

UNITED STATES DEPARTMENT OF AGRICULTURE  
BUREAU OF CHEMISTRY AND SOILS  
In Cooperation with the Texas Agricultural Experiment Station

# SOIL SURVEY

## HENDERSON COUNTY, TEXAS

BY

H. W. HAWKER, Texas Agricultural Experiment Station, in Charge  
and R. E. DEVEREUX, United States Department  
of Agriculture



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UNITED STATES  
GOVERNMENT PRINTING OFFICE  
WASHINGTON

1929

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## SOIL SURVEY

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# SOIL SURVEY OF HENDERSON COUNTY, TEXAS

By H. W. HAWKER, Texas Agricultural Experiment Station, in Charge, and R. E. DEVEREUX, U. S. Department of Agriculture

## COUNTY SURVEYED

Henderson County is in east-central Texas. Athens, the county seat and principal city, is about 80 miles southeast of Dallas. The county is bounded on the east by Neches River and on the west by Trinity River. The northern and southern boundaries run approximately east and west, causing the county to be roughly rectangular in shape with a panhandle in the northwest corner formed by the northwesterly course taken by Trinity River before it intercepts the north boundary line. The area included is 946 square miles, or 605,440 acres.

In eastern Texas the coastal plain, of which Henderson County is a part, consists of a dissected plain with a gentle southward slope. The dissection is general but in depth and completeness it varies from place to place. Areas of deepsand have been least thoroughly and deeply affected. There is a general slope toward the south, southwest, and east from the north-central part of the county. The relief ranges from almost level to hilly. The more nearly level areas lie west of a line drawn from the intersection of the north line of the county with the Texas & New Orleans Railroad south to Malakoff, thence in a southwesterly direction to the junction of Cedar Creek and Trinity River. The most severely dissected area is east of a line drawn from Brownsboro to Larue, on both sides of Flat Creek. The steep-sided, flat-topped ridges and isolated hills of the county are locally called mountains. The central or sand-hill region although rather deeply dissected presents, in the main, an undulating or moderately rolling appearance. The sand hills in the southern part of the county and the mountains in the eastern part are the most outstanding topographic features. They occur chiefly in those sections where the drainage is well developed, and near the larger streams, the bottoms of which are from 75 to 150 feet below the maximum elevation of the upland.

The slopes from the upland to the stream bottoms are generally steeper along the upper courses of the streams than in the more dissected country farther downstream, even though the latter areas

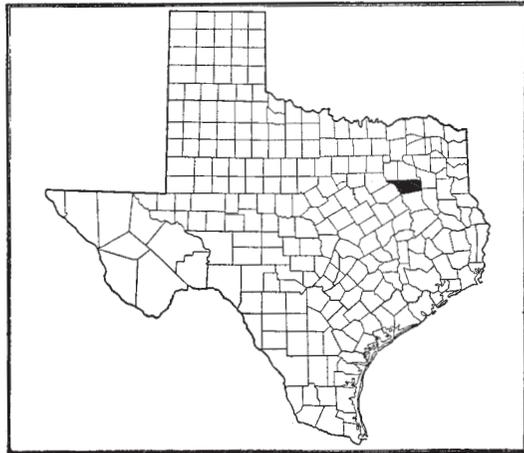


FIG. 41.—Sketch map showing location of Henderson County, Tex.

are, as a whole, more rolling. The divides between the streams are usually rather narrow and well rounded. In the sand hills (Norfolk fine sand), where the open soil favors liberal absorption of rain water and decreases surface run-off and erosion, the divides usually are wider, and the deep sandy soil is rolling. In the more nearly level country in the northwestern and western parts of the county, there is a larger proportion of poorly drained land, and the watersheds are not everywhere sharply defined; it is somewhat difficult, in places, to ascertain the direction of flow of the streams. In the more thoroughly dissected areas the steep-banked stream heads are locally called "dugouts." In fields adjacent to these "dugouts" or gullies, many of the gully heads wash back toward the head of the drainage way 100 or more feet during exceptionally heavy rains.

The bottom lands of Trinity and Neches Rivers, as well as those of the larger creeks, are flat and almost level, and usually have a slight slope toward the channel. Abandoned stream channels remain mainly as partly filled sloughs, shallow depressions, and lakes, in the wider bottoms. During floods, the flood plains of Trinity River and other streams are covered by backwater from which alluvial sediments are deposited at a rapid rate.

The greater part of the county lies within the east Texas timber belt, but the region west of a line from Trinidad to the intersection of the Texas & New Orleans Railroad and the north county line includes some prairies. According to reports, forests have encroached upon some of the land which was prairie at the time of the settlement of the county. The original growth on prairie areas consisted mainly of grasses and scattered mesquite trees, but some of the virgin areas are now covered with small oak, elm, and some mesquite. A line drawn north and south through Opelika and Larue roughly marks the western limit of the region where shortleaf pine grows, except for an outlying area of several square miles at Pine Grove School. Eastward from the area which was originally a prairie, the uplands are largely grown up with elm, hickory, and varieties of oak. East of Athens sweet gum is found both on the uplands and in the bottoms. The bottom lands support a growth of various deciduous hardwoods and softwoods, vines, and underbrush.

