suited to pecans, though in areas having a heavy subsoil, making root penetration difficult, their growth would be somewhat slow.

The recommendations for soil improvement made for other members of this series apply equally to this soil.

¹ See Farmers' Bulletin No. 339, U. S. Dept. of Agr.

Taken as a whole, the agricultural conditions prevailing over the entire area of the Greenville sandy loam are good. There is room for much improvement, but the present tendency is in the right direction. While a considerable proportion of the type is cleared and under cultivation a large area is in woods. The agricultural income of the county would be greatly increased by the further development of the type. Large holdings of the type are being divided into smaller farms and the cultivated areas more intensively utilized than in the past. Large tracts can be purchased at from \$10 to \$25 an acre.

GREENVILLE CLAY LOAM.

The surface soil of the Greenville clay loam consists of a reddish-brown to dark red heavy clay loam to heavy sandy loam from 3 to 6 inches deep. The subsoil is a bright red heavy sandy clay, underlain by a substratum of clay mottled with red, yellowish brown, pink, drab, and gray. In places the sandy covering becomes slightly deeper and the surface more of a sandy loam. In others the sandy soil covering is shallower, and the surface a heavy clay loam or clay. Here and there considerable quantities of small iron concretions are found in the surface soil. Such areas represent a gravelly sandy loam or gravelly clay loam. The sand content is generally of the medium grades in texture, though often slightly coarser in some places and finer in others. All these variations, however, are so small and so intricately associated with the typical soil that it was found impracticable to separate them on a map of the scale used.

The Greenville clay loam requires more care in cultivation than any other soil type in the county, except the Grady clay. The latter, however, is much less extensive and but little farmed. The heavy character of the soil section not only narrows the range of moisture conditions favorable for plowing and cultivating, but also often prevents needed tillage at the proper time. Heavier farm implements are also necessary to prepare the soil properly for planting and in subsequent cultivation. The soil clods badly if turned either when too wet or too dry, and when once plowed in poor condition it is only with much labor and difficulty that good tilth can subsequently be obtained. These peculiarities of the type frequently retard the preparation of the seed bed.

The Greenville clay loam is found extensively and typically developed throughout the western part of the county. With its companion types, the sandy loam and gravelly sandy loam of the same series, it constitutes what is known as the "red land" section of the county.

The topography is gently undulating to level. The slightly higher areas of associated types are usually of the sandy or gravelly sandy loam, and the lower-lying swampy areas are of the Grady series.

Surface drainage in the more undulating areas is fair to good; that of the more level areas is less satisfactory. The surface run-off as a whole is rather poor and only a little excess of water tends to saturate the soil. The subsoil can absorb liberal quantities of moisture but does so rather slowly. As a result heavy rains are rarely harmful, unless coming as sudden showers, when the soil can not absorb all the water and the loose top soil may be washed away. The gentle rains are stored in the soil section for later use by the crops. The ability of the soil to store this moisture depends to a large extent upon the organic-matter content and depth of tillage. With both of these conditions favorable it can receive without damage large quantities of water, but with a low organic content and shallow cultivation only a small percentage of the rain water can be stored and saved for the growing crops.

The origin of the Greenville clay loam, like that of the other Greenville types, is uncertain. The soil is apparently the result of residual disintegration and weathering of the Vicksburg limestone, which underlies it at no great depth. Unweathered fragments of this rock are often scattered over the surface and through the soil. There is no distinct transition from the red subsoil to the varicolored substratum, or between this deep subsoil and the soft, partially decomposed limestone rock below, indicating that the material is residual or largely so.

The whole type occurs in the "oaky woods" section of the county. Its timber growth is essentially of hardwoods, the predominating species being oaks and hickory. Longleaf yellow pine is the principal coniferous tree. Nearly all of the merchantable timber has been removed, though there is still much excellent firewood and some timber suitable for crossties and staves.

The Greenville clay loam has a high agricultural value, and is one of the most extensively developed soil types in the county. It is well adapted to corn, cotton, oats, forage crops, rye, and wheat. All these crops are now grown extensively, except wheat and rye. Where the soil is in good condition and thorough tillage is given, these crops seldom fail to give heavy yields. The yield of corn ranges from 10 to 50 bushels per acre, of cotton from one-half bale to 2 bales per acre, with an average of about 1 bale. Oats are almost always a sure crop when grown on this soil, producing from 25 to 60 bushels an acre, with an average of nearly 40 bushels. This grain crop is planted about October or November and harvested in May. Often the crop is lightly grazed during the winter season without injury to the yield of grain. Following the harvest of the oat crop the land can be planted to cowpeas for hay, which will cut from three-fourths of a ton to 1½ tons per acre, with an average of 1 ton. The stubble can be plowed under to improve the soil. The use of these two crops in the

rotation can not be too strongly urged. They give the soil a rest from the clean culture crops, corn and cotton, which in itself is beneficial. They also furnish sod crops with fine root systems and add to the organic-matter content. Besides these benefits, the cowpeas, being a legume, draw nitrogen from the air and store it in the soil. Velvet beans also improve the soils and furnish an excellent forage crop. Sorghum gives heavy yields of forage and sugar cane a large tonnage. The sirup from the cane grown on this soil, however, is of dark color and inferior flavor. Wheat has been grown to a considerable extent on the Greenville clay loam with good results, yields ranging from 15 to 20 bushels per acre. All kinds of garden vegetables are grown for home consumption with good results, though the heavy character of the soil makes them comparatively late and rather precludes the use of the type for such special crops on a commercial scale. It is believed that alfalfa can be produced on this soil.¹

Commercial fertilizers are quite extensively used, though often with good management and care the average yields mentioned can be and are secured without artificial fertilization. This may be done through the growing of cowpeas, deeper and better plowing, and good care and management in all the farm operations.

The Greenville clay loam is of high agricultural value and altogether a desirable soil. Much of its area is held in large plantations and can be purchased at a moderate price—from \$10 to \$25 an acre. The division of these plantations into smaller farms will do much for the development of the county. In addition to its high crop value, artesian wells of fine, pure water for domestic use and irrigation purposes can be located over practically its whole area.

ORANGEBURG GRAVELLY SANDY LOAM.

The surface soil of the Orangeburg gravelly sandy loam is a gray to brown or grayish-brown sandy loam from 6 to 10 inches deep, more or less completely filled with small gravel consisting of rounded iron concretions. This gravel is often so abundant as literally to cover the surface. The subsoil from 10 to 36 inches consists of a red sandy clay also carrying a large percentage of the small iron concretionary gravel. Most of these gravel particles do not exceed one-fourth to one-half inch in diameter, and the quantity is never sufficient to interfere with cultivation. This soil may be worked under a wide range of moisture conditions, its gravelly and sandy nature and gently undulating surface giving good natural drainage.

A relatively small area of this kind of soil occurs in Dougherty County. A considerable area is found around Pecan City, another west of Nelms, with several small, scattered areas east of the Flint River.

¹ See Farmers' Bulletin No. 333, U. S. Dept. of Agriculture.

The Orangeburg gravelly sandy loam occupies slightly higher positions than some of the surrounding types, and is probably derived from marine deposits of more advanced oxidation than are the other types of the series. It was formerly thickly covered with a magnificent growth of longleaf pine. Wire grass flourishes in uncleared areas and broom sedge in old fields.

The type is well adapted to all the general farm crops of the region. Where in good condition and the supply of organic matter has been kept up it is capable of producing from three-fourths of a bale to 1 bale of cotton, 25 to 50 bushels of corn, 30 to 60 bushels of oats, and 1 ton of pea-vine hay to the acre. It is also suited to early truck crops and pecans.

In the management of the type care should be taken to maintain the organic content of the soil. It should also be plowed rather deep to increase the capacity of the soil for storing moisture. This with shallow cultivation would greatly aid the growing crops to resist drought conditions. Where under cultivation the agricultural conditions are good and excellent yields are secured. Much of the land is still uncleared, though all of it has been denuded of its original stand of timber. It is held at nominal prices in comparison with its intrinsic value for crop production.

ORANGEBURG SAND.

The surface soil of the Orangeburg sand is a gray to light grayish brown medium sand, from 5 to 8 inches deep. The subsoil consists of a reddish-brown to red sand of the same texture, which in turn is underlain by a friable, red sandy clay. This substratum, however, is rarely encountered at depths of less than 3 feet. Cultivation is easy and can be accomplished with a lighter equipment than in case of the sandy loams of the county.

The type is of limited extent, being found in scattered areas throughout the eastern portion of the county, the largest and most typical area being situated about 2½ miles east of Albany. The topography is undulating to almost level and the drainage good. The light texture makes it possible to work this soil under a wide range of moisture conditions. It dries out quickly after heavy rains and is somewhat droughty, crops often suffering during periods of scanty rainfall.

