

UNITED STATES DEPARTMENT OF AGRICULTURE

Soil Survey
of
Hart County, Georgia

By

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Georgia State College of Agriculture



Bureau of Chemistry and Soils

In cooperation with the Georgia State College of Agriculture

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SOIL SURVEY OF HART COUNTY, GEORGIA

By G. L. FULLER, Georgia State College of Agriculture

COUNTY SURVEYED

Hart County is in the northeastern part of Georgia bordering South Carolina, from which it is separated by Savannah and Tugaloo Rivers. (Fig. 1) Hartwell, the county seat, is 115 miles northeast of Atlanta, 44 miles northeast of Athens, and 22 miles southwest of Anderson, S. C. The county comprises a land area of 261 square miles, or 167,040 acres

Hart County lies in the upper or higher part of the piedmont plateau; and although the land surface has been subjected to much erosion and denudation, many signs of the original plateau can be observed as is evidenced by the even skyline in all directions.

Savannah River and Tugaloo River and their tributaries constitute the dominant forces which have determined the relief of the county by dissecting it below the original plateau level.

Dissection has advanced from the rivers into all sections of the county, but the relief, or the depth to which dissection has advanced, varies widely in different sections

and is dependent not only on proximity to stream valleys but also on the character of the soil and of the underlying rocks. Granitic parts of the county, as in the northwest corner, are dissected much deeper and more intricately, with sharper relief, than are areas of quartz-mica schist. Since most of the county is underlain by quartz-mica schist, the relief is less abrupt, and more rolling land occurs here than in most counties adjacent to large streams in the piedmont plateau in Georgia. Owing to the greater distance from the large stream valleys, the relief is less in the southwestern quarter and the water table is noticeably higher, as evidenced in wells. In this section of the county water is usually reached in dug wells in Appling and Durham soils at a depth ranging from 15 to 25 feet, whereas in other sections, on Cecil and Madison soils, many wells are dug from 50 to 75 feet deep before reaching water.

The relief of the county ranges from rugged and hilly, with steep slopes bordering the river valleys and scattered over the granitic areas in the northwest quarter, to strongly rolling or gently hilly over most of the county. In the southwestern part there are many large areas in which the surface is gently undulating or gently rolling, even almost flat in places

The dip in the surface of the plateau level from northwest to southeast in crossing the county ranges from about 100 to 200 feet. The general elevations of the plateau level, as determined by the United



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

States Geological Survey, are about 800 feet above sea level, with the exception of the western side of the county, which ranges from 850 to 950 feet. Along the western side, the elevation of Royston in the southwestern part is 909 feet, of Canon is 916 feet, and of Bowersville is 934 feet above sea level. The top of the ridge above the Tugaloo River Valley in the northwestern corner is 850 feet. In the southeast quarter between the Coldwater Creeks the elevation is only about 750 feet. Tugaloo and Savannah Rivers have cut a valley below the level of the plateau from about 250 to 300 feet deep with a fall of about 100 feet within the county. Tugaloo River at the northwest corner has an elevation of about 600 feet. It joins Seneca River to form the Savannah at an elevation of 567 feet, and the elevation of Savannah River at the southeast corner of the county is 498 feet.

The area, of which Hart County forms a part, originally supported a mixed growth of shortleaf pines and mixed hardwoods, predominantly oaks. Practically all the original growth has been cut. Reproduction has consisted largely of loblolly pines with an intermixture of shortleaf pines, oaks, and other hardwoods. There is very little forested land in the county except on the steep broken slopes and other areas unsuited to agriculture. In small forested areas the tree growth ranges from very scattered to very dense, in most places with little grass undergrowth.

Hart County was established by act of legislature in 1853 from parts of Franklin, Madison, and Elbert Counties and was named for Nancy Hart of Revolutionary fame. Near Hartwell is the site of a famous Indian meeting place, known by the Indians as the "center of the world," where many trails crossed and council meetings were held. A monument now designates the location. Early settlement in the county was largely along the rivers which provided the main means of transportation. Much steep land was cleared and tilled at that time, which proved too difficult to farm and has been allowed to reforest itself. Many of the early settlers were soldiers of the Revolutionary War who took up Government grants. Later settlers came from other parts of Georgia, the Carolinas, and States farther north. The population at present is well distributed throughout the county, although it is of necessity more scattered in the rougher sections of the northwestern part and along the river valleys.

The total population of the county, reported by the census of 1930,¹ is 15,174, of which 11,261 are native white; 20 are foreign-born white, mainly Germans; and 3,893 are negroes. Since 1920 there has been a marked decrease in the colored population and a small decrease in the rural white population. Hartwell, with a population of 2,048, is the county seat and the largest town. It is the principal marketing center, and Bowersville, with a population of 271, Vanna with 158, and Airline are other trading points within the county. Royston, Canon, and Lavonia are towns along the county line either partly in the county or very close to it.

Rail transportation is provided by two branch-line railroads. The Hartwell Railway extends from Hartwell to Bowersville, where it joins the Elberton branch of the Southern Railway from Toccoa, which closely follows the western and southwestern county lines. The county is also served by several State and one Federal highway.

¹ Soil survey reports are dated as of the year in which the field work was completed. Later census figures are given when available.

United States Highway No. 29, which crosses the county between Anderson, S. C., and Athens, Ga., is the only paved highway. A State highway extends along the western and southwestern county line between Elberton and other southern points and Toccoa and other cities to the north. Another State highway crosses the northwest corner. The State highways are sand-clay surfaced and are kept in fair or good condition. In addition to these highways, roads radiate in all directions from Hartwell and penetrate all parts of the county. The main roads are kept in good condition most of the time, and the less-important roads are worked about once a year.

The schools are among the best in the State. There are 12 consolidated schools in the county with modern brick buildings. Eleven of these include vocational agriculture in their curriculums. Two colored vocational teachers are employed by the county. The influence of the vocational teachers has been very marked in several of the consolidated school districts, where highly efficient farming methods are general.

The county is well supplied with country churches, three of which are large attractive brick buildings which would do credit to any city. An unusual custom, practiced in some sections of the county, consists of giving the proceeds from a piece of land in cotton, usually one or more acres, to the church. Such land is known as "God's acre."

Telephone lines and rural free delivery routes extend into all sections of the county. The United States air-mail route from Atlanta to Washington, D. C., has two signal lights and one lighted emergency landing field in the county. A high-tension electric line also crosses the county.

Hart County is almost exclusively an agricultural county, the only manufacturing being done at one cotton mill at Hartwell. Sporadic mining ventures, which included mining for manganese and gold and quarrying mica, have been undertaken in the past, but all the attempts were of minor importance and no mining is engaged in at present.

CLIMATE

The climate of Hart County is characterized by long, moderately hot summers and short mild winters, throughout which brief freezing periods occur. A little snow may fall during the winter, but it soon melts. The variation between the summer and winter temperatures is not so wide as in counties farther north. During the summer hot spells are common, but the nights are usually moderate. The average date of the last killing frost is April 3, although killing frost has occurred as late as April 24. The earliest killing frost recorded was on October 11, but the average date of the first killing frost is November 2. The length of the average frost-free season is 212 days. Although the winters are sufficiently severe to prevent the growing of winter truck crops, such crops can be grown by using the protection of hotbeds. Grain crops are fall sown; turnips, collards, and rape do well during the winter months; and winter cover crops are highly successful. Ordinarily the ground freezes to a depth of only 2 or 3 inches and does not remain frozen for a long time, so that plowing can be performed nearly all winter. However, the slight freezes are sufficient to markedly improve the tilth of fall and winter plowed heavy-textured soils.

The mean annual precipitation is 47.82 inches, which is well distributed throughout the year, with the usual exception of the three fall months—September, October, and November—when there is the least rainfall, which favors the harvesting of crops. A succession of three dry years was recently experienced, of which 1925 was the driest ever recorded, when insufficient rainfall occurred during the growing season to mature any of the crops, and complete crop failure resulted in that year, with very low crop production in the following two years.

Table 1, compiled from the records of the United States Weather Bureau, gives the normal monthly, seasonal, and annual temperature and precipitation at Hartwell.

TABLE 1.—Normal monthly, seasonal, and annual temperature and precipitation at Hartwell, Ga.

[Elevation, 838 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1925)	Total amount for the wettest year (1929)	Snow, average depth
	°F.	°F.	°F	Inches	Inches	Inches	Inches
December.....	44.4	74	6	4.71	3.49	3.59	0.6
January.....	43.5	77	5	4.03	9.30	3.14	1.0
February.....	44.7	78	6	5.12	1.08	10.33	1.2
Winter.....	44.2	78	5	13.86	13.87	17.06	2.8
March.....	53.4	87	12	4.53	3.50	10.26	(1)
April.....	60.8	91	28	3.63	2.27	4.44	(1)
May.....	69.6	100	37	3.62	5.6	7.68	.0
Spring.....	61.3	100	12	11.78	6.33	22.38	0
June.....	77.0	105	45	3.90	3.0	4.29	.0
July.....	79.1	105	51	4.70	1.66	2.19	0
August.....	78.2	102	55	5.06	.37	.13	0
Summer.....	78.1	105	45	13.66	2.33	6.61	0
September.....	73.6	98	43	3.30	1.50	9.36	0
October.....	62.4	93	28	2.07	3.57	7.02	0
November.....	51.7	83	16	2.65	3.81	4.31	.3
Fall.....	62.6	98	16	8.52	8.88	20.69	3
Year.....	61.6	105	5	47.82	31.41	66.74	3.1

¹ Trace.

AGRICULTURE

Agriculture was established along the Savannah and Tugaloo River Valleys prior to the organization of Hart County. Pioneers came up the rivers and engaged in a type of agriculture which was self-sustaining. Cattle, hogs, and sheep were raised as the principal livestock, and corn, oats, wheat, rye, barley, and tobacco were the principal crops until the advent of cotton. Cotton was introduced at an early date and was shipped, together with other excess produce, down Savannah River to Augusta and Savannah.

The census of 1880 shows the county highly developed, with 75.8 per cent of the total area included in 1,078 farms. The number of

farms steadily increased until 1920, when 3,103 farms were reported, but since that time the number has decreased. The percentage of the county in farm land increased slowly from 75.8 per cent in 1880 to 88.2 per cent in 1910. The percentage of land in farms has since decreased to 80.7 per cent in 1930. This decrease has been due, in part, to selection of the better land for farming, with attendant abandonment of the rougher areas and other land unsuited to cultivation, although the decrease is probably owing partly to labor shortage. Many large old plantations were located close to the rivers. On these, much steep land was at one time cleared, which has since been allowed to reforest itself.

Attendant with the increase in the number of farms in Hart County, there was a corresponding decrease in the size of farms, indicating that the increase in number of farms was due not to clearing new land but to division of the larger farms. The census of 1880 reported the average size of farms as 154.9 acres. The average size has decreased steadily until 1930, when it was reported as 52 acres. At the present time there are very few large farms in the county, and many small farms include less than 20 acres.

According to the census of 1880, cotton occupied a larger acreage than corn and more land than all other crops (except corn) combined, in 1879. Beginning with 1889, cotton has occupied a larger acreage than all other crops (including corn) combined, and in 1909, 1919, and 1929 occupied more than double the acreage of corn.

Corn has been the crop second in importance since 1879. Oats and wheat have occupied about equal acreages since that time, both showing considerable decrease, although the acreage of oats has decreased somewhat more than that of wheat. Rye occupies a very small acreage, being used primarily as a soiling crop. Dry peas were produced to a considerable extent from 1899 to 1919 but were not reported in 1929. Hay crops were first reported for 1889, and they have assumed increasing importance up to the present time. The hay crops have been supplemented by grains cut green and legumes cut for hay. In 1929 the 671 acres devoted to hay crops included 12 acres in clover, 25 acres in alfalfa, 288 acres in other tame grasses, 20 acres in wild grasses, 184 acres in small grains, and 142 acres in annual legumes. The production of all forage crops is insufficient to supply local needs.