Elevations of stations along the railroads range from 298 to 538 feet above sea level. The first bottoms along Trinity River are about 25 feet lower than the terrace upon which Trinidad is located. The following elevations are for stations along the Cotton Belt (St. Louis Southwestern Railway) and the Texas & New Orleans Railroad: Murchison, 448 feet; Ash, 538 feet; Athens, 485 feet; Malakoff, 372 feet; Trinidad, 298 feet; Poynor 398 feet; Baxter, 477 feet; Eustace, 424 feet; Pauline, 377 feet; and Mabank, 389 feet.

The earliest settlers in Henderson County probably made their way up Trinity River, as the first settlements were near this stream. Buffalo is said to have been one of the first, if not the first settlement, and was the county seat for a few years after the county was formed from parts of Houston and Nacogdoches Counties in 1846. A settlement near Crossroads, known as Science Hill, was made about 1850. A college was established here, and it is said to have been one of the early educational centers of the State. Only its site, as

well as that of Buffalo, remains. A party of Norwegians settled near Brownsboro in 1851, and Athens was designated the county seat in 1854. After this time settlement increased rapidly. The early settlers were mostly plantation owners and slaveholders. The population of the county in 1859 was 4,412, of which 827 were slaves. In 1880 the population of the county was 9,735, of which 21 per cent were colored. The census reports show a steady increase so that in 1920 the total population was 28,327, of which 11.2 per cent or 3,176 were classed as urban. The density of the rural population at that time was 26.6 persons to the square mile.

Athens, the county seat, is the largest town and the principal trading point in the county. In 1920 its population was 3,176. Chandler, with a population of 630, is in the northeastern part of the county, and Malakoff, with 310 inhabitants, is between Athens and Trinity River. Trinidad, Wofford, Ash, Murchison, Opelika, and Brownsboro are trading points on the St. Louis Southwestern Railway; and Pauline, Eustace, Pickens, Baxter, Larue, and Poynor are situated along the Texas & New Orleans Railroad. Aley, Tool, Payne Springs, Crossroads, Fincastle, and Leagueville are inland trading points. Most of these towns have one or more cotton gins, and a compress and cottonseed-oil mill are located at Athens.

The westward extension of what is now the St. Louis Southwestern (Cotton Belt) Railway, reached Athens in 1880 and gave the county its first railroad shipping point. The Texas & New Orleans Railroad, constructed in 1900, established connections with Dallas and Beaumont. Prior to the construction of the railways, Trinity River played an important part in the transportation of products exported from the county. Overland transportation was by ox teams, Shreveport and Houston being the principal trading points and terminals for overland freight.

Good schools are located in the larger towns and at convenient points throughout the rural communities. Telephone service and rural mail delivery serve much of the county. The county has a small mileage of hard-surfaced roads and some of sand-clay material. Most of the roads are graded or ungraded dirt roads, which are maintained in only fair condition.

Dallas, Fort Worth, Beaumont, and Houston are the principal markets for the farm products of the county. Livestock is shipped almost entirely to Fort Worth.

#### CLIMATE

No Weather Bureau station is maintained in Henderson County. The records of the station at Palestine, in Anderson County, will be found to represent fairly accurately the conditions over most of Henderson County, and those of Corsicana, in Navarro County, will be found representative for the northwest extension. The former station is in the timber belt, at an elevation similar to that of the greater part of Henderson County, and the station at Corsicana is in the prairie region to which conditions in the panhandle of Henderson County are similar. It must be borne in mind that there is a gradual decrease in precipitation westward from eastern Texas toward the prairie region.

The data from the Palestine station, according to observations made during 41 years, give the mean annual precipitation at that point as 43.02 inches, with a maximum of 61.19 inches in 1892 and a minimum of 23.98 inches in 1909. The average annual snowfall of 2 inches occurs chiefly as light snows that melt within 24 hours. The heaviest rainfall occurs during the spring, and when favorably distributed is generally sufficient to insure crop growth. The high evaporation during the warm months necessitates mulching and other methods of conserving moisture for crop needs, especially when the rainfall during the growing months is below the average. The fall weather is generally favorable for harvesting crops.

A comparison of the precipitation records at Corsicana for a period of 34 years shows that the average annual rainfall is 36.22 inches, approximately 7 inches less than at Palestine. The rainfall at Corsicana for the wettest year on record, 1877, was 53.89 inches, and for the driest year, 1901, was 23.49 inches.

The mean annual temperature at Corsicana is 65.8° F., the actual range between the absolute minimum and the absolute maximum being from -7° to 113°. Warm weather commences in March and continues until the end of October. The period from November to February is generally not unpleasant, except during the sudden weather changes, locally termed "northers," when the mercury often falls 30° or more in a few hours. Northers may be accompanied by cold rains, and occasionally, during December and January, by light snows. The pronounced extremes of temperature occurring during these northers or during the few days immediately following, may cause damage to winter crops and fruit trees. The normal temperature is usually resumed within 72 hours after their occurrence. These northers sometimes prevail as far south as the Gulf of Mexico.