The Orangeburg sand probably owes its origin to the weathering of marine deposits.

Areas of this soil were formerly covered with a magnificent growth of longleaf yellow pine. This has been almost entirely removed and over many areas a second growth of the same tree has sprung up. There is also some post and scrub oak and a few live oaks and water oaks on the type. A scant sod of wire grass covers the ground.

The Orangeburg sand is preeminently a truck soil and should not be used extensively for the production of corn and cotton, or any long-season crops, especially if the growing period for that crop extends through the hot summer months, except crops like cowpeas, planted for turning under as green manure. Care should be taken to always maintain a high organic content in this soil. When in such condition it is well adapted to and should give good yields of cantaloupes, watermelons, cucumbers, garden peas, string beans, and strawberries. During the winter season such crops as lettuce, radishes, and spinach can be grown to advantage. After the truck crops are harvested cowpeas may be planted and cut for hay, or grown and plowed under as fertilizer for the following season's crops. Irrigation of the type from the "deep wells" would undoubtedly prove advantageous.

The Orangeburg sand is now used to some extent for cantaloupe and watermelon production with good success, except for occasional droughts. This danger would be entirely eliminated with irrigation. For the most part, however, this soil is utilized, largely by colored tenants, for corn and cotton, of which it gives only poor yields, the cotton rarely producing more than one-fourth to one-third of a bale and corn 8 to 10 or 12 bushels to the acre. With judicious fertilization and a higher organic content these yields can be considerably increased, but the best future utilization of the type lies in truck growing rather than in the production of general farm crops. Agricultural conditions are good to poor, much of the area being uncultivated. Land values are not high, though gradually increasing.

ORANGEBURG LOAMY SAND.

The surface soil of the Orangeburg loamy sand consists of a gray to reddish-brown coarse to medium sand, from 6 to 10 inches deep. The surface to a depth of a few inches is usually loose and incoherent, the grains of sharp to rounded sand being washed comparatively free of fine material by the rains. In old fields and those not freshly cultivated, where there has been a continuous washing by rainfall, the surface is gray. Beneath the color is generally gray, light brown, or reddish brown. In freshly cultivated fields, where there has been little or no washing by rains, the color ranges from a grayish brown to reddish brown. The subsoil to a depth of about 36 inches is a red to reddish-brown loamy sand to coarse loamy sand. The loamy character is imparted by the presence of a small though very noticeable proportion of fine silt and clay particles. At depths greater than 3 feet this loamy sand subsoil grades into a red sandy clay, or a mottled, heavy sandy clay substratum, which in turn grades into the partially weathered or solid limestone country rock.

While the structure of the whole 3-foot section of this soil type is open and rather incoherent, there is enough fine material present to cause the surface to bake after saturation, and to enable the material to stand without crumbling in perpendicular cuts. The type is easily cultivated, and can be handled soon after rains.

The Orangeburg loamy sand is of considerable extent in the county. A large, irregular shaped area is found south and southwest of Albany between the River Road and the Newton-Albany Road. Another area of lesser extent lies between the Newton-Albany and Pretoria Roads southwest of Albany. Another is found west of Albany, and two east of the Flint River east of Albany. The topography is almost level to very slightly undulating. Surface and internal drainage are good despite the fact that there are no streams traversing the areas. The open character of the whole soil section permits the absorption of large quantities of rainfall. Undoubtedly much of the drainage of the type is effected by seepage and escape through the rocks below.

The Orangeburg loamy sand is probably derived from a sandy mantle of marine material overlying the country rock. The gray surface is due to the washing and rinsing out of much of the fine red material leaving the gray to white quartz sand as the predominating soil-forming material.

The native forest vegetation consisted of a mixture of longleaf yellow pine, oak, and hickory, with some dogwood and persimmon. Wire grass and broom sedge thrive everywhere. Another conspicuous plant is Spanish dagger. About all the timber, except firewood, has been removed.

In comparison with its extent, the type may be considered one of the important agricultural soils of the county. It is especially well adapted to the truck crops though not used for their production to any extent. It is well suited to such crops as cantaloupes, watermelons, cucumbers, cabbage, table beets, radishes, lettuce, string beans, and garden peas. It is also adapted to early Irish potatoes and sweet potatoes. The former can be planted from the middle to the last of February, harvested in May, and can be followed the same season by the sweet potatoes. The yield of Irish potatoes with good culture and moderate fertilization ranges from 100 to 150 bushels per acre and of sweet potatoes from 100 to 300 bushels without additional fertilization. This type is also one of the best soils of the region for pecans.

This soil is now most extensively utilized in the production of cotton as a money crop and of corn to feed the work stock. It is highly esteemed for these crops. With moderate applications of fertilizer it will give from three-fourths bale to one bale of cotton and

from 15 to 20 bushels of corn to the acre. Oats are also a good crop for this soil, yields varying from 20 to 50 bushels to the acre. They are harvested in time to be followed by cowpeas, which yield from one-half ton to one ton of hay, besides furnishing roughage for improving the soil.

The future use and development of the Orangeburg loamy sand should be more along the line of special crops than of the general farm crops of the region. More of the legumes, cowpeas, crimson clover, and vetch should be grown both for forage and as cover crops and green manuring. In addition an occasional oat crop should be grown to rest the soil from the special truck crops. Irrigation systems are necessary to insure profitable crops each year.

The agricultural conditions prevailing over the Orangeburg loamy sand are fair to good. Much of it is cleared and in cultivation, producing excellent crops. As a rule the type is well farmed. Land values are only nominal as compared with the crop-producing power of the soil. Values are slowly advancing, however, as the county becomes settled and the worth of this soil type is recognized.

ORANGEBURG SANDY LOAM.

The surface soil of the Orangeburg sandy loam consists of a gray to light-brown medium to coarse sand, or light, incoherent sandy loam, from 8 to 12 or 15 inches deep. Shades of red or deeper brown are often noticeable, especially in freshly plowed and cultivated areas. In depressed areas accumulations of organic matter often impart a dark-gray to black color to the soil. In such areas local wash has formed a surface mantle of silty to clayey material a few inches deep. The subsoil, to a depth of 3 feet or more, consists of a red to bright-red, friable sandy clay. The sand grains of both soil and subsoil are more or less angular to subangular fragments of white quartz. The fine material is sticky and imparts the red color to the soil. In only a few places small, rounded quartz gravel and small, round iron concretionary gravel are present. Beneath the subsoil stratum there usually occurs a deep subsoil of varicolored sticky clay. This generally grades imperceptibly into a whitish, partially weathered product of the underlying limestone.

As a rule this soil type is easily cultivated, the light sandy surface covering quickly absorbing the rain water, which passes to the heavier subsoil below to be stored for subsequent use. In case of heavy precipitation, however, the soil becomes saturated and tillage is impossible, the soil tendency being to bake, if not promptly cultivated, as soon as the moisture conditions will permit. Such conditions are rare during the growing season. They are more likely to occur during the winter months and retard preparation of the land for crops.

Except for this feature, a seed bed of excellent tilth can be prepared and subsequent tillage easily and cheaply performed.

The Orangeburg sandy loam is extensively developed throughout the eastern half of the county. East of the Flint River it is the dominant soil type, except over some of the more rolling country along the Worth County line south of Acree, where it is superseded by the Tifton sandy loam. It is also found west of the river, except near Percosin and Cooleewahee Creeks, where it gives way to Greenville soils. Small areas of the type are found associated with the Greenville soils in the western half of the county.

The Orangeburg sandy loam occupies the gently undulating to slightly rolling uplands, nowhere steep enough to erode or to interfere with cultivation. Stream channels are few, but nevertheless drainage conditions are excellent. Lime sinks and other shallow depressions receive some of the water, but by far the greater proportion of the drainage is accomplished through subterranean channels in the underlying limestone. The type is not especially droughty, though crops may suffer from this cause. Much of this trouble could be averted by proper management through increasing the organic-matter content, by deepening the surface soil portion, and by frequent and shallow cultivation to reduce the loss of moisture through evaporation. Such cultivation should follow every rain to prevent the formation of a crust and to establish a mulch of loose soil.

The Orangeburg sandy loam is probably derived from the weathering of a sandy deposit of marine origin, though some portions of the subsoil may be residual from limestone. The lighter soil covering has been formed through the long continued loss of the finer earth particles by the washing of the original materials.

The Orangeburg sandy loam constitutes a portion of the "piney woods" section of the county. The original forest growth consisted chiefly of the longleaf pine with some oak, dogwood, persimmon, black walnut, elm, and hickory. The pine timber, which was of the best, has been nearly all cut off, the land in many places now being covered with a second growth of the same species. A few areas of fine virgin pine are still to be found.