Potatoes have never occupied an important acreage and are grown only for home use. The acreage devoted to sweetpotatoes increased from 259 acres in 1879 to 706 acres in 1919, when an attempt was made to produce them for outside markets. Many storage houses were built, but, owing to low prices and other causes, the crop was not profitable, and in 1929 sweetpotatoes occupied only a small acreage, the crop being insufficient to supply the local market.

Apples are produced in small orchards, primarily for home use. Peaches are also grown for home use, although a few commercial orchards were operated between 1900 and 1910. Many other kinds of fruit are grown for home use, including pears, plums, grapes, cherries, quinces, and figs. Pecans were first reported in 1910, and the number of trees has increased markedly.

Table 2 gives the acreage devoted to the more important crops grown in Hart County in stated years.

TABLE 2—*Acres of principal crops in Hart County, Ga., in stated years*

Crop	1879	1889	1899	1909	1919	1929
	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>
Cotton.....	14,923	27,007	37,059	45,058	49,805	43,056
Corn.....	14,312	13,812	20,718	18,114	22,279	16,581
Oats.....	4,876	3,976	1,290	3,657	2,635	6,072
Wheat.....	4,646	5,830	5,312	2,626	2,240	1,154
Potatoes.....		16	10	29	49	162
Sweetpotatoes.....	259	417	346	357	706	226
Hay.....		24	1,049	2,511	2,499	671

A few beef cattle are raised, but most of the cows are kept for milk production. The census of 1930 reports 4,254 cattle of all kinds in the county on April 1 of that year. Purebred Jerseys are kept mainly. Butter is sold locally, and sour cream is sold to the Hartwell cream station, although a small proportion goes to Elberton, Bowman, and Lavonia. There are only two silos in the county for storing feed for milk cows. In these corn and sorgo (sweet sorghum) are used principally, although milo is substituted for sorgo sometimes.

The number of swine reported by the census of 1930 was 1,619. The hogs are raised entirely for a home supply of meat, and the number is not sufficient to supply local needs. A few sheep and goats also are raised for home use.

The poultry industry is increasing rapidly. There were 164,131 chickens raised in 1929, 153,613 dozens of eggs sold, and 51,586 chickens sold. About one carload of live poultry is shipped each month. One school community, Shoal Creek, is shipping eggs twice a week, and an increased interest in egg production is shown throughout the county. White Leghorns are raised, mostly for egg production, although most farmers keep heavier breeds, such as Plymouth Rock and Rhode Island Red, for meat and eggs.

Bees, to supply honey for the home, are kept rather generally, and a few small commercial apiaries are maintained.

The principal work animals are mules, 3,570 being reported in 1930, as compared with 239 horses. Very few mules are raised in the county, however.

In 1880, 60.8 per cent of the farms were operated by owners and 39.2 per cent by tenants. The proportion of owner-operated farms has steadily decreased, until in 1930 only 23.7 per cent were operated by owners and the rest by tenants. Only one farm was reported as operated by a manager. Of the farm operators reported in 1930, 76.4 per cent were white and 23.6 per cent were colored.

Very few farms are rented for cash. The largest proportion of tenants are croppers, or tenants who work the farms on shares, with the owners furnishing the work animals and equipment. In 1930, of the 1,978 tenants, only 48 were cash tenants. Most of the other tenants are either share tenants or are standing renters who pay a stipulated quantity of the crops for the use of the farm. Under the share system the tenant furnishes the work animals and equipment and gives a share of the crop for the use of the farm.

In 1929, only 20 per cent of the farms reported hiring labor, at a total cash expenditure of \$40,554, or an average of \$78 for each farm reporting. At that time wages ranged from \$25 to \$30 a month with board, and day laborers received from \$1 to \$1.50.

Fertilizers constitute the largest single item of expense on Hart County farms. In 1929, \$272,880 were spent for fertilizers, which represented an average of \$112 for each farm reporting their use. It is estimated that from 15 to 20 per cent of the fertilizer used is home mixed, and the tendency at present is to increase this percentage. Superphosphate (acid phosphate), muriate of potash, sulphate of ammonia, and nitrate of soda are the principal ingredients used in home mixing, with a very small percentage of cottonseed meal. The present strong tendency is to use a much higher content of phosphoric acid in all fertilizers, with smaller proportions of both nitrogen and potash. The acre application also has increased in late years.

Good farm machinery, well adapted to meet the requirements of the average farm, is kept on most farms throughout the county, but a large proportion of the farm machinery is insufficiently protected when not in use. The census of 1930 reports 65 tractors in the county, a decrease from 80 in 1925. One reason for this decrease is that the tractors used were too large for the size of the farms, the character of the land, and the shape of the fields. Small tractors have proved more satisfactory.

Most of the farm buildings throughout the county, especially the farmhouses, appear well kept. The number of well-painted houses, modern homes, and well-kept old plantations in neat surroundings is more than is usual for most farming communities.

SOILS AND CROPS

Hart County lies in the smooth part of the piedmont plateau of Georgia. Practically all the land has been cleared, and at present about 80 per cent is farmed. Some of the steeper slopes, which were cleared in the early agricultural development, have been abandoned and are now gullied and eroded. Such areas, as well as a few cut-over areas, support a growth of loblolly pine, old-field pine, scattered oaks, hickory, dogwood, sourwood, poplar, sycamore, and cedar. A few abandoned fields are covered with a growth of briars, small pines, sassafras, sweetgum, or only broom sedge. Very little of the original timber stands to-day. The country is very open, and the soils occur in large areas of undulating or gently rolling relief.

The agriculture of Hart County is similar to the general agriculture of the southern piedmont region except that one crop, cotton, dominates it more exclusively than is common throughout the region. The crops of the county may be considered in two classes—cash crops and subsistence crops. Cotton is the only cash crop of appreciable value, although small areas of sweetpotatoes and truck crops are grown for the local markets. The subsistence crops include corn, oats, wheat, rye, and forage crops, principally.

Cotton dominates the agriculture of the county to such an extent that insufficient food, feedstuffs, and livestock are produced to supply local demands. Of the 77,957 acres of cropped land in 1929, reported by the census of 1930, 55.2 per cent, or 43,056 acres, were devoted to cotton, representing an area greater than that of all other crops combined. The area devoted to cotton is greater than would appear from ginning reports for the county because there are many cotton gins located near, but just outside, the county, which obtain a large part of their cotton from Hart County although their ginnings are

reported entirely for the adjacent county. Such gins are located at Lavonia, Canon, Royston, Bowman, Deweyrose, and Hardcash. It is estimated that at least 1,500 bales of Hart County cotton are ginned outside the county. Yields of the crop are estimated to average one-half bale an acre for the county, although in a recent cotton-growing contest one Hart County grower, on a Madison soil, produced 2,474 pounds of seed cotton and 876 pounds of lint cotton an acre.

Cotton has been grown for a long time, and the economic welfare of the county has depended on this crop. All grades of land values have been based on cotton. It is a crop that the landowners, and more particularly the tenants, know how to grow better, perhaps, than any other crop. It will stand more abuse in the way of poor cultivation and will also stand more drought than most crops and still make a fair yield. It is a crop which can be stored and sold at any time.

In Hart County, both the soils and climate are suitable for the production of cotton. This is especially true of the sandy-surfaced soils, particularly Madison sandy loam, on which soil cotton has returned a greater acre profit than any other crop.

The crop is grown on all soil types, although a larger proportion of the better soils is devoted to it than of the poorer soils. However, this is a case of adaptation in the larger sense, inasmuch as nearly 70 per cent of the county consists of the Madison soils which have proved to be the best cotton soils in the piedmont section of the State for many years. Consequently, a very large proportion of the Madison soils have been devoted to this crop.

Subsistence crops, especially those crops grown to support the livestock, are not sufficient to supply local needs, but there is a strong effort being made by the county agricultural agent to increase the acreage of these crops until home requirements, at least, are supplied. The corn acreage in 1929 amounted to 16,581 acres. Corn is grown on practically all soil types, although a larger proportion of first-bottom soils are utilized for this crop than for any other. It is common practice to grow corn on upland areas which are considered less productive than areas used for cotton, with the result that large areas giving low yields are common. The county agent is emphasizing the importance of growing corn on better soil areas to produce a crop with less cost and to obtain greater acre yields. The acreage devoted to corn is many times that of all other crops combined, exclusive of cotton, comprising 21.3 per cent of the total cropped area in 1929. The yield for the county averages between 12 and 15 bushels an acre. None is sold, and in some years corn is imported for local needs. Very little of the crop is cut and shocked, but the leaves are pulled or the tops cut for forage and the ears are picked, leaving the stalks standing in the fields. Corn is the principal silage crop.

In 1929, oats from 2,252 acres were threshed, and from the remaining acreage, 3,820 acres, they were cut in the dough state and used for green feed. Forage crops, leguminous crops, and small quantities of alfalfa and crimson clover, cowpeas, and a few velvetbeans, some rye, wheat, and sorgo are grown, and the yields are satisfactory. The Austrian winter pea is beginning to assume some importance as a winter crop. Apples, peaches, pears, plums, figs, and pecans are grown for home use. There are six commercial pecan groves in the county.

The present tendency is to produce more home supplies and devote less land to cotton.

Inasmuch as any diversification of crops or improvements in tillage methods or fertilizer practices can be based economically and scientifically only on the foundation of a definite knowledge of the kinds of soil on which the agriculture of the county is being conducted, a detailed description of each of the soils occurring in the county follows. These soil descriptions are based on studies and examinations made on every soil area in the county coincident with showing the location of each kind of soil on the detailed soil map which accompanies the report.

The principal soils of Hart County may be classified, on the basis of color and texture and also in a measure on their agricultural value, into two major groups—the gray and brown sandy soils and the red clay loam soils. A group of miscellaneous soils also occurs in the county.

In the following pages of this report, the soils of Hart County are described in detail, and their agricultural possibilities are discussed. The accompanying soil map shows their distribution in the county, and Table 3 shows their acreage and proportionate extent.

TABLE 3—Acreage and proportionate extent of the soils mapped in Hart County, Ga.

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Madison sandy loam.....	28,544	17 1	Appling sandy loam.....	15,232	9 1
Madison sandy loam, deep-sub-soil phase.....	1,728	1 0	Appling coarse sandy loam.....	1,600	1 0
Madison sandy loam, mixed phase.....	6,080	3 6	Durham sandy loam.....	3,584	2 1
Madison gravelly sandy loam, mixed phase.....	36,224	21 7	Worsham sandy loam.....	1,792	1 1
Cecil sandy loam.....	14,336	8 6	Cecil clay loam.....	11,068	7 2
Cecil sandy loam, mixed phase.....	20,288	12 1	Davidson clay loam.....	1,792	1 1
Wickham sandy loam.....	192	1	Madison gravelly clay loam.....	3,776	2 3
Congaree fine sandy loam.....	1,984	1 2	Steep broken land.....	9,792	5 8
			Meadow (Congaree material).....	8,128	4 9
			Total.....	167,040	-----

GRAY AND BROWN SANDY SOILS

The first group includes all the gray and brown sandy surfaced or light-textured soils in the county. These soils are readily distinguished, by their color, texture, and structure, from the red clay loams. They occupy high, broad, smooth, or gently sloping and gently rolling areas. They are extensively developed throughout the central and southwestern parts of the county. These soils are naturally well drained, owing to their high position and their porous open character. They are everywhere mellow and friable. Consequently they are very easy to till, and plowing to only a slight depth and the use of light farm implements meet the demands for most crops.

Naturally, these sandy surfaced soils, as evidenced by their light color, are severely leached of the soluble elements of plant food and are also deficient in organic matter except where this has been supplied by the farmers. They do not contain so much plant food to a depth of 2 inches as the red clay loam soils. However, their physical characteristics and their response to fertilizers render them desirable soils for the production of cotton, peanuts, bright tobacco, sweet-potatoes, garden vegetables, turnips, rape, watermelons, cantaloupes,

scuppernong grapes, and various fruits, as well as for the staple crops. Cotton matures earlier on these soils than on the clay loams, and this is a great advantage under boll-weevil conditions. These soils warm up quickly and can be cultivated earlier in the spring and sooner after rains than the heavier soils.