A southerly breeze from the Gulf of Mexico tempers the excessive heat during the greater part of the summer, but dry northerly winds which raise the normal temperature and the rate of evaporation sometimes occur during this period. These may seriously affect growing crops.

The average dates of the last killing frost, as shown by the records at Palestine and Corsicana, are March 8 and March 15, respectively, and the dates of the first killing frost are November 14 and November 15, respectively. This gives an average frost-free season of about 244 days, which is more than sufficient for the needs of all crops grown. The Palestine records show that a killing frost has occurred as late as April 5, while the earliest recorded killing frost was on October 20. The latest killing frost recorded at Corsicana was on May 1, and the earliest was on October 22. Early planting in the protected forested belt is considered safer than on the prairie lands. The lower elevation of the bottom lands makes them more susceptible to killing frosts later in spring and earlier in fall than are the uplands.

The tables following show the normal monthly, seasonal, and annual temperature and precipitation as recorded by the Weather Bureau stations at Palestine, Anderson County, and Corsicana, Navarro County.

*Normal monthly, seasonal, and annual temperature and precipitation at Palestine, Anderson County*

[Elevation, 510 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1909)	Total amount for the wettest year (1892)	Snow, average depth
	° F.	° F.	° F.	Inches	Inches	Inches	Inches
December.....	49.4	81	8	3.67	2.40	11.04	0.5
January.....	46.5	84	0	3.87	.19	3.93	.8
February.....	50.9	88	-6	3.39	3.56	5.05	.6
Winter.....	48.9	88	-6	10.93	6.15	20.02	1.9
March.....	58.5	90	20	3.47	2.27	4.70	.1
April.....	65.9	92	32	4.08	2.51	4.80	.0
May.....	72.5	96	39	4.89	.98	4.18	.0
Spring.....	65.7	96	20	12.44	5.76	13.68	.1
June.....	78.4	101	48	4.00	3.36	9.77	.0
July.....	81.5	105	60	3.00	.80	1.60	.0
August.....	80.5	108	54	2.22	2.11	3.41	.0
Summer.....	80.1	108	48	9.22	6.27	14.78	.0
September.....	74.7	104	43	3.20	1.55	.98	.0
October.....	66.2	97	27	3.60	2.74	5.74	.0
November.....	56.9	87	20	3.63	1.51	5.99	Trace.
Fall.....	65.9	104	20	10.43	5.80	12.71	Trace.
Year.....	65.2	108	-6	43.02	23.98	61.19	2.0

*Normal monthly, seasonal, and annual temperature and precipitation at Corsicana, Navarro County*

[Elevation, 445 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1901)	Total amount for the wettest year (1877)	Snow, average depth
	° F.	° F.	° F.	Inches	Inches	Inches	Inches
December.....	48.1	85	8	3.15	1.06	3.96	0.2
January.....	46.9	88	2	2.31	.28	1.06	.8
February.....	49.5	89	-7	2.38	2.63	6.84	.5
Winter.....	48.1	89	-7	7.84	3.97	11.86	1.5
March.....	58.0	95	18	2.73	2.93	4.81	Trace.
April.....	66.2	96	30	4.11	1.14	6.01	.0
May.....	73.2	98	31	5.01	5.41	4.75	.0
Spring.....	65.8	98	18	11.85	9.48	15.57	Trace.
June.....	80.6	107	41	3.12	.15	4.76	.0
July.....	84.0	113	54	2.50	.51	3.50	.0
August.....	83.4	112	50	2.33	1.01	2.85	.0
Summer.....	82.7	113	41	7.95	1.67	11.11	.0
September.....	77.2	104	42	2.57	4.02	2.33	.0
October.....	67.1	98	27	2.72	1.58	6.81	.0
November.....	56.0	88	18	3.29	2.77	6.21	Trace.
Fall.....	66.8	104	18	8.58	8.37	15.35	Trace.
Year.....	65.8	113	-7	36.22	23.49	53.89	1.5

## AGRICULTURE

The earliest definite land grant on record for Henderson County was made in 1835, although there were some settlements prior to that time. These grants were made by the State of Coahuila and Texas and by the Texas Republic, after its organization, to encourage settlement and agricultural development. The larger grants were usually given to colonizers as payment for bringing in a number of colonists, and the early colonists themselves were given agricultural and pasture lands. These colonists came mainly from the South-eastern States and from Kentucky and Tennessee.