Much of the type is cleared and in cultivation, though in many fields all the stumps have not been removed. These interfere with the use of farm machinery and increase the cost of crop production. Wire grass and broom sedge constitute the principal sod growth, the former in uncleared areas and the latter in cleared but uncultivated fields.

The Orangeburg sandy loam ranks among the best soils of the county. It is especially adapted to the growing of cotton, oats, forage crops, and corn, and is also well suited to the production of

watermelons, cantaloupes, cucumbers, Irish potatoes, sweet potatoes, and peanuts. Pecan trees grow rapidly upon this type and come into bearing earlier than when set on some of the other soils.

The type is most generally utilized for corn and cotton. There are, however, considerable quantities of oats and cowpeas grown upon it, the latter mainly for hay. Large areas of this soil type have been set to pecan orchards in the past few years and such development is still in progress.

The ordinary yields obtained from this soil are approximately 15 bushels of corn, from one-fourth to one-third bale of cotton, and from one-half to three-fourths ton of pea-vine hay to the acre. These figures, however, do not represent the productive capacity of the soil, as with the best of management from 25 to 50 bushels of corn, a bale of cotton, and from 1 to 1½ tons of pea-vine hay per acre can be produced. Oats are grown to a considerable extent and nearly always do well. The acreage of this crop should be increased. Yields vary from 20 to 50 and 60 bushels per acre. A crop of cowpea hay can be grown after the oat crop is harvested. Sorghum and sugar cane do well, though the sirup from the cane is inferior in color and flavor to that made from cane grown on types having a yellow subsoil.

The low average yields can be attributed largely to the tenant system of farming with its inferior methods of soil management, especially as regards the maintenance of the productiveness of the soil. More thorough preparation should be given the land. A regular system of crop rotation, with provision for a sod crop like oats, and a legume such as cowpeas, vetch, or crimson clover should be made the general practice. Such a cropping system will maintain the content of organic matter and nitrogen and improve the soil in other ways. Peanuts planted with the corn to be grazed off by hogs after the corn is gathered would not only prove profitable but would at the same time enrich the soil for succeeding crops.

The agricultural condition of the Orangeburg sandy loam throughout the county is good and is improving each year. Land values are not high in comparison with the intrinsic worth of the soil. Prices are slowly advancing as the region is developed and the large plantations are subdivided into smaller farms. Areas of the type can be secured at \$15 an acre up.

NORFOLK SAND.

The Norfolk sand consists of beds of medium to coarse sand varying from 3 or 4 feet to many feet in depth. The surface 5 or 6 inches are usually gray or dark gray in color, depending upon the varying content of organic matter mixed with the sand grains. Below this surface mantle the colors are grayish yellow to pale yellow. The

sand grains are for the most part rounded and subangular fragments of quartz, a conspicuous feature of the type being the small percentage of other minerals it carries. The surface portion of the soil section is often quite compact, while the subsoil portion is nearly always loose, open, and incoherent.

Cultivation of the Norfolk sand is easy, only a light farming equipment being required. Tillage without the frequent incorporation of organic matter tends to make the soil lighter colored, more incoherent in its structure, and much less retentive of moisture.

The Norfolk sand is most extensively developed in the eastern portion of the county. Areas of this type occur around depressions occupied by the Grady soils and some of the lime-sink ponds. It is also developed to some extent on Pine Island in the western end of the county. The topography is almost level to undulating. Both surface and internal drainage are good and in places excessive.

The formation of the Norfolk sand is due to the weathering and washing of a marine deposit of especially sandy material, from which much of the finer particles have been eliminated by water action.

The native vegetation of the type consists of longleaf pine, scrub oak, and a sparse growth of wire-grass as a sod covering. Broom sedge springs up in old fields. Most of the magnificent pine timber which the type formerly supported has been cut. In places a second growth of pine has come in and is flourishing where protected from fire. In the lower situations and around some of the limesink depressions and ponds large live oaks are found.

The Norfolk sand is the most open, best drained, and warmest soil type of the region. It is only moderately productive. The texture and structure are such that the growing crops are likely to suffer from lack of moisture.

The characteristics of the Norfolk sand which make it droughty also make it especially adapted to early truck crops. Garden peas, string beans, cantaloupes, watermelons, cucumbers, radishes, strawberries, lettuce, beets, spinach, etc., will do well providing the moisture supply is maintained and the soil well supplied with humus from compost or from the growing of leguminous crops. Many of these crops may be grown in the winter season for northern markets. For the production of these crops liberal applications of commercial fertilizers are also advisable, principally of phosphoric acid and potash in the ratio of about 2 parts of the former to 1 of the latter. Most of the nitrogen needed can best be secured by growing velvet beans, or cowpeas in the rotation, or by either of them or a crop of vetch turned under green. An application of lime at the time of turning under these green crops will aid in their decay to form humus and will also tend to make the soil more compact and retentive of moisture.

Sugar cane grown on this soil makes a sirup of superior quality, but the yield is small unless the fields are heavily fertilized. Sweet and early Irish potatoes usually do well if the soil is in good condition, and are the best of the general crops suited to the type. It is not adapted to cotton, corn, and oats, and seldom gives paying yields of these crops, which should never be planted on the type unless the soil is in excellent condition. Even then the truck crops will usually give far more profitable returns.

Comparatively little of the Norfolk sand is under cultivation. Where it is cleared it has usually been cropped to cotton and corn until it failed to yield paying crops, and has then been abandoned for crop purposes. By the use of proper methods and the growing of the truck crops this soil could again be made to contribute to the agricultural prosperity of the county.

Norfolk sand, rolling phase.—The Norfolk sand, rolling phase, consists of beds of sand of considerable depth. The surface material to a depth of a few inches is gray, owing to the presence of a small amount of organic matter, while below the color is a pale yellow. The apparent texture of the sand ranges from medium to coarse, though a fair proportion of the finer grades is present, especially in the upper portion of the section.

Five areas of this phase of the Norfolk sand are mapped, a single area of several hundred acres in extent east of the Flint River at Albany constituting the greater part of the phase. The other areas, one on the east side of the river near the Georgia Northern Railway bridge, one at the edge of the upland above the mouth of Piney Woods Creek, one at Acree, and another about $2\frac{1}{2}$ miles southeast of Pecan City, are all small.

These sand deposits have a gently rolling to billowy topography, standing conspicuously above the surrounding soils. They are loose and incoherent in structure and drift in the wind where not fully protected by a sod of wire grass. They originally supported some pine timber and scrub oak. The pine has been removed. Drainage is excessive, water passing from the surface downward almost without hindrance. The origin of these "sand hills" has never been definitely determined.¹

The Norfolk sand, rolling phase, if liberally supplied with organic matter to increase its moisture-holding capacity would be suited to the production of the earliest truck crops. If water could be supplied by irrigation it would make an excellent truck soil, dependence being placed upon fertilizers for forcing the crops to maturity. The present use of this sand is in the manufacture of a sand-lime brick. Little or no attempt is made to use it for agriculture on account of its leachy character.

¹ Geology of the Coastal Plain of Georgia, by Otto Veatch. Bulletin No. 26, Geological Survey of Georgia.

NORFOLK SANDY LOAM.

The surface soil of the Norfolk sandy loam consists of a gray, loamy sand to very light sandy loam, from 5 to 6 inches deep. This is underlain to a depth ranging from 6 to 12 or 15 inches by a pale-yellow to yellow loamy sand to sandy loam, which grades quickly into the real subsoil of bright-yellow, friable sandy clay. This subsoil stratum extends to considerable depths. While the surface portion of the soil section is light and loose, the lower portion is compact and makes an excellent reservoir for the storage of soil moisture. This type is easily tilled, though the compact, friable clay subsoil prevents the waters from passing quickly downward, thus slightly narrowing the range in moisture conditions for its effective handling. An excellent tilth can be secured for a seed bed and all cultivation satisfactorily and easily performed.

The type is of small extent in the county. The largest area is in the southeastern corner of the county with another along the Baker County line about 3 miles west of the Flint River. Other smaller areas occur throughout the eastern part of the county, with only infrequent occurrences west of the river.

The topography is undulating to rolling but never so steep as to make erosion a serious problem. Surface drainage is excellent except in local spots of small extent. Internal drainage movements are favorable in that excesses of water are seldom held long enough to be injurious to growing crops. On the other hand, the character of the subsoil is such that the waters received by the surface soil are not quickly removed to depths out of reach of the root systems of the crops. Careful tillage methods to prevent unnecessary loss of moisture will do much to insure crops from damage from drought except during protracted periods.

Ferruginous pebbles are present in some areas where the type approaches the characteristics of the Tifton soils.