All the members of this group of soils are well drained internally, and surface drainage ranges from good to excessively free, so that the greatest problem in their long-continued cultivation, on all except the very smoothest and most level of the sandy loam areas, is the prevention of surface erosion. All these soils will maintain their natural fertility and will retain added fertilization for a longer time under cultivation, if surface erosion is held in check, than will members of the second group. This group includes the most productive soils for general crops and the highest-priced land in the county.

The Madison soils of this group comprise the best general agricultural soils in the southern piedmont region. These soils are much less subject to erosion than are the Cecil soils under similar conditions. They appear to have greater absorptive power for moisture, which would be a large factor in their resistance to erosion and a valuable asset in times of drought. The Madison soils withstand drought better than the Cecil soils under similar conditions.

The soils of the county are in general well defined and typical in their occurrence. Areas occur, especially west, northwest, and north of Hartwell and in a few other sections, where the soils are in an exceedingly mixed and intricate association and it was impossible to show all the different soil types on the map, only the predominating ones being shown. Although it would be of little agricultural value to attempt to show areas of different kinds of soil, which are too small to receive any special attention or cultural treatment, such fields of mixed soils are known to be less desirable for tilling. The most common occurrence of this kind consists of spots of Madison soils, within large areas of the Cecil, Durham, and Appling soils, or spots of the Cecil, Durham, or Appling soils throughout large areas of the Madison soils.

This group of gray and brown sandy soils may be subdivided into two minor groups. The first subgroup includes the gray and brown sandy soils with red subsoils, and the second includes the gray sandy soils which have yellow or reddish-yellow subsoils.

GRAY AND BROWN SANDY SOILS WITH RED SUBSOILS

This subgroup includes Madison sandy loam, with a deep-subsoil phase and a mixed phase, Madison gravelly sandy loam, mixed phase, Cecil sandy loam, with a mixed phase, Wickham sandy loam, and Congaree fine sandy loam. All these soils are naturally well drained, and most of them have a surface relief favorable for agricultural purposes. They occupy the high interstream areas which slope gradually toward the drainage ways. The more sloping and rolling areas are subject to erosion. The mixed phases of the Madison and Cecil soils are the result of erosion. Such areas, unless protected by terraces or seeded to grass and devoted to pasture, will continue to wash and erode. Areas of the mixed phases occupy an intermediate position between the broad smooth and gently sloping sandy loam areas and the more sloping and rolling clay loam areas.

The red clay subsoils of these soils differ greatly from one another. In the Cecil soils, the subsoils are stiff brittle clays which range in

thickness from 2 to 4 feet. The subsoils of the Madison soils are also red clays, but they are more friable and crumbly and have a greater moisture-holding capacity than the Cecil subsoils and in most places are more shallow. Because of their friability they do not erode so badly as the Cecil soils similarly situated.

Wickham sandy loam and Congaree fine sandy loam occur on the second bottoms and first bottoms, respectively, along the streams. These soils have been formed from material brought down from the uplands and deposited at times of overflow. They are naturally productive, as they possess good physical characteristics and contain a large amount of plant food. The Wickham soil is naturally well drained, and the Congaree is as well drained as could be expected of a first-bottom soil.

The soils of this subgroup, especially the Madison soils, dominate the agriculture of Hart County. They produce the greater part of the cotton and a large percentage of the corn and minor crops. As has been stated, the Madison soils, particularly the sandy loam and the mixed phases, are the premier cotton soils of the piedmont plateau. All crops common to the county can be successfully produced on these soils. The retentiveness of the subsoils for manures and fertilizers enables the soils to be built up to, and easily maintained in, a high state of productivity.

Madison sandy loam.—The 8 to 10 inch surface soil of Madison sandy loam typically consists of light-brown sandy loam. The color may range from yellowish gray or brownish gray to almost brown or reddish brown, the latter color becoming more pronounced as different quantities of the red subsoil are mixed with the surface soil by tillage. This soil has a distinctly more brown surface soil than any other upland sandy loam soil in the county. The depth of the surface soil ranges from about 4 inches to as much as 15 inches. In many places the surface soil closely resembles that of Cecil sandy loam, although in most places there is a conspicuous and distinctive quantity of very fine mica flakes visible on the surface of Madison sandy loam. In cultivated fields, which have dried undisturbed after showers, the mica flakes give a velvety sheen to the surface. Here and there are small fragments of brown quartz-mica schist scattered over the surface and to less extent through the surface soil. Most of the fragments are less than an inch in diameter, and many of them are platy in form. In places a noticeable quantity of small angular fragments of quartz may be scattered over the surface, although many areas occur in which there is no gravel of any kind. A few areas, shown on the map by gravel symbols, are more gravelly than typical, and most of them contain larger fragments of angular quartz and of quartz-mica schist, although the diameter of the fragments rarely exceeds 6 inches. The gravel content is extremely variable, but in most places it is not sufficient to seriously interfere with cultivation. Areas southwest and south of Hartwell, extending to the vicinity of Bio School, have a surface soil consisting of coarse sandy loam. The coarse texture is due to the presence of coarse quartz grains and fine gravel in areas closely associated with Appling coarse sandy loam.

The subsoil of Madison sandy loam begins as red clay which is friable and readily breaks into a fine mealy mass under favorable moisture conditions. Dry lumps and fragments are crushed with moderate ease. Very little mica is visible in this layer, which ranges in thickness from 3 to 20 inches, although in most places it is between 5 and 10

inches thick. This layer is always more friable than the corresponding layer of the associated Cecil soils, under similar moisture conditions. It grades into the lower subsoil layer which consists of very friable red clay containing a large quantity of finely divided mica flakes. Dry fragments are readily crushed. The material in this layer is very crumbly and in most places is moist even during extremely dry weather. In most places the lower subsoil layer is thicker than the overlying layer, ranging from 5 to 25 inches in thickness, with an average thickness between 8 and 15 inches, before it grades into the underlying parent material from which the soil has developed.

The parent material consists of purplish-red partly disintegrated quartz-mica schist which in most places is bedded at oblique angles to the surface. Veins of the schist may extend up through the overlying layers nearly to the surface.

Madison sandy loam is one of the most extensive sandy loam soils in the county. It occurs throughout the central and south-central parts in many small and a few comparatively large areas. It occupies high areas of slightly rolling or gently sloping relief, usually on the crest of ridges in interstream areas with ideal drainage conditions. Practically no erosion has taken place on this land. It appears to absorb moisture better than other soils in the piedmont region and to have a greater reservoir for moisture, which probably explains in part the lack of erosion. This condition has another practical agricultural benefit in that it renders the soil more slowly susceptible to drought as compared with other soils.

Practically all the land is cultivated, this being considered one of the best soils in the county, or in the State, for the production of cotton. Perhaps 75 per cent of its total area is used for the production of cotton. Cotton yields range from about one-half to 1 bale an acre. Even higher yields are obtained at times, depending on the quantity of fertilizer used and the methods of preparation and tillage of the soil. The general practice is to use fertilizer of a 3-9-3² formula, applied at a rate ranging from 300 to 400 pounds to the acre. Corn occupies the next largest acreage to cotton, and the yields range from 10 to 30 bushels an acre. Corn may or may not be fertilized, but it is commonly given an application ranging from 50 to 100 pounds of nitrate of soda to the acre. Wheat and oats do well, wheat averaging about 15 bushels to the acre and oats about 30. Garden vegetables and fruits common to this locality are successfully grown.

Madison sandy loam, deep-subsoil phase.—Madison sandy loam, deep-subsoil phase, differs from typical Madison sandy loam in the presence of a large quantity of slightly weathered small tourmaline crystals, from one-eighth to one-half inch in length, on and through the surface soil, and in the greater depth to which the upper subsoil layer has developed. The crystals are brown or black, and most of them are very hard. Intermixed with the crystals are small fragments of quartz-mica schist of about the same size. The quantity on the surface is not sufficient to interfere with cultivation in any way, but it is sufficient to give the surface soil a brown cast and a pebbly appearance, similar to that of the Tifton soils which occur in the coastal-plain part of the State. The crystals are very few and scattered throughout the subsoil, and only occasionally is one found

² Percentages, respectively, of nitrogen, phosphoric acid, and potash.

through the underlying quartz-mica schist from which the soil has developed

The other distinguishing feature of this soil is the greater depth to which the subsoil layers have developed, as compared with typical Madison sandy loam. The upper subsoil layer extends downward from the surface to a depth ranging from 30 inches to more than 6 feet. The material in this layer is very friable and crumbly, with a slight tendency to stick rather than polish and scour freely from a plow. The color is deep red. The lower subsoil layer and the underlying parent material of quartz-mica schist are similar to corresponding layers of typical Madison sandy loam.

This deep soil occurs in one large area and one small area in the southwestern part of the county, in the vicinity of Goldmine, where it occupies a broad, high, slightly undulating ridge crest. All the land is farmed similarly to typical Madison sandy loam, although the deeper soil appears to be inherently somewhat more productive. The agricultural value of this soil equals that of any other soil in the piedmont region of the State, and it excels most.

Madison sandy loam, mixed phase.—The mixed phase of Madison sandy loam represents a condition which developed on typical areas of Madison sandy loam after the land was cleared and cultivated. Erosion has removed the surface soil in spots, exposing the red clay subsoil layers. This gives the fields a spotted appearance, with intermixed clay loam and sandy loam areas, and they are less desirable for agriculture because of their mixed condition. This soil is closely associated with areas of typical Madison sandy loam, but it occupies land with somewhat greater relief, although the surface is smoother than that of the mixed phase of Madison gravelly sandy loam. A few gravelly spots occur, but they are too small to differentiate on the map. Madison sandy loam, mixed phase, is an inextensive soil in Hart County. It occurs principally in the northeast, central, and southeast parts. Nearly all the land is under cultivation to crops similar to those grown on the typical soil, but most of it is in need of more efficient terracing. Some of the fields are being allowed to deteriorate, but others have been reclaimed to an excellent highly productive condition.

Madison gravelly sandy loam, mixed phase.—Madison gravelly sandy loam, mixed phase, differs from Madison sandy loam in the presence of a variable but uniformly conspicuous quantity of gravel on the surface and to less extent through the surface soil and subsoil; in the greater variability in the soil layers; and in the sharper relief which characterizes this soil in most places.

The gravel on the surface is variable both as to kind and quantity. In most places there is a mixture of fragments of quartz-mica schist and fragments of quartz, all of which are angular and in most areas range from 1 to 5 inches in diameter, although in a few scattered areas larger fragments occur, with here and there a boulder ranging from 1 to more than 3 feet in diameter. The quantity of rocks is not sufficient to hinder cultivation except in a few scattered areas. In some localities rock symbols are shown on this soil to indicate areas too rocky for cultivation.

This gravelly soil is extremely variable in its development. The surface soil has been removed in spots by erosion, in some places exposing only the red clay subsoil but elsewhere exposing the under-

lying disintegrated schist. Veins or outcroppings of the schist extend to the surface in many places. The subsoil layers are not so uniformly developed as in Madison sandy loam, in many places being very thin, passing almost directly from the sandy surface soil into loose friable disintegrated schist. East and northeast of Mill Town School and in the vicinity of Hartwell, this soil is extremely variable and includes many gravelly spots of Cecil soils, too small to be shown on the map. Such areas have a lower agricultural value, especially since most of them contain large quantities of quartz gravel.

Madison gravelly sandy loam, mixed phase, is the most extensive soil in Hart County. It is mapped in large areas throughout all except the northwestern part of the county. The relief in most places is sharper than that of the other Madison soils, except the gravelly clay loam. However, the areas range in relief from gently sloping or rolling ridge areas to sharp ridges and steep slopes. Included with this soil as mapped are a few narrow slopes, too steep to be farmed but too small to be shown on the map, which border small streams and drainage ways.

It is significant of this soil that a sandy surface soil will remain on it on rather steep slopes, whereas on similar slopes of the Cecil soils erosion has removed practically all the surface soil.