Early agriculture in Henderson County was influenced by the kind of agriculture practiced in the part of the United States from which these settlers came, by the fact that the land was forested, and by the remoteness from markets for products which were not consumed or utilized by the settlers and inhabitants of the small towns of the region. Agriculture at that time consisted of growing corn, wheat, oats, and some cotton, with the incidental raising of hogs, cattle, and sheep for subsistence. Even in the earliest days, cotton was the chief cash crop. It was transported to market by boat down Trinity River or overland by ox carts. Cotton is still the chief cash crop, but in recent years peaches, small fruits such as strawberries, blackberries, and dewberries, and truck crops such as watermelons, tomatoes, and cucumbers have added considerable income. Cattle raising is restricted by available pasturage. It is carried on only by those landowners who have large areas of upland suitable for grazing or a large acreage of bottom land where overflow makes the growing of crops impractical. The area of forests supplying mast and the quantities of mast available control to a large extent the number of hogs raised. At present the raising of cattle and hogs is secondary to the production of farm and special crops.

According to the census reports the acreage devoted to cotton since 1880 has equaled or exceeded the acreage devoted to all other crops. In 1919, out of a total cultivated acreage of about 160,000 acres cotton was grown on 88,105 acres, an acreage almost five times as great as that of 1880. The average acre production of cotton for the years 1879, 1889, and 1899 was, respectively, 0.32, 0.29, and 0.39 bale, and that for the years 1909 and 1919 was, respectively, 0.25 and 0.23 bale.

The range of acre yield for the county in an average year, according to the best information available, is from one-sixth to 1 bale. Smaller yields may be ascribed chiefly to inferior soil, inadequate rainfall, unseasonable weather, and the ravages of the boll weevil and other insects, although unskillful and inadequate cultivation has been a contributing factor.

Mebane and Kasch are the two most popular varieties of cotton, but other varieties such as Lone Star, Half-and-Half, and Rowden Big Boll are grown, and recently Acala has been introduced.

On the uplands which were originally forested, some fields are fertilized for cotton, but on the prairie soils and bottom lands fertilizers are rarely used. The applications of fertilizer vary from 100 to 200 pounds to the acre of mixtures analyzing from 8-2-2<sup>1</sup> to 12-4-4, and

<sup>1</sup> Percentage respectively of phosphoric acid, nitrogen, and potash.

in some cases home mixtures, consisting of equal amounts of cottonseed meal and 16 per cent acid phosphate, are used.

An effort to forestall damage from the boll weevil and from the dry weather in late summer has resulted in earlier planting during the past few years. When seasonal conditions permit, cotton is planted between the 1st and 10th of March, though it may be planted as late as June 1 and still mature fully. Picking begins in August, as a rule, and continues until all the cotton is harvested. The greatest damage by the boll weevil is done in wet years. Many farmers claim that the damage is not so severe now as it was shortly after the advent of this pest. Some trouble is experienced with cotton root rot on the prairie soils, the cotton dying in small and large circular areas about the time the first bolls are ready to mature and sometimes before. Where cotton succeeds itself the damaged area seems to increase. The damage is greatest during wet years.

Although the acreage used for the production of corn was tripled during the period from 1880 to 1920 and was increased by more than 10,000 acres in the decade preceding 1919, the yield is still insufficient for the needs of the county. The records for the years 1879, 1889, 1899, 1909, and 1919 show that the annual average yield of corn ranges from 13.7 to 18.7 bushels to the acre. The yield depends to a great extent on the amount of rainfall from July to September and the crop is frequently severely damaged by lack of rainfall during this period. Ferguson Yellow Dent is probably the most popular variety, but some Chisholm, Tuxpan, and some unknown white varieties were also observed in this area. Much of the corn has been grown in one locality for so long and has suffered crossing so often that it has lost its identity. Quick-maturing varieties are grown in the bottoms as the danger of overflow precludes planting until from the first to the middle of June. Of the "June corn" varieties, Surcropper is most used.

The planting of cowpeas with corn is a practice which is coming more and more into favor with the best farmers of the county. The cowpeas are generally planted at the time of the last cultivation, in alternate rows or every third row, or between alternate plants in the same row. Where the alternate or third row is used for this crop the yield of corn is said to be nearly equal to that from fields planted with corn alone. In addition, the early peas are generally picked and those remaining, together with the vines, furnish excellent fall grazing for cattle. The residue is plowed under to enrich the soil. Corn is rarely fertilized, but is generally planted after cotton which has been fertilized the year before.

The oat crop is not of great importance, the maximum acreage being 3,603 acres, though this probably does not include the large acreage of oats planted in the fall as a cover crop and for winter grazing. The yields range from about 10 to 50 bushels to the acre. Red Rustproof (Texas Red) is the leading variety. The total production of oats in Henderson County falls far short of the demand, and large quantities are shipped in.

Since 1900 cowpeas<sup>2</sup> have become a crop of some importance. In 1919, 1,837 acres were planted to this crop. This probably does

<sup>1</sup> MORSE, W. J. COWPEAS: CULTURE AND VARIETIES. U. S. Dept. Agr. Farmers' Bul. 1148, 26 p. illus. Sept. 1920.

<sup>2</sup> TRACY, S. M. FORAGE FOR THE COTTON BELT. U. S. Dept. Agr. Farmers' Bul. 1125, 63 p., illus. May, 1920.

not include the acreage of cowpeas planted with corn. Most farmers pick the early-maturing peas for seed and market. The later crop and the vines are usually cut for hay or are grazed. The yield ranges from 8 to 15 bushels to the acre, but some yields as high as 25 bushels were reported. Whippoorwill, or Speckled, seems to be the favorite variety, but Blackeye, Clay, Iron, Brabham, and Red Ripper are also grown. Sugar Crowder and Blackeye are the common table peas seen in most gardens.