The Norfolk sandy loam is composed of materials laid down when the region was covered by the sea. Much of the finer particles has been removed from the surface portion since emergence by wash, leaving the sandy soil mantle with the heavier subsoil. Upon weathering the materials of which this soil type is composed assumed a yellow rather than a red color.

The native forest growth consisted almost exclusively of longleaf yellow pine with some hardwood, oak, dogwood, etc. The timber has been about all removed. Wire grass flourishes on the uncleared areas and broom sedge in idle fields.

The type is a productive soil if properly managed. It is better adapted to the general farm crops of the region than to special crops. Corn, cotton, oats, cowpeas, sorghum, sugar cane, peanuts, sweet potatoes, and watermelons give good yields, and many of the truck

crops, such as beans, tomatoes, early Irish potatoes, cantaloupes, etc., do well. No difficulty is experienced in obtaining one-half bale or more of cotton, 20 to 40 bushels of corn, 25 to 50 bushels of oats, 1 ton of pea-vine hay, and 100 to 250 bushels of sweet potatoes per acre, providing the soil is well supplied with organic matter, properly fertilized, and the crops carefully cultivated. Average yields are probably somewhat smaller than the above figures, owing to the failure to keep up the organic content of the soil, to poor preparation of the seed bed, and to inadequate cultivation. The sirup from the cane grown on this soil is superior in quality to that grown on the "red lands" and the yield is good. The type is also well suited to pecans.

The use of commercial fertilizers on the Norfolk sandy loam is largely confined to the cheaper grades without regard to the conditions of the soil or to the differences in the requirements of the crops to be grown. The commonest mixture consists of 8 per cent of phosphoric acid, 2 per cent of nitrogen, and 2 per cent of potash. Acreage applications as a rule are small. Fertilizer practices should be varied to suit the crop and the soil conditions. The soil is capable of being quickly improved by growing the legumes, and most of the expense for nitrogen could be saved by growing such crops as cowpeas, velvet beans, and peanuts. In fact, better results can be obtained from commercial fertilizers when used in conjunction with green manuring crops of this kind.

The agricultural condition of the Norfolk sandy loam is usually good, though in some instances the type is uncleared. The valuation of the type varies with the proportion of cleared land, its location, condition, and productivity. Land values as a rule are low.

Norfolk sandy loam, deep phase.—The surface soil of the Norfolk sandy loam, deep phase, consists of a medium-textured gray sand about 6 inches deep, underlain to a depth of some 15 to 18 inches by a slightly loamy sand of pale-yellow color. This in turn rests upon a yellow, loamy sand or light sandy loam which soon grades into a yellow, sandy, friable clay, at depths ranging from 30 to 36 inches. The soil section is mellow and loose at the surface, gradually becoming more compact and heavier with depth. Cultivation is not difficult and can be performed under a wide range of moisture conditions.

The deep phase of this type is found in rather small areas scattered throughout the county east of Albany. It has an undulating surface and good natural drainage. It is not as droughty as the Norfolk sand and slightly more so than the sandy loam.

The Norfolk sandy loam, deep phase, is derived from the weathering and washing of marine sediments, which have taken on a yellow color in the process. The native timber growth consists largely of longleaf pine, with wire-grass sod over virgin areas and broom sedge in cleared but untilled fields.

The deep phase of the Norfolk sandy loam is adapted to truck crops such as early Irish potatoes, cabbage, and the vine crops, and also gives good yields of cotton, corn, oats, and hay if properly managed. Care should be exercised to keep the soil in good condition and well supplied with organic matter. Where this is done and soil moisture conserved excellent yields of all of the above crops can be secured. The fertilizer used for cotton, oats, and corn should be rather high in phosphoric acid, moderately rich in potash, and fairly so in nitrogen. The latter can be supplied in part by growing cowpeas and other legumes. If this is not done liberal quantities of commercial nitrogen will be necessary for all crops.

This phase is capable of high development. Its texture and structure are such as to make it a warm early soil and especially well adapted to the special crops rather than to corn and cotton.

Norfolk sandy loam, flat phase.—The surface soil of the flat phase of the Norfolk sandy loam consists of a gray to yellowish-gray sand grading in places into a loamy sand or light sandy loam, having an average depth of 8 inches. The subsoil is a yellow, slightly loamy sand to a depth of 12 to 18 inches, grading into a sandy loam of light yellow color. This in turn grades into a friable sandy clay of the same color, showing some mottlings of red at lower depths. The type is easily maintained in good tilth.

This phase of the Norfolk sandy loam occurs only in the western part of the county. It has a flat, almost level topography, with insufficient surface relief to afford good natural drainage. It occupies a position slightly lower than the surrounding soils and receives water from them in addition to its own natural supply. Drainage is mainly by percolation through the soil material as no surface drainage channels have been developed. Such drainage is slow and inadequate and crops are sometimes ruined by water standing on the surface for long periods of time. Open ditches could be used to remove such excess of water more quickly.

The origin of this phase of the Norfolk sandy loam is more or less in doubt. It seems likely that the upper and more sandy portion of the soil section is derived from the weathering of unconsolidated sands of marine origin. The lower portion of the subsoil is apparently derived from the decomposition in place of the country limestone rock of the region. The whole area of this phase is closely associated with the Grady soils of residual origin.

The native forest growth of the type consists of the longleaf pine with some scrub oak. There is a thick sod of wire grass. A very small proportion of its area is under cultivation at the present time. Small fields under favorable conditions will yield a bale of cotton per acre without the use of fertilizer. Cotton grown on this soil shows a tendency to rust. This can be largely prevented by the use of

kainit or some other potash fertilizer. Corn yields from 20 to 40 bushels to the acre. If this soil were adequately drained, it would make an excellent soil for corn, cotton, cabbage, sugar cane, and hay. The agricultural condition is now very poor. Most of the phase is really wild land.

CAHABA SAND.

The surface soil of the Cahaba sand is a grayish-brown to light-brown sand from 10 to 15 inches deep. The subsoil is a yellowish-brown sand extending to a depth of 36 inches or more. The texture of both the soil and subsoil is medium, but occasionally ranges from rather coarse to fine.

The type is of small extent, occurring in small areas along Piney Woods Creek in the northeastern part of the county and on the east side of the Flint River below Albany and below Putney. It occupies slight ridges or elevations on stream terraces above usual overflow, and the drainage is good.

The type is best adapted to the production of truck crops such as watermelons, cantaloupes, strawberries, etc. It is light, loose, and warm, and these crops can be forced to early maturity with fertilizers. It is not well adapted to the heavy crops of the region, such as cotton, corn, and oats, though where well supplied with organic matter and fertilized it gives good yields. Cowpeas should follow the truck crops either for hay or for green manure.

Agricultural conditions prevailing over this type are only fair to poor. Much of its area is uncleared.

CAHABA SANDY LOAM.

The soil of the Cahaba sandy loam consists of a grayish-brown to light-brown sand to sandy loam from 5 to 15 inches deep. The sand ranges from medium to coarse in size and is usually quite sharp and angular. The subsoil is a slightly friable, reddish-brown to red clay. In places the color is yellowish red to dull red and the clay less sandy, stiff and brittle. In other places it becomes mottled with red and brown in the lower depths. Such areas represent an approach toward or a real development of the terrace phase of the Grady sandy loam, the areas being too small to map separately. Occasionally the type ranges to a coarse sandy loam in texture. Cultivation is not difficult, except that the heavy subsoil checks the downward movement of moisture and in times of excessive rainfall tends to keep the surface saturated.

The type occupies the high terraces lying above the Flint River bottoms and is rarely if ever overflowed. It is not of large extent in the county. A few areas are found along the river in the vicinity of Putney, along Dry Creek, and along the upper portion of Piney Woods Creek. The topography is nearly level and the drainage only fair to good.

This soil type has been formed by deposits of material by the streams when they flowed at higher levels than at present. The original timber growth consisted of pine, magnolia, oak, hickory, and other hardwoods, with a thick undergrowth of brush. A considerable proportion of the type is cleared and in use for crops.

The Cahaba sandy loam is an excellent soil for cotton, corn, oats, and forage crops. It is poorly suited to any of the special truck crops of the region, and is also considered undesirable for pecans on account of the rather dense and heavy subsoil.

If plowed deeply, well supplied with organic matter, and otherwise properly cared for, cotton will produce from three-fourths of a bale to 1 bale, corn from 20 to 40 bushels, oats from 25 to 60 bushels, and forage crops about 1 ton to the acre. The larger yields are obtained with liberal applications of fertilizers. The soil stands in need primarily of more organic matter, which can best be supplied by growing such crops as cowpeas, velvet beans, crimson clover, or other legumes. Better and more thorough tillage would greatly improve its productiveness. The heavy subsoil makes it retentive of moisture. In some cases underdrainage would be helpful.