About 75 per cent of the land is cultivated to crops similar to those grown on Madison sandy loam. Most of the rest is forested with loblolly pine and to less extent with shortleaf pine. Crop yields are similar or slightly less than those obtained on Madison sandy loam.

Cecil sandy loam.—In plowed fields Cecil sandy loam has a surface layer of light-brown or gray sandy loam extending to a depth ranging from 4 to 14 inches. The color tends to become lighter and more gray after long cultivation. This layer is underlain by a subsurface layer of reddish-yellow friable heavy sandy loam which ranges from 1 to 8 inches in thickness but in most places is from 4 to 6 inches thick. In areas with somewhat sharper relief, this layer in many places is very thin or is entirely lacking, the gray or brownish-gray surface soil resting directly on the red subsoil.

The upper subsoil layer consists of red stiff brittle clay which breaks into irregular lumps that can be crushed only with difficulty. This layer ranges from 10 inches to 6 feet or more in thickness, but in most places it is about 30 inches thick before grading into the underlying layer. The lower subsoil layer consists of light-red very friable clay material, most of which is somewhat micaceous. This layer in most places is about 8 or 10 inches thick, but may range from only 5 inches to more than 25 inches in thickness. It overlies disintegrated granitic parent material, from which the soil is derived.

This soil is distinguished from Madison sandy loam, which it closely resembles, by the absence of mica or fragments of quartz-mica schist in the surface soil, and, more especially and more significantly important, by the stiff brittle clay and comparatively great thickness of the upper subsoil layer. In several sections of the county, as north of Montevideo, and southeast of Nancy Hart School, where many small spots of Madison soils occur through the areas of Cecil sandy loam, the two soils are closely intermixed. About 1 mile southwest of Eagle Grove School hard granite bedrock lies immediately under a surface soil of sandy loam or coarse sandy loam. This included soil is of low agricultural value. Such spots, together with small spots of

Appling soils, are included with Cecil sandy loam in this vicinity because they are too small to be shown separately on the soil map.

Cecil sandy loam is one of the most important agricultural soils in the county. It occurs in many comparatively large areas throughout the western half, southeast quarter, and north-central part. It occupies high, smooth, gently undulating areas, in few places having a slope of more than 2° or 3°, commonly on the crests of wide ridges and interstream areas, where excellent drainage conditions exist.

This is one of the more extensive soils of the county, and about 80 per cent or more of the land is farmed, principally to cotton and corn. Next to Madison sandy loam, this soil constitutes the most desirable farm land for general agriculture in the county. However, on most areas exceptional care must be taken to prevent both surface erosion and gulying, which can be readily checked by adequately maintained terraces. A brief period of inattention or neglect may result in very serious damage from erosion on cleared fields.

The greater part of the farm land is used in the production of cotton, which yields from one-half to 1 bale an acre, depending on tillage conditions and fertilization. From 300 to 400 pounds of a 3-9-3 fertilizer is most commonly used. Corn yields range from about 12 to 30 bushels an acre and oats from 18 to 40 bushels, although higher yields of both crops have been obtained. A small acreage is devoted to the production of wheat, yields of which range from 10 to 30 bushels an acre. Wheat, oats, and corn are sometimes given an application of nitrate of soda, ranging from 50 to 100 pounds an acre, in addition to the fertilizer they may receive at the time of planting. Garden vegetables, watermelons, cantaloupes, berries, fruit, and scuppernong grapes do well, and sweetpotatoes give excellent returns. Sorgo does well, but the color of the sirup is not quite so bright as that obtained from sorgo grown on the Durham soils.

Cecil sandy loam, mixed phase.—Cecil sandy loam, mixed phase, differs from typical Cecil sandy loam in the variable depth of the surface soil, which is normal in places, whereas within a few yards it may be very thin or entirely absent, exposing the red clay subsoil. Such a condition is due to surface erosion which has removed the surface soil in places and given rise to a characteristic gray and red spotted appearance in cultivated fields. Practically all areas of this mixed soil represent a condition which has developed coincident with cultivation and is caused by unchecked or inadequately controlled erosion.

Owing to the conditions under which this soil occurs, the various areas differ considerably. In some areas, erosion has done little but remove the surface soil in spots, whereas elsewhere it has developed incipient gullies. Here and there the underlying rocks have been exposed. Northeast of Montevideo this soil includes many small spots of Madison soils which are too small to be shown on the map. Some small spots are very gravelly, the gravel consisting of coarse angular quartz fragments from about 2 to 5 inches in diameter, together with a few large fragments. Most of the gravelly spots are very small, but the larger areas are shown on the map by gravel symbols.

Although the mixed phase is farmed similarly to the typical soil, it is less desirable for tillage, owing to the mixed texture of the surface soil. Unless adequate protective measures are taken, the fields will

become more eroded and hence of lower value. Some fields have already become very nearly ruined, and a few have been reclaimed with remarkable success. In one large reclaimed field, gullies have been filled by scrapers, excellent terraces have been constructed, and the entire field has been plowed to a depth of at least 10 inches. Legumes have been plowed under, until at present the field is highly productive and in excellent condition, its past condition being evidenced only by the alternating colors of grayish brown and red throughout the field.

This is one of the more extensive soils in the county, occurring in areas intermediate in relief between the smooth sandy loam areas and the steeper clay loam areas. In many places it occupies areas separating these two types of soil. It occurs in many comparatively large areas throughout the western half of the county, especially the northwest quarter, and in the southeast quarter, although small scattered areas occur in all parts. Crop yields are usually slightly less than those obtained on Cecil sandy loam.

Wickham sandy loam.—Wickham sandy loam is characterized by a brown sandy loam surface soil to a depth ranging from 5 to 15 inches. This material is very dark when wet. The subsoil is reddish-brown friable and crumbly sandy clay, the color of which changes very little on drying. This layer extends from 20 to 60 inches below the surface, where it grades into a lighter shade of reddish-brown very friable sandy loam. Several areas of this soil in Hart County are very small, and they vary greatly in texture and depth of the alluvial material. In some of these small areas, lenses of sand are present in the lower part of the subsoil and various quantities of small water-rounded gravel occur on the surface.

This is an inextensive soil in Hart County. It occurs as a terrace or second-bottom soil, above normal overflow along the rivers and larger creeks. The largest area lies near Savannah River, east of Mill Town School. Smaller areas are along the same river, west of the north end of Harper Island and near the southeast corner of the county; near Tugaloo River west of Chandler Ferry and east of Knox Bridge; and near Reed Creek, west of Reed Creek School.

The land occupies nearly level smooth relief, on terraces adjacent to first-bottom soils, where it is rarely if ever subject to overflow. Both surface and internal drainage are good.

Practically all the land is cultivated. Cotton and corn occupy about equal acreages, and a small acreage is devoted to hay crops. Typical areas of this soil constitute the best agricultural soil in the county. The soil is highly productive and especially favored for ideal cultivation by texture, structure, and relief. Good yields of cotton and corn are obtained where the soil is fertilized and properly handled.

Congaree fine sandy loam.—The surface soil of Congaree fine sandy loam consists of grayish-brown or brown fine sandy loam to a depth ranging from 8 to 16 inches. This layer is underlain by brown fine sandy loam which extends to a depth ranging from 40 to more than 80 inches. Small mica scales are present in both surface soil and subsoil. Bordering the stream channels of Savannah and Tugaloo Rivers, there is in most places a natural levee of light-brown loose fine sand or sand, from 20 to more than 100 feet in width, which is included with this soil in mapping. Part of the soil on the islands in Savannah River is

also loose fine sand. Near the middle of McMullins Island the soil includes a narrow ridge of Wickham sandy loam.

Small areas of Congaree silt loam, along the larger creeks and along the rivers, are also included with the fine sandy loam areas. The principal areas of the silt loam are on Cedar and Little Cedar Creeks, and an area is west of the south end of Weldon Island. Here the surface soil is brown silt loam from 6 to 18 inches deep. It is mellow and smooth and contains a small quantity of fine mica flakes. The subsoil is brown or light-brown silt loam, most of which contains more mica than the surface soil. The subsoil extends downward to a depth ranging from 25 to 50 inches, where it passes into light-gray material mottled with brownish yellow or rust brown. This, at varying depths, rests on sand.

Congaree fine sandy loam, together with the included areas of Congaree silt loam, occupies nearly level first bottoms which are subject to overflow. Both surface and internal drainage are good for a first-bottom soil. It is reported that the crops are inundated, on an average, in about 1 or 2 of every 5 years. Most of the fine sandy loam areas occur along Savannah River, on the islands in the river, along Tugaloo River, and on Weldon Island. Probably from 60 to 70 per cent of the land is under cultivation. On the heavier-textured areas, corn and hay are the principal crops. Yields of corn range from 30 to 60 bushels an acre without fertilizer. On the fine sandy loam, cotton is grown to some extent. Watermelons are particularly well suited to this soil, and exceptionally large fine-flavored melons are produced. The heavier-textured and more poorly drained areas afford excellent summer pasturage for cattle.

The silty areas included with Congaree fine sandy loam are inherently the most fertile soils in the county, and their productivity and utilization are limited only by danger of overflow. During flooding a new deposit of silt and fine sand is deposited on the surface, and on drying a crust is formed, owing to a puddling process. It has proved advisable to cultivate this land, as soon as it becomes sufficiently dry, in order to break the crust.

GRAY SANDY SOILS WITH YELLOW OR REDDISH-YELLOW SUBSOILS

This subgroup includes Appling sandy loam, Appling coarse sandy loam, Durham sandy loam, and Worsham sandy loam. The surface soils of these soils are the lightest colored in the county, ranging from almost white or light gray to yellowish gray. The subsoils are yellow, reddish-yellow, or mottled yellow and red stiff but brittle clay.

These soils are most extensively developed in the southwestern quarter of the county, although small areas occur throughout the northwestern part and elsewhere. Some of the largest areas lie east, northwest, and south of Eagle Grove School, to the north of Holly Springs Church, and in the vicinity of Vanna. These soils occupy some of the flattest and smoothest parts of the uplands. Although drainage is good in the Appling and Durham soils, it does not appear to be so good as in the Madison and Cecil soils. The light color of both the surface soil and subsoil indicates this condition and also indicates that aeration and oxidation have not advanced so far as

in the red soils. The extremely light color of the surface soils indicates also that there has been a great deal of leaching of the organic matter and soluble elements of plant food.

The slow internal drainage, particularly of the Durham soil, in some places is an important factor in the utilization of the soils of this subgroup. For example, in wet seasons crop growth in some places is seriously hampered by too much water held in the soil. Worsham sandy loam is prevailingly wet during a greater part of the year, as it receives considerable seepage water from the higher-lying soils. Taken as a whole, the soils of this subgroup are considered by some farmers as late soils, that is, they remain cold and wet a little longer in spring or after heavy rains in summer than the sandy soils with the red clay subsoils. These soils are more deficient in organic matter and have undergone further leaching than any other soils in the county, and the surface soil consists mainly of different-sized quartz or sand grains, together with a small quantity of silt and clay. The coarse texture and looseness of the surface soils constitutes a fertilizer problem which has received practically no attention. Fertilizers are likely to leach more readily from these soils than from soils which contain more fine material. These soils are not subject to serious erosion, mainly because of their surface relief and because the surface soil is so porous that rain water readily penetrates it. On the other hand, slight depressions or seepage spots occur here and there.

In the Carolinas, the Appling and Durham soils are especially well suited to the production of bright-leaf plug wrapper and cigarette tobacco. They are also well adapted to the growing of truck crops, peanuts, and cotton. Sorgho produces an excellent quality of sirup, especially on Durham sandy loam. One of the greatest needs of these soils is organic matter, and when this is supplied, better results may be expected from the mineral fertilizers used.