Velvet beans were recently introduced, but as yet the acreage is small. They are planted with corn and are used mainly for grazing in the fall and winter.

In 1919, 1,376 acres of peanuts were grown. The total yield was 24,818 bushels. White Spanish is the popular variety. The vines are generally pulled with the nuts attached and are stacked loose in cocks and stored in sheds after drying. Some farmers cut the vines for hay and gather the nuts or pasture the fields, turning hogs in to forage on the nuts after the cattle have eaten the vines.

At present wheat and rye are of little importance in Henderson County. Rye is used chiefly as a winter-cover and grazing crop, and several hundred acres are generally planted during the fall for this purpose. Some farmers prefer rye to oats for winter and early spring pasturage, especially on the lighter soils. A small acreage is devoted to feterita, darso, hegari, milo, and kafir, and these crops are growing more and more popular as, under droughty conditions, they can be grown with greater success than corn. Hegari is probably the most common of the grain sorghums.

A little sugar cane or ribbon cane, for brown sugar and sirup, was grown by nearly every early settler who had on his farm a strip of bottom land. In the absence of good bottom-land soil, sorgo (sweet sorghum) was grown instead. The chief variety of sorgo is the Amber, but there is some Early Orange. Honey Drip is the principal variety of ribbon cane grown for sirup. Yields vary with the season, the drier seasons curtailing the production. Sorgo yields of sirup range from 60 to 150 gallons to the acre; ribbon cane yields from 125 to 250 gallons. The land used in the production of sorgo for sirup is generally fertilized with from 100 to 250 pounds of a mixture analyzing about 10-3-3, but ribbon cane, being planted on the more productive bottom-land soils, is rarely fertilized.

The chief native grasses are Bermuda grass, carpet grass, wild barley, Torrey's beard grass, wire grass, wild millet, tallow weed, rescue grass, and broom sedge. Bermuda grass and carpet grass are relied upon mainly for pasturage. The former is occasionally cut for hay on the better-drained bottom lands. As many as three cuttings a season are obtainable and the yields range from one-half to three-fourths ton to the acre for each cutting. It is estimated that an acre of good Bermuda grass pasture will support one or two head of cattle in ordinary seasons, and as many as three head when rainfall is abundant and well distributed. Johnson grass is a pest in both upland and bottom-land fields. A few meadows of this grass yield from one-half to 1 ton of hay to the acre for each cutting, and several cuttings are obtainable in favorable seasons. Sudan grass does well on the better-drained sandy bottom lands. Two or three cuttings are made annually, yielding from three-fourths to 1 ton to

the acre for each cutting. The acreage of this crop could well be increased.<sup>3</sup>

Very little alfalfa is grown. It does better on the land in the western part of the county, where some lime is present in the subsoil or substratum of most of the soils, than in other parts. The crop on these heavy soils is sometimes damaged by cracking in hot dry weather, and by drought. Two, and in favorable seasons, three cuttings of alfalfa are obtained, with yields ranging from one-half to three-fourths ton to the acre for each cutting.

Sorghum is planted both for pasturage and for hay, small acreages being grown on many farms. When grown for hay two cuttings a year are sometimes obtained, if there are good rains. Usually only one cutting is made, the second growth being used for fall pasturage. The cuttings yield from three-fourths to 1 ton to the acre. Redtop is the principal variety grown.

In 1919, according to the census, 10,133 acres were devoted to hay of all kinds. The yield was 9,897 tons, an average of nearly 1 ton to the acre. The normal production of hay is insufficient for the needs of the county, and a large quantity is annually imported to carry work animals through the summer season. In recent years the movement to make the farmer more self-supporting has caused a noticeable increase in the acreage of feed crops grown.

Special crops of vegetables, fruits, and nuts yield a large revenue and are of considerable importance in the agriculture of Henderson County. Their value in 1919 was equal to more than one-half the value of all the cereals, and to one-sixth the value of the cotton crop. In 1923, peaches were the principal orchard fruit, and strawberries, blackberries, and dewberries the main small fruits. The principal vegetables grown for commercial purposes are tomatoes, cucumbers, sweet potatoes, and watermelons. Pecans constitute the most important nut crop. They are mostly of the native varieties found growing in the bottoms of the larger streams, but some small orchards of papershelled varieties are being established. The upland soils having friable subsoils, such as the deep phase of the Norfolk and Ruston fine sandy loams, are well suited to growing papershelled pecans. Some black walnut trees grow in the stream bottoms.