CAHABA FINE SAND.

The Cahaba fine sand consists of a brown fine sand about 8 inches deep, underlain to a depth of 36 inches or more by a light-brown to yellowish-brown fine sand. The whole section is loose and open in structure and texture, the proportion of silt and clay being relatively small.

The type is found on both sides of the Flint River along its course throughout the county. It occurs as narrow ridges and flat, narrow terraces. A narrow ridge of this fine sand almost always lies along the immediate bank of the river. It is well drained but subject to occasional overflow.

The Cahaba fine sand represents terrace deposits, laid down by floods of an earlier period.

The timber growth consists of pine, magnolia, sycamore, a few scrub oaks and willows, and sassafras brush. Wiregrass, broom sedge, ferns, brambles, and a varied brushy undergrowth are often found on this type.

This type is best adapted to early truck. At present practically none of it is under cultivation owing to the danger from the floods. It could be easily irrigated by pumping water from the river. Where the danger from overflow is small, and an adequate supply of water for irrigation is available, it is an excellent soil for cantaloupes, watermelons, Irish potatoes, sweet potatoes, tomatoes, snap beans, peas, table beets, radishes, and other special crops.

CAHABA FINE SANDY LOAM.

The surface soil of the Cahaba fine sandy loam consists of a grayish to light-brown loamy fine sand to fine sandy loam, from 12 to 24 inches deep. The subsoil is a brownish-red to dull-red, moderately friable clay. In places the clay becomes stiff and brittle with a decrease in the sand content, such areas representing an approach to the Grady soils. The texture becomes heavier with depth, at 3 feet and below being usually a dense, plastic, sticky clay, mottled red, brown, yellow, and gray in color.

The more sandy areas of this soil type are easily cultivated, though the heavier portions are rather intractable, clodding if plowed when too wet or too dry, and baking in dry weather. There is also some danger of puddling in these heavier areas if not handled when the moisture content is favorable. However, with good judgment and a reasonable amount of time and energy in the preparation of fields before planting a good tilth can be secured and this can be easily maintained by subsequent cultivation.

The Cahaba fine sandy loam occurs rather extensively on both sides of the Flint River, along Piney Woods Creek, and along the lower course of Dry Creek. An extensive and typical area is found south of Albany along the River Road. The type occupies high, level terraces and has a flat terrace topography.

Drainage is fair to poor. The almost level topography prevents the rapid run-off of the rains, and the heavy, dense subsoil checks downward percolation, with the result that the surface soil is often completely saturated and cultivation prevented for short periods of time. Areas along the smaller streams are somewhat subject to overflow. Shallow, open ditches would do much to improve the drainage conditions where necessary on the higher lying terraces, and the cleaning out, deepening, and straightening of the stream courses would relieve other areas of at least some of the danger of inundation.

The Cahaba fine sandy loam is probably formed from reworked marine deposits laid down when the water of the stream was flowing at a considerably higher level than at present. The type was originally covered with a good stand of yellow pine, which has been cut off. There is some second-growth pine and a scattering of water oak and scrub oak now over much of its area.

The type is well suited to oats, corn, cotton, cowpeas, sorghum, etc., while the lighter, more sandy areas are adapted to the truck crops of the region. Where cleared and under cultivation it is generally utilized for cotton, corn, and oats, and pea-vine hay. Corn yields from 15 to 30 bushels, cotton from one-half bale to 1 bale, oats from 25 to 50 or 60 bushels, and hay about 1 ton per acre. Some fields are probably giving smaller returns than the above, but in ordinary seasons the yields should not fall below the minimum given.

Drainage, as already suggested, would greatly improve the soil. The growth of more legumes in connection with the production of corn and cotton and an occasional green crop of cowpeas, vetch, or crimson clover turned under, would also enhance its productiveness. A light application of lime made at the time of turning under the green manuring crops would also be beneficial.

The agricultural conditions prevailing over the region occupied by the Cahaba fine sandy loam are only fairly satisfactory. Land values are not high and much of the type is undeveloped.

GRADY GRAVELLY SANDY LOAM.

The surface soil of the Grady gravelly sandy loam is a yellowish to brownish-gray sandy loam about 7 inches deep. The subsoil is somewhat variable but usually consists of a yellow to yellowish-brown, friable sandy clay from 12 to 24 inches deep, underlain by a stiff, brittle sandy clay, becoming heavier with depth. In many places the lower part of the 3-foot section is a stiff, tough, plastic clay of mottled color, showing various shades of brown, pink, yellow, and gray. The iron concretionary gravel which characterizes the type occurs irregularly. In places it is strewn over the surface in large quantities; in others it may be almost entirely absent. The subsoil contains this gravel in varying quantities. It is often particularly abundant in the upper portion, and differs from that in the other gravelly soils of the county in that much of it is soft. The gravel particles are black or brown, those of black color being partially decomposed and easily crushed.

The soil of the Grady gravelly sandy loam is compact and often difficult to cultivate when dry. When once broken up it becomes light and loose and can be easily worked. The soil becomes more close and dense as the depth increases, but usually there is a sandy surface of sufficient depth to insure a satisfactory seed bed.

The type occurs around the areas of Swamp throughout the western part of the county, as narrow strips between the Swamp and the upland soils. Many of these strips are too narrow to be shown on a map of the scale used in this survey. The largest area lies along the Central of Georgia Railway about 2 miles southwest of Duckert. The type has a flat, almost level surface and is usually inadequately drained.

The Grady gravelly sandy loam is probably of mixed sedimentary marine and residual origin. The surface sandy portion of the soil section is probably composed of unconsolidated Coastal Plain deposits and the lower and heavier portion of the subsoil of residual material from the underlying limestone. The native timber growth consists of oak, hickory, pine, etc.

Practically none of the Grady gravelly sandy loam is under cultivation. If cleared, drained, and cultivated it should give good yields

of corn, oats, hay and cotton, sugar cane, and a number of forage crops.

The following table gives the results of mechanical analyses of fine-earth samples of the soil and subsoil of this type:

Mechanical analyses of Grady gravelly sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
252115.....	Soil.....	1.4	9.5	17.6	39.6	16.8	11.6	3.6
252116.....	Subsoil.....	1.4	5.8	8.7	22.7	10.7	9.2	41.5

GRADY SANDY LOAM.

The surface soil of the Grady sandy loam consists of a gray to dark-colored, loamy sand to light sandy loam, from 6 to 15 inches deep, somewhat coarse textured in some places. The subsoil is a gray to bluish-drab, plastic, sandy clay to sticky, plastic clay mottled with dull red, brown, and yellow. The immediate surface of the type is nearly always a loose, incoherent sand which ordinarily grades in the lower portion into a sandy loam. In not a few places, particularly near the outer edges of some of the areas, the gray sand or coarse sand extends to the depth of 3 feet, but such spots are too small to map. In other places the clay of the subsoil comes to the surface, the sandy covering being absent. Angular fragments of the underlying limestone rock are often scattered over the surface and through the soil section. These fragments are usually siliceous and fossiliferous.

A variation from the typical soil occupies low, wet, narrow drainage ways in the western part of the county. This variation differs from the normal soil in having a somewhat finer texture and a peculiarly distinctive topography. It includes spots the texture of which range toward a fine sandy loam or silt loam. The areas on the Flint River terrace probably represent areas from which a possible former covering of Coastal Plain deposit has been removed by stream gradation.

Grady sandy loam, flat phase.—The surface soil of the flat phase of the Grady sandy loam consists of ashy gray, fine to medium sandy loam, averaging about 7 inches in depth. It is compact on the surface and difficult to break, but when once plowed is loose and incoherent when dry. The subsoil, beginning at 7 to 15 or 18 inches, is a mottled brown and yellow or yellow, stiff, sandy clay becoming more plastic, tough, and sticky with depth. This is underlain by a plastic, sticky, tough clay of yellow color, showing mottlings of light-gray, white, and pinkish colors.

The most important areas of the flat phase of the Grady sandy loam are located in the western part of the county about 3 miles

southwest of Pretoria. Several smaller areas are found scattered throughout the western part of the county, the one at Locketts deserving special mention.

The typical Grady sandy loam is distributed more or less throughout all parts of the county. It occupies the bottoms of shallow, basin-like depressions caused by the collapse of limestone caves. Such areas have no surface drainage outlets, many of them holding water except during the driest part of the year. Others are ponds nearly always containing water. In others the water escapes downward through the underlying limestone, seldom standing at the surface even during wet weather. The flat phase has not sufficient surface relief for adequate drainage. None of the Grady sandy loam can be classed as well-drained soil.

The Grady sandy loam is probably almost entirely residual from the underlying limestone. Portions of the more sandy surface soil covering, however, may have been derived from marine sedimentary deposits either as originally laid down or reworked from some of the surrounding and higher lying soils.