Appling sandy loam.—Appling sandy loam has a surface soil of sandy loam which ranges in color from pale yellow in freshly cleared land to almost white in old long-cultivated land. The color of the surface soil in most places is noticeably lighter, that is, more gray or white than in any of the other sandy loams of the county except Worsham sandy loam. Very commonly a noticeable quantity of coarse quartz sand is beaten out on the surface by rains. The surface soil is from 10 to 18 inches thick, and it grades into the upper subsoil layer of reddish-yellow moderately friable clay which breaks into irregular lumps. The air-dry lumps can be crushed with moderate difficulty. This layer ranges from about 4 to as much as 12 inches in thickness. Underlying it is the lower subsoil layer of mottled and streaked light-red, yellow, brown, and gray clay which is firm and stiff but more friable than the overlying layer. Air-dry lumps of this material are readily crushed. This layer, ranging from 15 to 45 inches in thickness, is in most places the thickest layer in Appling sandy loam and the most readily noticed in cuts. It is underlain by the parent material from which the soil has developed, consisting of mottled light-yellow, light-red, and white very friable disintegrated and partly decomposed granite or gneiss.

The profile shows more or less variation, due in part to the variability in drainage conditions under which the soil has developed and in part to the character of the parent material. In many places, approaching the bases of gentle slopes the upper subsoil layer becomes

thinner until it disappears entirely and the lower subsoil layer gradually includes more gray material until the soil merges with Worsham sandy loam, many areas of which are too small to be shown on the map. On slightly higher elevations within areas of this soil, small spots of Durham sandy loam are common, especially in and east of Hartwell. In a few areas Appling sandy loam includes small spots of Madison sandy loam, occurring as small knolls. Included with this soil also are a few small areas of second-bottom, or alluvial, soils which would have been mapped as Altavista sandy loam had they been of greater extent. Such areas, which have a pale-yellow sandy loam surface soil, with an upper subsoil layer of yellow sandy clay becoming mottled with gray at a slight depth, lie 1 mile west of Reed Creek School along Reed Creek, along Cedar Creek south of McMullins Mill, along Shoal Creek west of Providence Church, and on Lightwood Log Creek southeast of Mount Hebron Church. In the last-mentioned areas, a small quantity of colluvial surface material has been washed in from adjacent slopes occupied by reddish-brown soils.

Appling sandy loam is most extensively developed in the central and southwest parts of the county, and important areas occur in the north-central and southeast parts.

Most areas of this soil occupy high very gently sloping or nearly level land with very little relief. The soil commonly occurs on very gentle slopes between the higher-lying Cecil, Durham, or Madison sandy loam areas and the lower-lying stream-bottom or Worsham sandy loam areas. In many places it occupies the gentle gradients leading to drainage ways that head in the high level upland areas.

This soil is cold and slow to warm up in the spring. It suffers more severely from prolonged drought than do members of the red-subsoil subgroup, and it is also more seriously affected by excessively wet seasons. Terracing is necessary to check surface erosion, but exceptional care should be taken in terrace construction to minimize the retention of water in restricted areas. Numerous broad-based terraces appear to be the most satisfactory type.

Fields that have been under cultivation for some time are extremely low in nitrogen. This feature, together with the fact that fertilizers are not retained so well as on higher soils, tends to produce low crop yields on typical areas. Cotton and corn are often stunted. It is common to see cotton stalks stunted and matured on this soil at the same time the plants are green and still growing on the adjoining higher soils. Late side applications of nitrate of soda aid in producing better stands of corn and cotton. In favorable seasons this land produces good yields of corn and oats, but yields of wheat are in general poor. However, yields are better on the higher areas which are associated with the higher surrounding soils.

About 75 per cent of the land is cultivated, and probably 80 per cent of the cultivated area is devoted to the production of cotton. Cotton yields vary considerably, ranging from one-fourth to three-fourths bale an acre, depending on the season, method of farming, and kind of fertilizer applied. Corn is the next crop of importance, and the yields range from 8 to 25 bushels an acre. Sweetpotatoes do exceptionally well, particularly where manured or fertilized. The yields of cowpeas are low. Cantaloupes, asparagus, tomatoes, and all kinds of garden vegetables do well. This soil produces better crops in ordinarily dry seasons.

Cotton is commonly fertilized with an application ranging from 200 to 400 pounds of 3-9-3 fertilizer. Corn and small grains usually receive from 50 to 100 pounds of nitrate of soda.

Plowing under green-manure crops, especially legumes, will be especially beneficial for this soil. It is probable that tile or other subsurface drainage, especially under terraces and across lower-lying areas, would prove efficient if the crops grown would warrant the expenditure. Areas not cultivated can be readily and naturally reforested to loblolly pine by keeping out hardwoods.

Appling coarse sandy loam.—Appling coarse sandy loam differs from Appling sandy loam in that the surface soil contains a large percentage of coarse sand which is also more prominent throughout the rest of the soil profile. The soil has been developed from coarse-grained granitic material. In some areas the coarse texture has been accentuated by surface leaching and erosion of much of the fine material which has been carried to depressions and lower-lying areas, leaving behind the coarse-textured material. Such a condition exists in the large area between Holly Springs Church and South Beaverdam Creek, in the southwest corner of the county, where coarse sandy loam occurs on the higher elevations and fine sandy loam occupies small depressions. Included in mapped areas of Appling coarse sandy loam are small spots of Durham coarse sandy loam.

Appling coarse sandy loam is an unimportant soil and is comparatively inextensive, occurring in only two important areas, the larger one in the southwest corner, northwest of Holly Springs Church, and the other about 2½ miles southwest of Hartwell.

Except for its slightly lower agricultural value, due to the coarser texture, this soil is similar to Appling sandy loam in characteristics and requirements. About 60 per cent of the land is farmed, almost exclusively to cotton and corn, yields of which vary widely with the seasons and the fertilization, but the soil is inherently of lower agricultural value than Appling sandy loam.

Durham sandy loam.—The surface soil of Durham sandy loam consists of pale-yellow, grayish-yellow, or almost white light sandy loam to a depth ranging from 8 to 18 inches. It is underlain by a yellow clay upper-subsoil layer which is brittle and very friable. It breaks into irregular lumps which readily crumble into a fine granular mass, and air-dry lumps are readily pulverized. In most places this subsoil layer is thick, extending to a depth ranging from 24 to 50 inches below the surface before it grades into the lower subsoil layer. The lower subsoil layer consists of streaked light-red, yellow, and gray sandy clay which is similar to the upper subsoil layer in the upper part, but it becomes more friable in the lower part. This layer ranges from 10 to 30 inches in thickness and grades into the underlying very friable disintegrated and partly decomposed granitic material from which the soil is derived. Much mica is present in the upper part of the parent material which is mottled reddish yellow and yellow.

Durham sandy loam is very uniform in its development, with few variations, although in an area northwest of Holly Springs Church a few small spots of Appling sandy loam and a few rocky knobs are included in mapping.

This is one of the less extensive soils in the county, occurring principally in the southwestern quarter in close association with the Appling soils, where comparatively large areas lie about 1½ miles

northeast of Eagle Grove School, 1½ miles northeast of Goldmine, and 1 mile northwest of Holly Springs Church. An important area occurs at Kings Bench in the north-central part of the county, and two areas lie in the southeastern part, one-half mile south and 1½ miles southwest of Cokesbury Church.

Durham sandy loam occupies areas of high nearly level surface relief, little dissected by drainage ways, although both surface drainage and internal drainage are adequate. Nearly all the land is farmed to the general crops of the county, and fair to good yields are obtained in most places, except when the season is wet. It is reported that, in normal seasons, this soil almost equals the red soils in productivity for corn, cotton, and oats, but that it is a poor soil for wheat. It is considered a "dry-weather" soil.

This soil is especially benefited by plowing under green-manure crops, particularly legumes. It is the soil best adapted for growing bright-leaf tobacco, should the production of that crop be attempted in the county.

Worsham sandy loam.—The 5 to 14 inch surface soil of Worsham sandy loam is pale-yellow, yellowish-gray, or gray sandy loam, and the subsoil is steel-gray or bluish-gray clay, with streaks and mottlings of yellow and rust brown. In some places the color of the subsoil, when dry, is nearly white, and the material in this layer is used locally for whitewashing. The clay has a smooth slick feel and is stiff and brittle or tough and slightly sticky. The dry lumps can be pulverized with difficulty. Coarse quartz grains are scattered throughout the subsoil in most places.

Variations occur in this profile as the higher surrounding soils are approached, where the soil becomes better drained, and the profile gradually changes to that of the bordering soils, especially in the surface layers. In some places a Durham or Cecil surface soil may have a Worsham subsoil. Small areas having surface soils of mixed colluvial material are also included in mapping.

Worsham sandy loam is inextensive, but the small areas are conspicuous. Most of the bodies lie along the borders and around the heads of incipient and intermittent drainage ways. This soil occurs most extensively in the southwest quarter and central part of the county, in close association with the Appling and Durham soils.

Surface drainage is good in most places, but internal drainage is slow, and the soil is in general seepy. None of the land is cultivated, except a few small better-drained areas which are used for sorgo and corn. It supports excellent pasture, especially if seeded with Bermuda grass. Some of the land is gullied and adapted only to forest production.

RED CLAY LOAM SOILS

The second important group of soils, or the red clay loam soils, locally known as "red clay lands," includes Cecil clay loam, Davidson clay loam, and Madison gravelly clay loam. Although these soils occur to more or less extent throughout the county, their greatest development is in the northwest quarter. Some areas are in the southeastern corner, southeast of a line from Alford's Bridge to Pleasant Hill Church.

The clay loam soils occupy slopes ranging from gentle to steep, and in some places they occupy fairly smooth narrow interstream ridges. The surface relief is well marked and surface drainage is excellent;

in fact, rain water runs off too rapidly. Davidson clay loam areas are moderately sloping and are smoother than areas of Cecil clay loam. Cecil clay loam is largely a product of surface erosion, and, as the sandy surface material is removed from Cecil sandy loam, more Cecil clay loam areas will be developed in the county. Erosion of the surface soils is active on all the soils of this group, particularly on Cecil clay loam. Madison gravelly clay loam does not erode so quickly as Cecil clay loam in similar situations.

The clay loam soils are the heaviest-textured soils of Hart County; in fact, they are the heaviest soils developed in the piedmont plateau. These soils have excellent surface drainage, but internal drainage of the surface soil is slower than in the sandy soils. Because of the texture and structure of their surface soils, they are more difficult to till than the lighter-textured soils, as they require heavier machinery and stronger work animals for efficient handling. The soils respond readily to the addition of lime or any form of organic matter. It appears that organic matter or both organic matter and lime improve the consistence of these soils, rendering them more crumbly and friable, which allows them to absorb more of the rainfall and retain it for the crops. The soils naturally contain more plant food, especially potash, than the sandy soils.

The clay lands, regardless of their productivity, have been the first to be abandoned in favor of the sandy loams in the change in soil utilization which has accompanied changing economic conditions.

Wheat, oats, and clover are the crops best suited to these soils. Davidson clay loam is not only suited to these crops, but it is the best soil in the piedmont plateau for the production of alfalfa. It has been used at Rock Hill, S. C., and in many places in North Carolina for growing this crop. Large yields of wheat, oats, and clover have been obtained from these soils in many parts of the piedmont plateau. These clay loams do not mature cotton so early as do the more sandy soils and therefore are less desirable under boll-weevil conditions.

Cecil clay loam.—Cecil clay loam has a surface soil of brownish-red or reddish-brown friable clay loam to a depth ranging from 3 to 7 inches. The topmost inch or two of soil is brown sandy loam. The upper subsoil layer is stiff and brittle red clay which extends to a depth ranging from 20 inches to more than 6 feet below the surface. It grades into the lower subsoil layer of lighter-red clay which is more friable and in most places contains a noticeable quantity of mica flakes. This lower subsoil layer ranges from 8 to 20 inches in thickness, finally grading into the underlying disintegrated and partly decomposed granite or gneiss. This soil is distinguished from Davidson clay loam, which it resembles and with which it is associated in the northwestern part of the county, by the lighter color of the surface soil, by the more brittle, blocky structure of the subsoil, and by the presence of sharp angular quartz sand grains.