The growing of peaches on a commercial scale was begun about 1895 in the vicinity of Ash, but previous to this small orchards for home use were found on many farms. The industry reached its peak between 1909 and 1915. After that there was a decline, and in 1923 there were only a few large orchards in the county. The census of 1909 indicated that there were 520,287 trees in the county, and that of 1919 showed 181,609 bearing trees and 68,071 young trees. The greater part of the peach crop is shipped in carload lots to the larger cities. Elberta is the chief variety, but there are a few plantings of Mamie Ross, Belle of Georgia, and Indian Cling. The chief deterrent to the establishment of a successful and permanent peach industry in Henderson County is the climate. Ordinary winter damage due to low temperatures is uncommon, but in the latter part of February or the beginning of March there usually is a period of weather warm enough and long enough to cause the sap to rise

<sup>3</sup> TRACY, S. M. Op. cit. VINALL, H. M. SUDAN GRASS AS A FORAGE CROP. U. S. DEPT. AGR. FARMERS BUL. 605, 20 p., ILLUS. SEPT., 1914. YOUNGBLOOD, B. AND CONNER, A. B. SUDAN GRASS. TEX. AGR. EXPT. STA. BUL. 172. 28 p. ILLUS. JANUARY, 1915.

and the trees to bud and sometimes to bloom. After this, the temperature often approaches or reaches the freezing point, and the fruit buds are damaged to a greater or less extent.

A few pear, apple, and plum trees are found in most orchards. Their production is chiefly for home use, though some pears are sold in the local markets. Kieffer and LeConte, the blight-resisting varieties of pears, are the principal varieties grown. Figs and some Japanese and Chinese persimmons are also grown for home use. Thickets of wild plums are common along fence lines and in abandoned fields. Native persimmons grow in the stream bottoms and in abandoned fields on the uplands.

Strawberries are grown commercially in the vicinity of Chandler. In 1923 approximately 75 acres were devoted to this crop. This is a slight decrease from former years, brought about by marketing conditions. Klondike is the variety preferred because of its better shipping qualities. The acre yield ranges from 125 to 150 crates, though yields as high as 200 crates to the acre are reported. Well-drained, open-structured soils are used for the production of strawberries.

Blackberries<sup>4</sup> and dewberries grow wild over the greater part of the county and are found in home gardens, but it is only of late years that they have been grown on a commercial scale. It is estimated that at the time of the survey (1923) there were about 50 acres of these berries in the county. The yield ranges from 150 to 200 crates to the acre. The Austin dewberry is the chief variety grown, and the Lawton blackberry seems to be preferred on account of better shipping qualities. Some McDonald and Dallas blackberries were also seen.

Cucumbers, tomatoes, watermelons, and sweet potatoes are the most important truck crops. Cucumbers are of more importance in the eastern and central parts of the county, tomatoes in the southeastern part, and watermelons in the central and northeastern parts. Sweet potatoes are grown generally over the county.

The Burrell Special cucumber is the variety chiefly grown. Cucumbers not more than 3½ inches in length are preferred for the pickling industry, and the market price for this size is nearly three times as much as for the larger ones. Cucumbers were grown on 510 acres in 1923. They yielded an average of 3,000 pounds to the acre. The entire crop is grown under contract, the seed being furnished at cost by the contractor. Salting stations are maintained at Poynor, Baxter, Athens, Brownsboro, Chandler, Malakoff, and Trinidad. The salted product is shipped mainly to Houston for commercial packing.

The acreage devoted to tomatoes<sup>5</sup> is between 100 and 200 acres. The upland soils with deep friable subsoils are generally used for this crop, but colluvial slopes to stream bottoms and high, well-drained bottom lands are sometimes used. Three hundred crates, containing from 20 to 24 pounds to the crate, constitute an average acre yield. The crop is ready for market between May 20 and June 10, depending on the season. Detroit is the chief variety.

<sup>4</sup> DARROW, GEORGE M. BLACKBERRY CULTURE. U. S. Dept. Agr. Farmer's Bul. 643, 13 p., illus. January, 1915.

<sup>5</sup> THOMPSON, H. C. TOMATO GROWING IN THE SOUTH. U. S. Dept. Agr. Farmer's Bul. 642, 13 p., illus. February, 1915.

Some Acme and Gulf State, which are generally earlier than the Detroit variety, are also grown.

Tom Watson is the watermelon preferred for shipping purposes, though the Irish Gray is becoming more popular in the northeastern part of the county. The melons are sent by rail and auto truck to outside markets. The yield and price obtained vary considerably with the season. Melons weighing from 25 to 30 pounds are preferred for shipment. Their cultivation is profitable in years when markets are good. The Rocky Ford variety of cantaloupes does well in Henderson County, especially on the lighter soils, but they are grown only for the local markets.

Sweet potatoes and yams are grown on many farms, the local markets consuming those in excess of home needs. Porto Rico yam and Nancy Hall sweet potato are the chief varieties. They are used to some extent for feeding livestock. In 1919, 850 acres yielded 87,508 bushels, or slightly more than 100 bushels to the acre.