The native vegetation is varied. In the lime-sink depressions are found water oaks, live oaks, mayhaw, and a thick undergrowth of swamp grasses and shrubs. In a few of these areas there occurs a thick stand of cypress and gum. In the low areas the timber growth consists of pine, water oak, magnolia, maple, elm, cypress, gum, and bay, with usually a thick jungle of rushes and switch cane. In the flat, or better drained phase the woods are more open, the pine supplanting to a large extent those varieties of trees partial to low, swampy positions. Some gum, water oak, scrub oak, and an undergrowth of broom sedge are also found in such areas.

Well-drained portions of the type are suited to the production of corn, sorghum, cowpeas, and cotton. Cotton grown on this soil is inclined to grow to weed and to fruit sparingly, a condition which necessitates the use of fertilizers containing relatively small amounts of nitrogen in comparison to the percentage of both phosphoric acid and potash. On account of the prevailing poor drainage only a very small proportion of the type is utilized for crops. In drained fields corn does unusually well. The yields of sorghum and cowpeas for forage are also good.

In the improvement of the Grady sandy loam drainage is the most essential step. Ordinarily the lime-sink depressions can be reclaimed by sinking a well to the underlying stratum of porous limestone. Many small areas of such character in the pecan orchards have been successfully reclaimed from a wet condition in this way. The low areas could be largely relieved of excess water by ditching, although such drainage work would be rather expensive for small areas, but the cost is by no means prohibitive for the larger areas of the type.

The results of mechanical analyses of samples of the typical soil and subsoil are given in the following table:

Mechanical analyses of Grady sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
252113.....	Soil.....	1.8	9.6	15.9	33.1	16.2	19.1	4.4
252114.....	Subsoil.....	1.0	3.9	6.2	15.0	7.6	11.7	54.8

GRADY CLAY.

The surface soil of the Grady clay consists of a drab to bluish-gray, stiff, tenacious, plastic clay. The subsoil is a sticky, plastic, heavy clay, 3 feet or more in depth and showing mottlings of yellow, drab, brown, gray, and red. As a rule this mottling is found throughout the subsoil section, but sometimes is confined to lower portion. Both surface soil and subsoil usually carry a noticeable quantity of sand grains and in places the surface few inches of the soil is quite sandy. This is especially true near the sandy loam type with which the clay soil is associated. In fact small areas of the Grady sandy loam are mapped with this clay type, and vice versa.

A phase of the Grady clay occurs in the eastern portion of the county on the Flint River terraces. As a rule the mottled subsoil occurs at a shallower depth in this phase, although there is little difference in the main characteristics of the material. It has a level topography and lies slightly lower than the other terrace soils.

The typical soil occupies the bottoms of lime-sink depressions found in all sections of the county. Drainage is poorly established. There is no surface outlet for waters held in these depressions. The only means of escape for the drainage water is downward through the soil itself to the porous limestone rock. Often no such outlet is offered and water stands on the surface for weeks at a time. Subterranean outlets in the porous limestone may be obtained by sinking drainage wells. With the terrace areas there is generally an opportunity for surface run-off, but otherwise this phase is as poorly drained as are the lime-sink areas. In the case of the terrace areas better surface drainage could be established by means of shallow surface ditches.

The Grady clay is of residual origin, being derived from the limestone, which underlies the whole region at no great depth. A former covering of sedimentary material has doubtless been removed.

The tree growth of the Grady clay consists of pine, oak, some hickory, mayhaw, gum, and cypress. Swamp grasses and other vegetation partial to heavy, wet soils flourish in the poorly drained areas.

Cultivation of the Grady clay is difficult at best. It is the heaviest, most intractable soil in the county. Its heavy texture and close, tenacious structure make tillage slow and ineffective. If plowed when too wet it turns in clods which when dry can scarcely be reduced, and if plowed when too dry the same condition is likely to result. A heavy farm equipment is necessary to handle soils of this kind.

The poor drainage and difficulty experienced in handling the type make it of low agricultural value. Comparatively little of its area is utilized for farming, though it affords some pasturage for cattle and hogs. A few areas are tilled and produce good crops of corn and cotton when not damaged by excessively wet weather. When drained its best use would likely be in producing forage crops, corn, and cotton. The material forming this type is a good brick clay and has been extensively worked for the manufacture of brick near Albany.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of this type:

Mechanical analyses of Grady clay.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
252123.....	Soil.....	0.6	1.3	1.5	10.4	14.6	31.1	40.2
252124.....	Subsoil.....	.2	.6	.6	5.2	6.6	16.3	70.5

HENDERSON STONY LOAM.

The surface soil of the Henderson stony loam consists of a brown gravelly sandy loam to sandy loam from 5 to 10 inches in depth. The subsoil is usually a sticky, plastic, tenacious clay of mottled color, shades of red, brown, drab, yellow, and gray predominating. The gravel present on the surface and in the surface soil is composed of small iron concretions. Throughout the soil section and scattered over the surface are large and small angular fragments of siliceous limestone. These are generally so abundant that it is necessary to remove them from land intended for cultivation. But for these rock fragments cultivation of the type would be comparatively easy, except where the surface soil is shallow, the heavy, sticky clay making cultural operations rather difficult.

The type is found most extensively east of Pecan City in the rolling region of the Chattahoochee formation of impure limestones from which it is here derived. In the western part of the county there are many small stony areas too small to be shown on the soil map. These are derived from the impure, siliceous portions of the Vicksburg limestone, and have a red, sandy clay subsoil instead of the sticky clay which is typical of this soil. Only a few of these latter areas are mapped.

The topography is rolling, the type occurring as ridges or crests of the highest elevations. A few exceptions to this are found where small areas occur at the base of slopes where other materials seem to have been removed. Surface drainage is good, though the heavy, impervious clay subsoil causes poor internal drainage. The type was once covered with a good stand of longleaf pine with a scattering of hardwoods, mostly dogwood and oak.

The intractable subsoil and stony character of the type make this soil rather undesirable for farming. However, it gives good yields of cotton, oats, and forage crops where the stones have been removed.

SUSQUEHANNA SANDY LOAM.

The soil of the Susquehanna sandy loam consists of a gray medium to coarse sand from 6 to 8 inches in depth, grading into a gray to grayish-yellow light sandy loam, which extends to a depth of 18 inches or more. The subsoil is a heavy, tough, sticky clay mottled with red, drab, brown, gray, and yellow. In places the upper portion of the subsoil is of a bright-yellow color. This type is associated with both the Norfolk sandy loam and the Tifton sandy loam and contains small patches of both these types. The light sandy surface makes cultivation easy, though often delayed by excess of water, which is held in check by the impervious clay subsoil.

The type is of small extent, occurring only in the southeastern portion of the county. The topography is rolling and the surface drainage good. The heavy, intractable subsoil, however, retards internal moisture movements.

The material forming this type is apparently derived from marine clay beds associated with limestone formations. This is especially probable in case of the tough, sticky clay subsoil. Possibly marine sands have modified the surface soil. The limestone may also have influenced the soil to some extent.

The whole area of this type was originally covered with a good stand of longleaf yellow pine.

The Susquehanna sandy loam is well adapted to corn, cotton, and forage crops. Where the surface soil is shallow it is rather intractable and yields are poor, but where the sandy surface soil covering is of fair depth good yields may be expected. But little of the type is under cultivation, the greater portion being in a logged-off state.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of this type:

Mechanical analyses of Susquehanna sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
252161.....	Soil.....	3.5	20.3	17.0	27.1	17.9	8.6	5.5
252162.....	Subsoil.....	4.1	15.3	12.1	21.7	14.4	7.5	28.0

TIFTON SANDY LOAM.

The surface soil of the Tifton sandy loam consists of a gray to yellowish-brown sandy loam from 6 to 12 inches deep, the average depth being about 10 inches. The subsoil is a friable, sandy clay of bright-yellow color, or about the color of cottonseed meal. It is often tinged and slightly mottled with red and rusty brown iron stains. A characteristic feature of this type of soil is the occurrence of a varying, though usually large percentage of small concretionary iron gravel in both surface soil and subsoil. The greater number of the gravel particles are less than half an inch in diameter. They are a dark-brown to rusty-red color outside and dark-red inside. They are usually hard, but a few are soft. Where this soil is typically developed these pebbles are very abundant on the surface and generally scattered through the soil section. In places, however, they are wanting. Locally the deep subsoil is a plastic, mottled clay. Occasionally rough, angular fragments of insoluble parts of the local limestone are found scattered over the surface and through the soil section.

Tillage is not difficult, though somewhat more so than on soils of similar texture and structure where the gravel is lacking. A good tilth can, however, be obtained and maintained with a reasonable expenditure of time and labor.