In places erosion has removed entire soil layers, in some places exposing the parent material which has the appearance of gray coarse sandy loam directly overlying the hard granite or gneiss. Such spots are of very low agricultural value, but they are small. Southeast of Flat Rock Church and in a few other localities, the soil includes a noticeable admixture of Madison soils in spots too small to show on the map. A few narrow steep slopes of steep broken land are also included in mapping. Most of these areas border drainage ways for

short distances. In an area one-half mile east of McMullins Mill, north of Cedar Creek, an admixture of Davidson clay loam, in spots too small to be shown separately on the map, has been included in mapped areas of Cecil clay loam.

Cecil clay loam is one of the important soils of the county, occupying a large portion of the northwestern and southeastern parts, as well as occurring in small areas along some of the creeks in the southwestern part. Soil of this kind usually occupies slopes of more than 5°, and some of it occurs on more gentle slopes, in some places occupying the entire ridge of the narrower interstream areas. The slopes range from gentle to those too steep for cultivation, although most of the steep slopes have been mapped as steep broken land. A variation from the typical soil lies at the mouth of Cedar Creek on a flat stream-cut terrace between Savannah River and Cedar Creek, but little or no deposition of alluvial materials remains.

Internal drainage is good, but surface drainage ranges from free to excessive, necessitating adequate protective terracing on all cultivated fields. About 60 per cent of the land is cultivated. A larger percentage has been cultivated in the past, but has been eliminated from cultivation to be reforested or abandoned to the ravages of erosion. Some of the first land cultivated in the county was on these clay loam slopes which proved highly productive until they began to suffer from erosion.

Cecil clay loam is a productive soil where adequately protected from erosion, but it is harder to work and requires greater skill in tillage than the sandy loam soils. It retains added fertilizers longer and, where plowed deep, suffers less from drought than do the more sandy soils. It was noticeable in the summer of 1929, which was very wet in the spring and unusually dry until late summer, that shallow-plowed areas of this soil suffered severely from drought—worse than the sandy loam soils—but that the deep-plowed, well-tilled clay loam areas withstood drought better than any other soils in the county, except the Madison soils. Exceptional care has to be taken on this soil not to till or to plow it when too wet, otherwise a hard, lumpy condition will be developed; and if consistently plowed too wet, the material will become so lumpy that crop yields will be materially reduced for several years following cessation of tilling the land when wet.

The soil is used for the production of cotton and corn. Corn yields from 12 to 35 bushels an acre. It receives an application ranging from 100 to 150 pounds of nitrate of soda to the acre. Cotton yields range from one-fifth to three-fourths bale an acre. Wheat and oats produce well where the soil has been manured, organic matter turned under, or fertilizer applied. Small-grain and hay crops are grown on a rather large acreage. In Clarke County and a few other counties in Georgia this soil has been successfully used for alfalfa, although it is not so well adapted to that crop as is Davidson clay loam. Land of this kind is especially responsive to winter cover crops. Deep fall plowing gives best results, although a few farmers practice spring plowing with success.

Areas not desired for cultivation can be readily reforested to loblolly pine in most places, except where erosion has reached advanced stages, by merely allowing the field to "lay out" if a few seed trees border the field.

Davidson clay loam.—The surface soil of Davidson clay loam consists of dark reddish-brown clay loam which is brownish black or very dark brown when wet. When wet the material is heavy, stiff, and sticky and is referred to by many farmers as "push land," owing to its characteristic of adhering to a plow and other implements used in cultivation. The air-dry soil naturally breaks into a fine granular mass, in which the granules are about the size of BB shot. Large dry lumps are readily crushed into this friable mass. The surface soil ranges from 4 to about 10 inches in thickness and averages 6 inches.

The subsoil is dark-red or maroon-red clay, which is slightly lighter in color when dry and assumes a yellowish-red color on a cut surface. The clay is heavy, smooth, firm, and sticky, but not tenacious. It breaks into irregular lumps, which are readily crumbled into a fine granular mass, in which the granules are about the size of BB shot. The dry granules are pulverized only with difficulty. The surface of an exposed cut is usually covered with these fine granules, which give it a fluffy appearance. In walking over an exposure of the subsoil, the material appears soft and velvety in sharp distinction from the hard bricklike surface of exposed cuts of the subsoils of the Cecil soils, with which Davidson clay loam is associated. The subsoil varies somewhat in thickness, ranging from 40 to 90 or more inches, and it is uniformly thicker than in any other soil in the county. The subsoil grades into the parent material, from which the soil has developed, which consists of ocherous-yellow and red disintegrated, partly decomposed basic rock, with black streaks and black faces along nearly all fracture lines. This material is very friable and is readily crushed. The basic rocks from which the soil is derived appear to be principally hornblende schist, although a little chlorite schist was also observed.

Davidson clay loam occupies a comparatively small total area, but it is an important soil in the restricted section of the county in which it occurs. With the exception of one small area, one-half mile southwest of Eagle Grove School, it occurs exclusively in the northwest quarter of the county. The largest area lies west of Shoal Creek School, and many small areas are in the same section of the county.

Most areas of this soil occupy high, gently sloping land, with moderate relief, although a few have sharp relief, including some steep slopes. A few rocky and gravelly areas are indicated on the soil map by rock and gravel symbols. The land in general has excellent drainage, but most areas need a moderate amount of terracing to prevent erosion.

Davidson clay loam is one of the most productive soils in the county. As with Cecil clay loam, care must be taken not to plow or till this soil when too wet. The land is used principally for cotton, with a less amount in corn. It uniformly produces excellent yields, and deep-plowed, well-tilled areas are affected less by drought than any of the upland soils in the county, with the possible exception of Cecil clay loam. However, the soil is hard to till, and there is a noticeable proportion of the land plowed too shallow. It retains fertilizers exceptionally well, but the structure and fertility would be materially improved by plowing under a green-manure crop in a regular rotation. This soil is especially well adapted to alfalfa, which crop would also prove very beneficial to the soil. Although practically none is grown at present, the crop is to be sown in several places in the near future.

Practically all the Davidson clay loam land has been cleared and farmed at one time, but a large proportion of it is now idle, less than 50 per cent being cropped, principally because it tends to mature cotton too late under boll-weevil conditions. The soil is used in the production of cotton, corn, peaches, alfalfa, oats, and wheat. Wheat yields are reported as high as 35 bushels an acre, although the average for the county is much less. Alfalfa yields from 3 to 4 tons to the acre, and oats do well. The yields of corn depend on the methods of preparation and cultivation of the land, the amount of organic matter in the soil, and the fertilizer applied. Peaches do well on this clay land, and their color is especially good.

This is one of the best soils in the piedmont plateau for the production of alfalfa, wheat, and clover. It can be built up to a high state of productivity, and large yields of these crops can be obtained. The fertilizer application recommended for cotton on this soil is from 400 to 600 pounds to the acre of a 4-12-4 mixture.

Madison gravelly clay loam.—Madison gravelly clay loam has a 3 to 5 inch surface soil of reddish-brown or brownish-red friable clay loam. A variable but important quantity of small angular quartz fragments and small particles of quartz-mica schist, most of them ranging from 1 to 4 inches in diameter, occur on the surface, although the quantity is in few places sufficient to interfere with cultivation. In many places the gravel is probably a direct benefit to the soil, in that it prevents the clay from becoming as close and compact as it would otherwise become when plowed too wet, which is a rather common practice.

The surface soil is underlain by an upper subsoil layer of red clay which is stiff but friable and extends to a depth between 20 and 30 inches, in some places to 60 inches, before grading into the lower subsoil layer. The lower subsoil layer consists of very friable micaceous red clay ranging from 8 to 20 inches in thickness before grading into the underlying parent material of quartz-mica schist from which the soil has developed. Here and there veins of schist penetrate the subsoil layers, but in few places do they extend to the surface.

The soil profile of Madison gravelly clay loam is better developed than might be expected from the relief of the land, and it is more uniformly deeply developed than is the profile of Madison gravelly sandy loam, mixed phase, with which it is closely associated.

This soil occurs principally in the southeastern part of the county near Savannah River, in the vicinity of Smith-McGee Bridge, south of Alford's Bridge, southwest of Cordell Mill, and along Cedar Creek. Small areas are in the extreme northwestern corner of the county. The land occupies high ridges and sloping areas bordering steep non-agricultural slopes. In the vicinity of areas of this soil, the relief is sharp and the land is subject to marked erosion. However, this soil shows little effects of erosion except in the absence of a sandy surface soil. Surface or sheet erosion is evident in places, but very few gullies have developed.

About 60 or 70 per cent of the land is cultivated, mainly to cotton. A small acreage is in corn and small grains. Efficient terraces are needed on much of the soil, and greater care should be taken not to till the land when too wet. Although this is a very inextensive soil in Hart County, if properly tilled and protected from erosion it is very productive.

MISCELLANEOUS SOILS

The miscellaneous soils include steep broken land and meadow (Congaree material). These two classifications of material differ widely from each other in all their characteristics, as color, texture, structure, surface relief, and drainage. They do not fit into the general grouping of the soils of the county, and steep broken land is unsuited to farming operations.

Steep broken land.—Steep broken land is a miscellaneous classification consisting of both Madison and Cecil soil material. It includes slopes too steep to be cultivated, many of which are rocky and all of which are gullied or eroded. The texture may be clay, clay loam, or sandy loam, the sandy loam in most places being little more than disintegrated rock. Areas of the Madison soils, especially, are in general rocky, and rock outcrop is common.

Steep broken land occurs principally along the valleys of Savannah River, Tugaloo River, and the larger creeks in the northern and eastern parts of the county.

None of this land is cultivated, except small isolated spots having smoother relief. Practically all of it is forested to shortleaf and loblolly pines, with a small admixture of oaks and other hardwoods. Nearly all the forest has been cut over. Spots here and there make fairly good pasture, but most of the land is best used for forest production.

Meadow (Congaree material).—This is a miscellaneous classification of Congaree material, occurring along the creek and river bottoms, which is too mixed in texture to be shown as separate soil types on the map. It includes areas of sand, sandy loam, silt loam, and silty clay loam. Many of the creek bottoms were originally areas of uniformly developed first-bottom soils, but they have become covered by a deposition of mixed material following clearing of the adjacent hillsides, and many of them are reported to be filling with this alluvial material, thereby developing poor drainage. Several of the creeks have been dredged and the channels straightened, but these operations have proved very expensive, considering the amount of land benefited, and the channels are reported to be badly filled within seven or eight years. South Beaverdam Creek bottom includes some highly productive areas of Congaree silt loam and Congaree fine sandy loam, together with many poorly drained areas and areas covered with loose incoherent sand. Shoal Creek was dredged at a cost of about \$24 an acre, but a large part of the bottoms is still too wet for cultivation.

About 50 per cent of meadow is cultivated, and most of the remainder is used for summer pasture, which is good. Excellent hay crops are obtained from parts of the land, and corn is an excellent crop on the better soil areas. It is doubtful whether extensive drainage will prove economical, but restricted areas have been benefited by such operations.

AGRICULTURAL METHODS AND MANAGEMENT ³

All the soils of Hart County are highly leached. They are very deficient in organic matter and therefore very low in nitrogen. The deficiency in organic matter is due primarily to the climatic conditions under which the soils have developed, but it is further enhanced by the

³ This section of the report was prepared in part by the division of agronomy, Georgia State College of Agriculture.

practice of removing or burning crop residues. Although this practice is not general throughout the county, it is consistently carried on in some sections, very often on the Durham and Appling soils which are in greatest need of organic matter.

The needs for organic matter can be met by the application of manure or by growing legumes to be plowed under in a regular crop rotation. Since very little livestock is kept in the county, the main source for organic material will necessarily be from legumes. Hairy vetch, Austrian winter peas, and crimson clover are winter legumes recommended by the division of agronomy of the Georgia State College of Agriculture. Many of the soils, especially a large proportion of the Appling and Durham soils, are so low in organic matter that satisfactory stands of these legumes can not be obtained. To improve such soils it is recommended that rye be grown and turned under until they will support hairy vetch or Austrian winter peas. After the fertility is improved by these crops, crimson clover can be sown. Crimson clover is the best winter legume for soils fertile enough to support it, but it will not make satisfactory growth on soils low in fertility, as will hairy vetch or Austrian winter peas. It is suggested that summer legumes be grown also, both for soil improvement and as feed for livestock. Cowpeas or soybeans should be interplanted in all the corn and sown after wheat or oats. It is reported by the county agent that the acreage of hairy vetch and Austrian winter peas has increased 500 per cent in the last two years, and it is hoped that the increase will continue.