Potatoes are grown only for home use. Two crops are obtained in a season if there is sufficient moisture in the ground in the fall of the year to warrant the planting of a fall crop. Irish Cobbler, White Triumph, Red Triumph, and Greeley are the chief varieties grown. Owing to climatic conditions the keeping qualities of potatoes are impaired. The 1919 census shows 119 acres planted to potatoes, with a yield of 8,398 bushels, or slightly less than 75 bushels to the acre. This probably does not include the small patches grown in most gardens.

The Red Poll, a dual purpose breed of cattle, is the predominating beef breed in Henderson County, both among the purebred and grade stock. Hereford, Angus, and Shorthorn are less popular beef breeds. The Jersey is the most popular dairy breed, with Holstein second. Dairying is carried on in the vicinity of Athens and Chandler to supply local needs, and considerable cream is shipped to Dallas, Houston, and Fort Worth from cream stations at Athens, Eustace, Malakoff, and Murchison. The census reports 7,097 head of beef cattle and 12,377 head of dairy cattle in Henderson County in 1919.

The census also reports 31,807 hogs, mostly grade animals, in the county in 1919. There are, however, a large number of purebred hogs, including many good sires. Big-boned Poland China is probably the most popular breed, Duroc-Jersey is second, and Berkshire and Hampshire vie for third place.

Only a few sheep and goats are kept in the county. They are valuable chiefly for clearing up the undergrowth in forested areas but are used to some extent for mutton and chevon.

The poultry industry has received considerable local encouragement in late years. Several large flocks of chickens of good strains, chiefly White Leghorn, are kept. Poultry and eggs are shipped to Dallas and Fort Worth.

The existing system of credits and renting tends to restrict crop production largely to cotton and corn, which occupy from 75 to 90 per cent of the tilled lands on many farms regardless of soil conditions. Cotton is generally grown for two or three years, followed by corn one year, then by cotton. On the stronger prairie lands cotton is often grown from 6 to 10 years in succession. Both cotton and corn are clean-cultivated crops, and, when plowed under, return to the soil only a small amount of organic matter, so that the productivity of

the fields is decreased and the soil must sooner or later require artificial fertilization to secure profitable yields. This is especially true of the more sandy soils. These lands are sometimes permitted to lie fallow for a season or two, and the weed growth is plowed under to increase the supply of organic matter.

A suitable rotation, including a legume to add nitrogen, would do away with the necessity of fields lying idle. This fact is realized by most owners and renters of land, but the average renter will not expend labor on a crop which may not be of direct profit to him. Therefore, rotation is rarely practiced on rented lands. The best farmers, however, practice rotation to as great an extent as is permitted by the crops suited to the soils and conditions in the county.

An increase in the acreage devoted to cowpeas can not be too strongly recommended. Their use in a rotation following either cotton or corn, or in combination with corn, is especially urged. As most of the sandy soils are low in organic matter the plowing under of a green crop of cowpeas would lessen this deficiency, would make the soils more retentive of moisture, less liable to blowing during the spring, less in need of commercial fertilizers, and increasingly and lastingly productive at less cost than any other method.

The more progressive farmers of the county tend to utilize their lands in the production of crops best suited to their particular soils, or for the purposes best suited to topographic conditions. The mountains in the eastern part of the county, whose soil is mapped as stony Kirvin fine sandy loam, the sand hills in the south-central part of the county, and the very rolling areas adjacent to the stream bottoms are used almost entirely for pasture. The first-bottom lands, where subject to frequent overflows, are largely disregarded for the production of farm crops and are utilized only for pasture for cattle and hogs. The more level areas are utilized for general farming, the comparatively level prairie lands in the western and northwestern parts of the county having a higher proportion of farmed land than any other locality.

A great deal of damage is done annually by gullying during heavy rains on both cultivated and pasture lands, but more especially on the former. In recent years many slopes have been terraced, but many more should be so protected. The farms operated by renters suffer most from soil washing.

According to the census report, the 4,423 farms in the county in 1920 included 63 per cent of its land area of 605,440 acres. The average size of the farms was 86.3 acres, of which 46.9 acres were improved. The average land value in 1920 was \$32.24 an acre. This increase of \$22.74 an acre over the average value in 1910 is attributed largely to the abnormal rise in land values after the war. The average value of land at this time (1923) is below that for 1920.

Of the 2,178 tenants on farms in Henderson County in 1919, 1,639 were share tenants, 36 paid cash rent, and the remaining 503 were classed as croppers, that is, share tenants who do not furnish either their own equipment, seed, or livestock. In the latter case, the landlord receives half of all products grown on the farm. Share tenants pay one-fourth of the cotton and one-third of all other products grown as rentals. Pasture lands are generally rented for cash.

Farm labor in Henderson County is very scarce. Most of the laborers are colored, though in some sections white laborers are

employed. In 1923, when hired for the season, farm hands were paid from \$20 to \$40 a month, sometimes with board; day laborers from \$1 to \$1.50 a day. Cotton pickers receive from \$1 to \$1.50 a hundred pounds in a normal season, and more if the crop is short. Berry pickers average 1½ cents a pint.