The Tifton sandy loam is of extensive occurrence all along the eastern edge of the county. Other areas are scattered throughout that portion of the county east of the Flint River. Only one area is mapped west of the river, being found west of the River Road about 9 miles south of Albany.

The topography is rolling to undulating, the type occupying the roughest portion of the county, the Altamaha upland. Surface drainage is excellent and internal drainage conditions are favorable. While the surface soil is usually free from excess moisture soon after rains, the subsoil retains much moisture, which is readily furnished to the growing crops as needed. As a result crops seldom suffer from drought where ordinary care is taken to conserve the natural moisture supply. If not cultivated as soon as the soil is in proper condition after being saturated from heavy rains, the surface is liable to bake and harden, making tillage difficult and also causing a loss of moisture through evaporation.

The Tifton sandy loam has been derived through weathering from old Coastal Plain materials. The deep heavy clay substratum portion seems to be residual from the underlying limestone.

The native timber growth, which has nearly all been cut off, consisted of a magnificent forest of longleaf pine. Wire grass is a characteristic plant in virgin areas and broom sedge abounds in old fields lying idle. In low, poorly drained areas, which are of small extent,

gum, water oak, a few cypress, and other water-loving plants are found.

The Tifton sandy loam ranks as one of the best soils of the region and county. It is well adapted to all of the general farm crops of the region, being especially prized for cotton. The lint from cotton grown on this soil is clean, usually unstained, and of excellent quality. With fair treatment and moderate fertilization yields of one-half bale to 1 bale an acre are common. The average yield, however, is nearer the lower of the two figures, due to careless tenant farming. The average for normal seasons should be about 1 bale per acre. Corn is grown to some extent to supply feed for the work stock. It ordinarily yields between 15 and 40 bushels per acre, with an average of 20 bushels. With good cultivation and fertilization the average could be materially increased. Oats do unusually well on this soil, yielding from 20 to 75 bushels an acre, with an average of about 40 bushels. Cowpeas may be sowed after the oat crop is harvested and, if the soil is in good condition, will yield about 1 ton of hay per acre. The type is also well suited to peanuts, cantaloupes, melons, strawberries, blackberries, etc. Sugar cane does especially well if fertilized, producing sirup of excellent flavor and quality.

The type is easily improved and capable of high development. The legumes—cowpeas, velvet beans, vetch, and crimson clover—grow well, and no other methods of soil improvement would do more for the type than the addition of humus from the growing of these crops. Cowpeas and velvet beans make excellent hay. Vetch and crimson clover also add nitrogen to the soil. They can be grown as winter cover crops and plowed under in the spring in time for the planting of the money crops. A regular rotation should be practiced, including one of the legumes for hay and one for green manure. If this were done there would be but little need of the nitrogen in the commercial fertilizers used. If need be, oats or rye could be grown to furnish winter grazing for cattle and hogs.

A considerable portion of the type is cleared and in a good state of cultivation. Much of it is cut-over pine land that only awaits cultivation to make it produce abundantly. Land values are low, but steadily advancing. They are lower for this type of soil than in other counties of the State where it occurs extensively.

KALMIA SANDY LOAM.

The soil of the Kalmia sandy loam is an ashy-gray sand to very light sandy loam from 8 to 15 inches deep, grading in the lower portion into a pale-yellow color. The subsoil consists of a heavy, lemon-yellow, sandy clay. In many places it is a tough, brittle clay mottled with gray, red, and brown in the lower portion of the section. The type is friable and easily tilled.

Extensive areas of this soil are found along the upper course of the Dry Creek, with smaller areas along the western side of the Cooleewahee Creek. The type occupies flat terraces above ordinary overflow. Drainage is not so well established as in the case of the Cahaba sandy loam, nor is the type so subject to drought.

Practically none of the type in this county is cleared and cultivated. In other regions it is highly esteemed for corn. Oats, cowpeas, sugar cane, sweet potatoes, and watermelons also do well. Cotton runs to weed, but this tendency may be counteracted by using fertilizers high in potash and phosphoric acid and relatively low in nitrogen.

Most of the type is now in the logged-off state and is held at rather low prices.

THOMPSON SANDY LOAM.

The surface soil of the Thompson sandy loam is a gray to dark-gray sandy loam about 6 inches deep. The subsoil consists of a bright-yellow, heavy, friable sandy clay, occasionally showing mottlings of grayish-brown and reddish colors in the lower depths. The soil is compact, but readily takes on a good tilth, which can be maintained by cultivation throughout the growing season. The subsoil is quite dense and close in structure, and has a marked capacity for storing moisture.

This soil type occurs only in the southeastern part of the county. Three areas of it are found—one along a branch of Dry Creek near the Mitchell County line, southeast of Putney; one southeast of Pecan City; and the third east of the latter town. It occupies flat, almost level first bottoms along poorly developed stream channels. As a result, drainage is poor and much of the type is saturated and often covered by standing water for long periods. The reclamation of this soil by digging artificial channels to remove the surface waters would render it a valuable soil for farming.

The type is closely related to the Norfolk sandy loam and Kalmia sandy loam in color characteristics. The soil-forming material is probably very similar also, though its topographic position and formation differs somewhat from that of the Norfolk. Its occurrence in the narrow valley positions indicates alluvial origin, though it may be, in part, a marine deposit, the surface of which has been graded down by stream action.

The native timber growth of the type, now removed, consisted largely of longleaf pine, with some oak, bay, and gum, along the margin of the stream courses. There is also a sod growth of wire grass, and in poorly-drained portions water-loving grasses and brush.

When drained as suggested the Thompson sandy loam would become an excellent soil for corn, cotton, oats, and hay. Its flat

topography, relatively low position, and comparatively heavy subsoil would insure a better moisture supply than that possessed by most of the other soils of the county. There would consequently be almost no danger of crops suffering from drought.

MEADOW (OCKLOCKNEE MATERIAL).

The Meadow (Ocklocknee material) consists largely of a brown silt loam to a depth of 5 or 6 inches, underlain by a silt loam or silty clay loam of light-brown to yellowish-brown color. In the areas mapped as Meadow (Ocklocknee material) are small areas of fine sandy surface soil overlying the silty subsoil, and also ridges of brown, fine sand. In the dense undergrowth it was not possible to separate such areas as distinct soil types on the scale of mapping used.

These materials occur only along the Flint River where they are found on both sides of the stream as first bottom or as the present flood plain and are consequently frequently overflowed. Each inundation adds to the formation and often alters the surface texture according to the nature of the fresh accretion.

Areas of Meadow (Ocklocknee material) are usually covered with a dense growth of pine, magnolia, hickory, gum, some oaks, sycamore, bay, and in low places with cypress. There is often an undergrowth of short saw palmetto, switch cane, brambles, vines, bushes, and wild grasses of various kinds.

Practically none of the area is under cultivation on account of the liability to overflow in times of high water. The type furnishes some pasturage for cattle and hogs.

SWAMP.

Swamp consists of the comparatively low, flat areas along the Cooleewahee and Chickasawhachee Creeks. The areas vary from narrow strips to bottoms of a mile or more in width, and are bounded on the sides and the upper end by higher ground. Their limits are usually sharply defined by a bank varying in height from 1 foot to 10 feet. The surface of these areas on a transverse section is practically level, while on a longitudinal section the surface slopes from 1½ feet to 5 feet to the mile.¹ This gradient in an open, unobstructed channel is sufficient to give good drainage under ordinary conditions. However, the streams traversing these areas are tortuous and more or less filled with trees and trash, and the water spreads out over much of the surface, except during times of drought.

The surface soil of Swamp is somewhat variable. Usually it is composed of 8 to 12 inches of fine black mud containing a large percentage of partially decayed vegetable matter. Near the margins

¹ Drainage Conditions in Georgia, by S. W. McCallie, Bulletin No. 25, Geological Survey of Georgia, p. 22.

and upper ends of the areas the surface soil is colored a dark red from material washed in from the adjoining red soils. The subsoil in many places consists of two parts, an upper layer of gray to yellowish-gray sand or sticky sandy loam and a lower portion of bluish-gray to blue plastic clay to silty clay loam. The sandy upper subsoil is not always present, the blue clay directly underlying the silty surface soil.

Swamp in its native state supports a heavy growth of timber, the chief varieties being cypress, swamp or hard pine, ash, swamp maple, bay, magnolia, and sweet gum. In the higher situations there are many magnolias and water beeches. A thick jungle or undergrowth of switch cane, brambles, and vines of various kinds, besides water-loving grasses, is almost always present. Some of the cypress timber has been removed.