A rotation of crops providing for the frequent use of legumes on all fields should be practiced. A 2-year rotation suggested for the projects of the boys in the classes in vocational agriculture is as follows: Half the land in cotton and the other half divided between corn and small grains. Cotton to be followed by corn and small grains, and that part of the cotton land to be followed by corn should be planted in late summer or early fall to a winter legume to be plowed in the following spring for soil improvement. Cowpeas or soybeans are planted in all the corn to be harvested for seed or feed, and after small grains, cowpeas or soybeans are planted to be harvested as hay.

Excellent information for growing winter legumes can be obtained from Bulletin 374 of the Georgia State College of Agriculture, entitled "Winter Legumes for Georgia." This bulletin gives recommended rotations which include legumes for soil improvement for many types of farming, together with instructions for growing the various legumes.⁴

Much of the land is now planted continuously to one crop, although the better farmers are using rotations. A common rotation is cotton, corn, small grain. A much better rotation in use consists of cotton, a winter legume, corn or sometimes cotton again. The winter legume is turned under except where grown with oats for hay. Another rotation commonly used is cotton, small grain, cowpeas for hay, corn or cotton.

Much of the corn crop is planted on fields that are, or can be, rotated with cotton, but a rather large proportion is planted in small stream bottoms that are planted continuously to corn. It is recom-

⁴ ALEXANDER, E. D. WINTER LEGUMES FOR GEORGIA. Ga Agr Col Bul 374, 24 p., illus. 1929

mended that corn on those bottoms, as well as on uplands, be interplanted with cowpeas or soybeans for soil improvement and for feed. Hastings Prolific and Whatley Prolific are popular varieties of corn. Pure seed of these or similar prolific varieties should be planted.

In parts of the county large acreages are planted to varieties of cotton producing a very short staple. The quantity of this cotton produced is sufficient to cause the average price paid for cotton in the markets in the county to be lower than the average price paid in some near-by markets not receiving so much of the very short staple cotton. Variety tests of cotton made at the Georgia State College of Agriculture, Athens, Ga., and at Clemson College, S. C., indicate that higher money value to the acre and greater profits are obtained by planting some of the well-adapted varieties having longer staple. This is especially true when such varieties are grown exclusively by communities and uniform lots of unmixed high-quality staple are offered to buyers.

At present only about 50 acres in the county are devoted to alfalfa, but it is urged by the county agent that this acreage be greatly extended on all soil areas suited to the crop. Davidson clay loam is the best alfalfa soil in the piedmont section of the State. Cecil clay loam and Madison clay loam are successfully used for the crop elsewhere in the State, although more lime is required on these two soils than on the Davidson soil. Where the crop has been successfully grown, acre applications of about 2 tons of ground limestone and from 400 to 600 pounds of superphosphate are used.

Hay and other feedstuffs are shipped into the county in large quantities. The acreage and acre yield of all feed crops should be increased until the farms are self-supporting in this respect. Dairying and poultry raising should be increased to provide better distribution of the farm income. To do this economically it is necessary to increase both the acre yield and the acreage of corn, oats, wheat, hay, and other field crops. Pastures can often be improved by sowing Bermuda grass and Lespedeza for summer grazing. In many places clover can be used profitably for winter pasture.

The county agent has adopted an improvement policy which will be of great benefit to the agricultural development of the county if successfully achieved. The salient features of this program include the following: Alfalfa for land suited to it; increased acreage of oats; increased acreage of rye for green manure and grazing, the rye to be used to render poor land fit for growing legumes; barley for grazing and for grain; corn grown after winter legumes; cotton confined to better land and soil-improvement crops put on poorer land; more cowpeas sown for hay; velvetbeans sown in corn for soil improvement; enough sorgo and potatoes produced for the local market; and more winter cover crops grown.

The principal fertilizer application for cotton is from 300 to 350 pounds of 3-9-3 fertilizer an acre, although there is a marked tendency to increase the acre application of a higher-grade fertilizer. Small quantities of 4-10-4, 4-12-4, and 5-15-5 fertilizer are being used. Experimental data and the practices of the best farmers indicate that it would be profitable to use somewhat larger quantities of fertilizer and fertilizer of higher analysis for cotton than is now used on most farms. It is suggested that from 400 to 600 pounds an acre of 4-12-4, 5-15-5, or a similar high-analysis fertilizer, be used for this crop. The larger applications are recommended for those soils that are in

better physical condition. In most fields it will prove profitable to make side applications ranging from 100 to 200 pounds an acre of nitrate of soda or other source of quickly available nitrogen, at about the time squares begin to appear. It is recommended that all corn be fertilized with 200 or more pounds an acre of a complete fertilizer, and that 100 pounds or more an acre of nitrate of soda or other source of quickly available nitrogen be applied to the growing crop.

For small-grain crops it is recommended that from 200 to 400 pounds of superphosphate be applied in the fall and 100 pounds of nitrate of soda in early spring, unless legumes have been plowed under.

A good proportion of the land is well plowed and tilled, although deeper plowing is needed in some sections, especially on the clay loam soils. Fall plowing is especially recommended for the clay loam soils, although success has been made by spring plowing of such land. However, the winter freezing of fall-plowed areas is sufficient to be very beneficial to the structure of these soils. Deep plowing provides a better seed bed and a larger plant-feeding reservoir. It also serves to conserve moisture so that the soils withstand drought conditions far better than shallow-plowed lands. By their better ability to absorb moisture, the deep-plowed soils also resist erosion to a greater extent, especially if aided by winter cover crops. There have been some unfortunate experiences with deep plowing, and especially with subsoiling, in the county, due to the manner and extent to which it was done. In the fields noted, a large quantity of subsoil was turned up at one time, with very injurious results. On soils with heavy subsoils, including all the red subsoils, the depth of plowing should be gradually increased, about an inch at each plowing, until the desired depth is reached. Subsoiling will usually give good results, unless too much heavy clay is turned up into the surface soil. However, the growing of deep-rooted legumes, especially alfalfa, will avert the necessity for subsoiling. Such crops will greatly improve the structure, especially of the heavier soils, as well as increase their fertility.

More adequate terracing is needed in most sections of the county, although practically all cultivated land is now terraced to a varying extent. On the smoother land with gentle slopes, broad-based terraces could well be adopted and would prove most economical for tillage. Some land now in cultivation is so steep that terracing can not prevent erosion, and such land should be reforested. The extent to which the mixed phases of the Cecil and Madison sandy loams occur throughout the county demonstrates the extent to which erosion has damaged those soils. However, a few excellent examples occur where such eroded areas have been reclaimed and terraced adequately, making them very desirable fields. All rocky, steep, and poorly drained areas should be reforested. Assistance in reforestation can be obtained from the division of forestry, Georgia State College of Agriculture, Athens, Ga.

SOILS AND THEIR INTERPRETATION

Hart County lies in the central part of the piedmont plateau, in northeast Georgia, bordering Savannah and Tugaloo Rivers. It lies in the red and yellow soils region of the United States.

Previous to clearing for cultivation, the upland soils supported a growth consisting principally of shortleaf pines, with a variable admixture of oaks and a few other hardwoods. Areas which have been

naturally reforested, such as abandoned fields and cut-over lands, now support mainly loblolly pines, with mixed hardwoods in places. The natural growth of grasses is sparse, compared with that on areas farther north in the United States. Such vegetative cover has not been conducive to the accumulation of a great quantity of organic matter in the surface soils, as in the prairie and some other soil regions

The county lies in a region of high annual precipitation, which is well distributed throughout the year, the mean annual precipitation at Hartwell being 47.82 inches. Such high precipitation has tended to leach the organic material that would naturally accumulate, and the warm temperature prevailing through the long summers has further assisted in complete oxidation of the organic material. The result of these conditions is that there is very little organic matter in any of the soils, and in few places does it extend to a depth of 2 inches in virgin areas. The organic matter is but partly disintegrated and in many places consists of litter on the surface. Consequently, the soils of the county have been formed without any coloration from organic decomposition below the topmost inch or two, and this has given rise to soils with light colors (grays, light browns, yellows, and reds) in the A horizon

A further result of the high precipitation has been to completely leach all calcium carbonate and other soluble bases from the soil. Although the ferromagnesian rocks, especially, contain calcium, calcium carbonate does not accumulate as a decomposition product in any horizon in the profile. The soils range from slightly acid to rather strongly acid

The parent materials from which the soils are derived consist of granite and gneiss, quartz-mica schist, and ferromagnesian rocks, principally hornblende schist. Quartz-mica schist is the predominating parent material and occurs almost exclusively across the central part of the county in a northeast-southwest direction. This parent material gives rise to soils which have a friable B₁ horizon and a very friable micaceous B₂ horizon. The soils from this material are comparatively resistant to erosion, and they seem to conserve water against drought rather better than the other soils of the county. Soils of the Madison series are the only ones derived from this parent material

Granite and gneiss predominate in the northwest, west, and southeast parts of the county. Such parent material gives rise to soils with a stiff, brittle, somewhat friable B horizon, where development has been under favorable conditions of drainage and aeration, especially when compared with the soils derived from quartz-mica schist. Where development has taken place on flat areas, in which drainage has been slow at some period, the B horizon is, in general, more friable and contains a larger proportion of coarser material. The mature well-developed soils from this material are subject to serious erosion if they occupy sloping land. The Cecil, Appling, Durham, and Worsham soils are derived from this material.

The ferromanganese rocks are comparatively inextensive in the county, occurring only in small areas in the northwest corner. The principal rock of this group is hornblende schist, although a small quantity of chlorite schist also occurs. This parent material gives rise to soil with a heavy, stiff, brittle, smooth B horizon, which in most places is weathered to a greater depth than is the B horizon of

any other soil in the county. The only soil derived from this material is Davidson clay loam.

The soils of Hart County may be classified into two groups, according to the maturity of the soil profile. The first group includes all those soils in which a normal mature profile has developed. The second group includes all those soils in which a normal profile has not been developed, owing to poor drainage, or, once developed, has been mutilated by erosion.

The first group may be further divided into two subdivisions, according to the color of the subsoil, which is indicative of the conditions under which oxidation has taken place or the extent to which it has advanced. The first subdivision includes those soils having a red B horizon, and it includes the most mature soils of the county, those which have developed under excellent drainage. In this group are Madison sandy loam, Madison sandy loam, deep-subsoil phase, Cecil sandy loam, Davidson clay loam, and Wickham sandy loam. In all these soils, sesquioxides from the A horizon have accumulated in the B horizon, where advanced oxidation has progressed to considerable depth. The removal of the iron from the surface soil, together with the practical absence of organic matter, has given rise to a very light-colored (gray, light-brown, or yellowish-brown) A horizon, except in Davidson clay loam. Likewise, the accumulation of the iron under favorable conditions for complete oxidation in the B horizon gives rise to a deep-red color in the B horizon of each soil. In some places the red color extends to a depth of more than 10 feet. The B horizon of the soils in this subdivision is very heavy, whereas the A horizon is light in texture, except in Davidson clay loam, indicating an advanced stage of illuviation. These soils have developed under excellent drainage on fairly smooth land which is subject to very little erosion.

The second subdivision includes soils with a yellow B horizon. Durham sandy loam is the only member in this subdivision in Hart County. This soil appears to have been developed where a periodically high water table either has prevented complete oxidation of the iron or more probably has removed most of the sesquioxides from the soil in solution. It is a notable condition that this soil retains water longer following rains than soils of the red-subsoil group. During the course of the survey, it was also observed that dug wells reached water at much slighter depths in this soil than in soils of the red-subsoil group. Water was commonly reached in Durham sandy loam at a depth ranging from 20 to 25 feet, whereas in the red-subsoil group wells were commonly dug to a depth ranging from 50 to 75 feet before water was reached.