The area of Swamp is of considerable extent. None of it is cleared, its permanent wet character preventing cultivation. In its present condition it is of no agricultural value. If the stream channels were opened the drainage would be sufficient to reclaim the Swamp and make it valuable agricultural land. The soils would then be adapted to corn, cotton, and forage crops of all kinds. Such improvement would add thousands of acres to the agricultural lands of the county

SUMMARY.

Dougherty County is located in the central part of southwest Georgia and has an area of 343 square miles or 219,520 acres. The physiographic features are those of a low plain of little relief, except for some rolling country near the eastern edge and southeast corner. Lime-sink depressions are common. Drainage is usually good, although swampy areas occur along some streams. The Flint River is the principal stream and receives the surface drainage. Other large streams are the Muckafoonee, Kinchafoonee, Muckalee, Cooleewahee, and Chickasawhachee Creeks. Of all these streams, the river only has cut a deep channel. The largest spring in Georgia, Blue Springs, is located 4 miles south of Albany. The Flint River is navigable as far as Albany.

The county was first settled in 1837. The last census shows a population of 16,035. Albany, the county seat, has 8,190 inhabitants. It is a railroad and manufacturing center, and a distributing point for southwest Georgia.

Transportation facilities are excellent over most of the county. Branch and trunk lines of three different systems traverse the county, besides two local lines. Water transportation to the Gulf is also furnished by the Flint River.

Markets are good for all of the products of the county. Much produce consumed within the county which could be grown within the area is supplied from outside points.

The climate of the region is mild and equable. The summers are long and not excessively hot and the winters short and mild. The mean summer temperature is about 82° F., the winter mean being about 50° F. Snow rarely falls, though frosts are common during the winter months. The rainfall ranges from 65 inches for the wettest year to 40 for the driest year, with a normal of about 50 inches. The precipitation is usually well distributed throughout the year.

Agriculture is the leading industry of the county. The earliest statistics show a large production of corn, cotton, and other general farm crops. These crops have always been staples and predominated in the agriculture of the region.

Changes incident to and following the Civil War resulted in a great depression in land values within the county which has only recently been overcome. The forests of longleaf pine, oak, hickory, and cypress which were formerly the source of large income are about exhausted, though some lumbering, especially of cypress, and the cutting of railroad cross ties is still carried on.

The present-day agriculture consists of the production of cotton, corn, oats, hay, and vegetables. The county also enjoys the distinction of having the largest acreage in pecans of any county in the State.

Most of the farms are operated by tenants, which militates somewhat against modern agricultural practices, such as the rotation of crops and the adaptation of crops to the soils best suited to their production. This feature is reflected in the average crop yields, which are much lower than they should be.

The supply of farm labor is insufficient to till all of the cleared land, and largely unskilled, except in the production of cotton.

Farm land prices are advancing steadily, but are still low, the average acreage value for the county being only \$13.99. Good land can be secured at prices ranging from \$10 to \$30 an acre. Usually a considerable proportion of this is cleared and ready for cultivation.

Improvement should be made in the cropping systems, in cultivation, and in fertilizer practice. Irrigation can be practiced easily, the water supply being secured from flowing artesian wells, or from the "deep wells" of the region by pumping. Drainage is needed on many areas now lying idle or only partly cultivated. More live stock should be kept, including poultry of all kinds. The markets for dairy, meat, and poultry products are largely supplied from outside points at present.

Twenty-four soil types, representing 10 distinct soil series, exclusive of Meadow and Swamp, were separated and mapped. The Greenville series of soils, locally known as "red lands," are the most exten-

sive soils of the county. They range in texture from gravelly sandy loam to clay loam.

The Greenville gravelly sandy loam is a rather extensive and important soil type: It is an excellent soil and adapted to cotton, corn, oats, and forage crops. It is also fairly well adapted to the truck crops.

The Greenville coarse loamy sand and loamy sand are especially well adapted to the production of truck crops, as well as of cotton, corn, oats, and forage crops. The loamy sand is the cantaloupe soil of the region. The coarse loamy sand is of small extent, while the loamy sand is quite extensive. These types are also good pecan soils.

The Greenville coarse sandy loam and sandy loam are well suited to growing cotton, corn, oats, and forage. They are also adapted to the heavier and later truck crops and pecans. The former is of small extent, while the latter is one of the most extensive soils of the county.

The Greenville clay loam is widely developed in the western part of the county. It is an excellent soil, adapted to cotton, corn, oats, and forage crops, and also well suited to stock raising. Yields of all crops are usually good on this type.

The Orangeburg soils, called locally "gray lands," are of extensive occurrence on both sides of the Flint River. All the types of this series occurring in Dougherty County are sandy, ranging in texture from a gravelly sandy loam to a sandy loam.

The Orangeburg gravelly sandy loam is comparatively inextensive. Cotton, corn, oats, and forage crops all do well, and also some of the truck crops and pecans.

The Orangeburg sand, of which the area is small, is preeminently an early truck soil, though now utilized largely in growing the general farm crops. The yields are low, and the land should be devoted exclusively to special crops.

The Orangeburg loamy sand is an important type. It is adapted to truck crops, though it is now used mainly for cotton and corn. It gives good yields of these crops, but its future development should be along special lines of higher-priced crops, for which it is especially suited. It is also a good soil for pecans.

The Orangeburg sandy loam is one of the most extensive and important soil types of the county. It is the prevailing soil on both sides of the Flint River. It is well adapted to cotton, corn, oats, and forage crops, for which it is most generally used, giving good yields where well farmed. It is also adapted to the truck crops, which should be grown more extensively than at present. Pecan trees do well, and large orchards of this nut have been planted.

The Norfolk series includes areas known locally as "gray lands." The subsoils are yellow and iron concretions are not found. These soils are not extensive. The texture ranges from sand to sandy loam.

The Norfolk sand, with a rolling phase, is best adapted to truck crops. Where used for cotton and corn, the soil requires heavy fertilization to insure satisfactory yields. The rolling phase is especially droughty and poorly suited to agriculture.

The Norfolk sandy loam and its deep phase are suited to corn, cotton, and forage crops. They are also adapted to the truck crops. Yields are satisfactory where the soil is maintained in good condition. Pecans also thrive on these soils. The flat phase is poorly drained and but little utilized for farming. Where drained it gives good yields of cotton and corn.

On the stream terraces occur two series of soils—the Kalmia and Cahaba. The Cahaba series includes four types. Two sand types where not subject to overflow are adapted to the early truck crops. They are of small extent and in an undeveloped condition. The Cahaba sandy loam and fine sandy loam are excellent soils for cotton, corn, oats, and hay, and give good yields when properly farmed. The sandy loam is of small extent, while the fine sandy loam is of rather wide development. The Kalmia sandy loam has a small extent and is largely undeveloped. It is an excellent general farming soil in other areas.

The Grady soils, also called "gray lands," are partly in the upland and partly on the terraces. Three soil types were mapped.

The Grady gravelly sandy loam is of small extent and mostly in a wild state. If cleared and drained it would make a good soil for corn, cotton, oats, and forage crops.

The Grady sandy loam is of considerable extent. It is poorly drained, as a whole, and not much used for farming. Where cultivated it gives good yields of cotton, corn, and forage.

The Grady clay, the heaviest soil type in the county, is intractable and difficult to till. Much of its area is uncleared and uncultivated. Where cropped it usually gives good yields of corn, cotton, and hay.

Two types of local occurrence are also mapped in the "gray lands" district. These are the Henderson and Susquehanna soils. The Henderson stony loam is of relatively small extent and of low agricultural value. The stone content often interferes with cultivation, as does the tough clay subsoil. Moderate to good yields of cotton, corn, oats, and hay are obtained on this soil.

The Susquehanna sandy loam is also of small extent. It is similar to the Henderson stony loam except for the absence of stone.

The areas known locally as "gravelly land" are included in the Tifton sandy loam, a type developed to a large extent in the extreme eastern portion of the county, and characterized by a large content of iron concretions. The type gives excellent yields of corn, cotton, oats, and hay. Much of it is now in a logged-off condition.

The Thompson sandy loam is similar in color and texture to the Norfolk sandy loam and the Kalmia sandy loam. It, however, occurs in first-bottom positions. It is not cleared or drained. Where improved it should make an excellent soil for corn, cotton, oats, and all of the forage crops.

The Meadow (Ocklocknee material), undifferentiated, represents first bottoms along the Flint River. It is frequently overflowed and is not cultivated, but furnishes some grazing.

Swamp is the low, wet first-bottom land along some of the streams. It supports a dense growth of water-loving trees and underbrush. If cleared and drained it would make an excellent soil for corn, oats, and forage crops, though subject to inundations from the river during floods.



[PUBLIC RESOLUTION—No. 9.]

JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided,* That in addition to the number of copies above provided for there shall be printed as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]

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