The Appling soils may be considered as mature soils, intermediate in profile development between the Durham soils and the Cecil soils. The Appling soils have an A horizon similar to that of the Cecil soils, but the B₁ horizon is reddish yellow and the B₂ horizon is mottled red and yellow, indicating imperfect oxidation, or an uneven distribution of the iron. However, it is questionable whether the Appling soils are mature in their present profile development or represent a transitional stage in the profile of other soils. There is evidence to indicate that at least some areas of these soils are developing from the mature Cecil soils toward the Durham soils, ahead of advancing drainage ways, by leaching and hydration of the iron. There are indications

also that part of the soil has so developed, owing to conditions of internal drainage, that in the upper part oxidation and illuviation are similar to oxidation and illuviation in the Cecil soils, but with increased depth, aeration, and hence oxidation, are periodically imperfect, giving rise to the mottled appearance in the B₂ horizon. If this condition became more pronounced, the profile would probably become similar to that of the Durham soils; but since drainage would naturally improve with advancing drainage ways and attendant better oxidation of the iron, the profile will probably become similar to that of the Cecil soils, unless too large a quantity of iron is lost in solution by run-off waters. Insufficient analytical work has been done to show which way the Appling profile is developing, but such analyses are now being undertaken at the State College of Agriculture.

The second group, or the group of immature soils, includes Cecil clay loam, Cecil sandy loam, mixed phase, Madison sandy loam, mixed phase, Madison gravelly sandy loam, mixed phase, Madison gravelly clay loam, and steep broken land. Some of these phases, and perhaps part of the Cecil clay loam at one time, had a normal soil profile and were fundamentally sandy loams of their respective series. On account of surface erosion, most of the sandy covering has been removed and has exposed, in many places, the clay loam or clay material. As erosion progresses in this county there will be less and less of the normally developed sandy loams and larger areas of the clay loams and the mixed phases.

Cecil clay loam and Madison gravelly clay loam are mainly products of severe erosion, that is, practically all the sandy covering and even in places a part of the B horizon has been removed, thus giving a B-C profile. The B and C horizons throughout these soils are almost identical with the corresponding horizons of the normally developed soils.

In this group are also the Worsham and Congaree soils and meadow (Congaree material). The Worsham soil has not developed a normal profile, owing to poor drainage, to seepage waters, and also to the fact that erosion has been severe. The Congaree soil and meadow (Congaree material) are recently deposited materials which have not lain in one position for sufficient time and have not had adequate drainage to produce a normal soil profile. These deposits are constantly being changed by the addition of new sediments at times of overflow or by removal of material.

Throughout the county the B horizon of all the soils is the heaviest-textured horizon in the soil profile. It constitutes the zone of illuviation. It is, in general, uniform in color, texture, and consistence. In the soils occurring on smooth or nearly level surface relief, the A horizon is uniform to a depth ranging from 8 to 16 inches.

The soils of Hart County are grouped into series on the basis of the characteristics of the various horizons, and all features, such as color, consistence, origin, and drainage, are taken into consideration. The soils in these series are differentiated according to differences in texture. Eight soil series are represented in the county and two miscellaneous classifications of material, steep broken land and meadow (Congaree material).

Following are profile descriptions of the dominant soil types of Hart County, taken at representative locations.

Typical areas of Madison sandy loam are nearly all in cultivation. A typical area, which has been in pasture for a long time, is 1 mile east of Reed Creek School. It shows the following profile:

- Horizon A. From 0 to 10 inches, light-brown sandy loam containing small mica flakes and a few small fragments of quartz-mica schist.
- Horizon B₁. From 10 to 22 inches, friable red clay. A cut surface is yellowish red. The clay breaks into irregular-shaped lumps which are readily broken into a fine mealy mass. Air-dry lumps are readily crushed. The material in this layer contains very little visible mica.
- Horizon B₂. From 22 to 34 inches, red clay which is very friable and contains a large quantity of small mica flakes. Very crumbly, with a smooth micaceous feel. The clay is readily crushed when dry. It is usually moist, even during very dry times.
- Horizon C. From 34 to 40+ inches, purplish-red partly disintegrated and slightly decomposed quartz-mica schist. In most places schist lies at oblique angles to the surface, and in some places veins extend upward through the overlying horizons.

A virgin area of Cecil sandy loam, supporting a mixed forest growth and occurring 1¼ miles northwest of Kings Bench, shows the following profile:

- Horizon A₁. From 0 to one-half inch, dark-gray sandy loam which contains much partly disintegrated organic matter consisting mainly of pine needles, oak leaves, and moss.
- Horizon A₂. From one-half to 6 inches, light-brown loose and friable sandy loam.
- Horizon A₃. From 6 to 9 inches, reddish-yellow heavy sandy loam which when moist breaks into lumps that are readily pulverized. The dry lumps are pulverized with some difficulty.
- Horizon B. From 9 to 38 inches, red stiff brittle clay. A cut surface is yellowish red. The material breaks into irregular lumps which finally break into irregular small hard lumps that can be crushed only with difficulty. Dry lumps can be crushed with moderate pressure.
- Horizon C₁. From 38 to 48 inches, light-red friable micaceous decomposed granitic material.
- Horizon C₂. From 48 to 53+ inches, creamy white, or mingled white and yellow, disintegrated granite.

A virgin area of Durham sandy loam forested with oaks and scattered pines, located 2 miles northeast of Eagle Grove School, has a profile as follows:

- Horizon A₁. From 0 to 1 inch, dark-gray sandy loam which contains a large quantity of partly disintegrated organic matter and many roots.
- Horizon A₂. From 1 to 12 inches, pale-yellow mellow and friable light sandy loam.
- Horizon B₁. From 12 to 18 inches, yellow brittle friable clay which is pale yellow when dry. The material breaks into irregular lumps which readily crumble into a fine granular mass. The dry lumps are readily crushed.
- Horizon B₂. From 28 to 44 inches, streaked light-red, gray, and yellow sandy clay which is brittle but friable and breaks into irregular lumps that can be crushed with moderate difficulty. Dry lumps can be crushed only with considerable pressure.
- Horizon C. From 44 to 54+ inches, finely mottled reddish-yellow and yellow very friable material which consists of disintegrated granite containing a conspicuous quantity of mica. Dry lumps are easily pulverized.

In Table 4 are given the results of mechanical analyses of samples of the surface soil, subsurface soil, and several layers of the subsoil of Durham sandy loam.

TABLE 4.—*Mechanical analyses of Durham sandy loam*

Number	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		<i>Per cent</i>						
259101	Surface soil, 0 to 1 inch.....	14 2	25 4	13 2	15 5	6 9	14 1	10 6
259102	Subsurface soil, 1 to 12 inches.....	13 9	23 1	13 5	15 4	5 9	15 7	12 6
259103	Subsoil, 12 to 28 inches.....	10 1	16 4	8 3	8 0	2 9	10 1	44 1
259104	Subsoil, 28 to 44 inches.....	7 5	9 7	3 8	4 4	2 5	13 7	58 2
259105	Subsoil, 44 to 64 inches.....	18 2	19 1	6 5	9 5	6 0	11 6	29 2

The soils of the Appling series are characterized by subsoils intermediate in color between the red subsoils of the Cecil and the yellow of the Durham. In structural characteristics they are similar to Cecil sandy loam.

A grassy area of Davidson clay loam, $2\frac{1}{4}$ miles northwest of Crossroads Church, has a profile as follows:

Horizon A. From 0 to 5 inches, dark reddish-brown clay loam which is nearly black when wet but is friable and mellow under dry field conditions, owing to granulation of the fine clay material. Dry lumps are readily pulverized. The material is tenacious and slightly plastic when moist. The dark color is caused largely by manganese dioxide. Heavy black small crystalline sand particles, which are sufficiently magnetic to affect a compass needle, accumulate in pockets and rain-washed spots on the surface.

Horizon B. From 5 to 60 inches, dark-red or maroon heavy brittle and smooth clay which breaks into irregular lumps and these in turn into a fine granular mass. Dry lumps can be crushed with moderate or extreme difficulty.

Horizon C. From 60 to 65+ inches, ocherous-yellow and red disintegrated and partly decomposed hornblende schist containing black streaks and stains, especially along breakage lines. The material is readily crushed when dry.

The dark color of the A horizon, which is caused by manganese dioxide, is a distinctive feature of this soil. It is the darkest color occurring in any of the well-drained soils of the piedmont plateau in the State. In the decomposition of the ferromanganese rocks from which the soil is derived, the manganese is readily oxidized into manganese dioxide, which is highly insoluble and accumulates in the A horizon, except that part carried downward by eluviation. Thus, there is a higher percentage of manganese in the surface soil than in the subsoil. On the other hand, the iron being more soluble is largely carried to the B horizon.

Worsham sandy loam is comparatively inextensive in Hart County, but it is important in that it represents the result of soil formation from granitic material under very poor drainage, the opposite or extreme conditions from those under which the Cecil soils have developed.

Wickham sandy loam is the only member of the Wickham series in Hart County. It has a reddish-brown sandy loam A horizon and a friable red or brownish-red sandy clay B horizon, in which small black specks and small soft concretions are common. The C horizon is lighter in color and texture than the B horizon.

The first-bottom soils are represented by Congaree fine sandy loam and meadow (Congaree material). The Congaree soils are brown, and they carry a conspicuous quantity of small mica flakes, owing to the origin of the soils from piedmont material. Meadow (Congaree material) is so variable in color, texture, and structure that no type distinction can be assigned it.

The only other soil separation made in the county is steep broken land which includes slopes of any soil too steep for tillage. It is significant geologically in that where quartz-mica schist rock occurs at the top of the slope, granite and disintegrated granitic material occupy the bottoms of the valleys.

SUMMARY

Hart County is in the northeastern part of Georgia, in the piedmont plateau region. It comprises 261 square miles. The county consists of remnants of a high plateau, below which the tributaries of Savannah and Tugaloo Rivers have cut an intricate drainage system, and erosion has been and still is very active bordering the drainage channels.

The average annual precipitation is 47.82 inches. The summers are long and moderately hot, and the winters are short with occasional freezing periods of short duration. The length of the average frost-free season is 212 days.

Hartwell, the county seat, with a population of 2,048, is the principal local market and shipping point in the county. United States Highway No. 29 is paved across the county, and the other roads throughout the county are generally kept in good condition.

The Madison, Cecil, Davidson, and Wickham soils all have red subsoils and constitute about 80 per cent of the soils of the county. The Madison soils are the most extensive and are highly productive, being especially suitable for the general farming practiced in the piedmont plateau region. The Cecil soils are nearly as extensive as the Madison soils and are nearly as desirable for general farming. Davidson clay loam is the best alfalfa soil in the county, and it is also highly productive for all general crops. Wickham sandy loam and Congaree fine sandy loam are highly productive soils.

The Durham and Appling soils are the best bright-leaf tobacco soils in the county. The relief of these soils is very favorable, and they are used for the general farm crops.

Cotton occupies the largest crop acreage in the county, greater than that of all other crops combined. There is a recent tendency toward greater diversification of crops, following increased interest in livestock and poultry raising, in alfalfa production, and in sustenance crops. Corn ranks second in acreage. A fair quantity of wheat is grown, but it has proved to be an uncertain crop. Oats are grown mainly to be cut green for forage. Fruit crops of many kinds are grown for home use, but very little fruit is produced commercially.

Hart County is a strictly agricultural county. It is one of the most progressive and highly developed farming counties in the State. All the rural schools are consolidated. In 11 of them vocational training, including agriculture, is taught. Throughout the county there is an exceptional number of resident farmers who have received an education higher than that obtained in the local schools, and many have sent their children to higher educational institutions. The character of the residents is also indicated by the large number of well-kept rural churches, of which three are exceptionally beautiful buildings. A large active membership is enrolled.

Practically all the better agricultural land has been cleared, but at present there are unusual opportunities for prospective settlers, owing to the abandonment of many farms, which can be purchased at an extremely low price.

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