The following figures compiled from the census reports show the value of all agricultural products for the season of 1919:

*Value of all agricultural products for 1919*

Cereals.....	\$1, 448, 505
Other grains and seeds.....	106, 017
Hay and forage.....	209, 137
Vegetables.....	432, 421
Fruits and nuts.....	231, 527
All other crops (mostly cotton).....	3, 966, 055
Dairy products, excluding those used at home.....	183, 635
Poultry and eggs.....	264, 804
Wool, mohair, and goat hair.....	535
	<hr/>
	6, 842, 636

The average expenditure per farm in 1919 for fertilizer was \$48.30.

#### SOILS

The soils of Henderson County belong to the Susquehanna, Lufkin, Ruston, Bowie, Norfolk, Kirvin, Greenville, Portsmouth, Wilson, Crockett, Houston, Sumter, Bienville, Cahaba, Leaf, Irving, Kalmia, Bell, Trinity, Johnston, Ochlockonee, and Bibb series. Of these 22 series, the first 12 are soils occurring on the uplands, the next 6 are stream-terrace soils, and the remaining 4 are first-bottom soils. In addition to these peat is mapped as miscellaneous material. Of the upland soils the Wilson, Crockett, Houston, and Sumter soils were developed under prairie or grass-covered conditions and occur in the western and northwestern parts of the county; the others were developed under forest conditions.

The upland soils occur roughly within four belts extending north and south across the county. Describing from west to east, the first belt is composed of a group of soils, developed under prairie conditions, which have compact, heavy, and in places calcareous subsoils. These soils lie west of a line from Trinidad to the southeastern corner of Kaufman County. Between this line and a north and south line drawn about 3 miles west of Athens is the second belt comprising what is locally termed "tight" or "post-oak" lands, in which the soils, developed under forest growth, have heavy, compact, noncalcareous subsoils. East of this region extending roughly to a line drawn through Brownsboro and a point 2 miles east of Larue, is a third belt in which most of the soils are composed of fine sand to a depth of more than 3 feet, and in which the remainder are largely underlain by friable subsoils. To the east of this area, and continuing to Neches River, the fourth belt of upland soils includes forested areas of nearly every type of soil of the county and also the conspicuous hill development of the Kirvin fine sandy loam of the mountains. However, small areas of soils with friable subsoils occur in the region of heavy subsoils, and vice versa.

The alluvial soils of the county fall into two distinct groups. The members of the Trinity, Ochlockonee, Johnston, and Bibb soil series occur at levels subject to overflow. The members of the Bienville, Cahaba, Leaf, Irving, Kalmia, and Bell soil series lie above overflow on the first and second bottoms and on the terraces. The elevation of the terraces above stream overflow varies from just above the high-water level to 25 or more feet above the highest overflows.

The Susquehanna soils are characterized by grayish-brown topsoils underlain by heavy subsoils, mottled red and yellow, or red, yellow and gray. The Lufkin soils, on account of their poorer drainage, have not reached the stage of oxidation of the Susquehanna soils, and the heavy subsoils are gray or dark gray. The Kirvin soils represent an advanced stage in the weathering of Susquehanna materials. They show more brownish-red color, less mottling, and somewhat greater friability in the subsoil and contain more red iron oxide material.

The subsoils of the Ruston, Bowie, Greenville, and Norfolk soils are friable, probably partly because of somewhat better drainage and aeration but chiefly because they contain more sand and less clay in the parent material. The members of the Ruston series have grayish-brown or brown topsoils, underlain by yellowish-red or light-red friable subsoils. The topsoils of the Norfolk soils are predominantly grayish brown, and the friable subsoils are yellow. The Bowie soils apparently have reached a stage of oxidation between that of the Ruston and Norfolk soils, for the grayish-brown topsoils are underlain by friable, yellow subsoils mottled and splotched with light red or red. The Greenville soils have reached an advanced stage of oxidation. They have reddish-brown or light brownish-red topsoils underlain by deep-red subsoils.

The Portsmouth soils, as found in Henderson County, consist of small, very poorly drained areas of soils, similar to the Norfolk soils, except that they contain enough organic matter to impart to the soil a dark-gray color, and the poor drainage causes the subsoil to have a dull-gray color.

In the prairie region the Crockett soils have been most extensively developed. They have brown topsoils over subsoils of dull red or yellow, or of mottled dull red, yellow, and gray. The members of the Wilson series have topsoils and subsoils ranging from gray to nearly black. In the Houston soils the black topsoils are underlain by calcareous heavy clay varying in color from olive brown to black. The Sumter soils occur on slopes. The topsoil is generally brown and the subsoil yellowish brown or light brown. The Crockett soils may be calcareous at a depth of 3 feet and are generally calcareous within a depth of 5 feet below the surface; the Wilson soils are not generally calcareous within 3 feet of the surface, and may not be calcareous within 6 feet. The subsoils of the Sumter soils are generally calcareous and may contain large quantities of lime concretions. The Houston soils are generally calcareous throughout.

Of the terrace soils, the Bienville, Kalmia, and Cahaba soils have friable subsoils. Bienville fine sand has a subsoil of yellowish-brown or light-brown fine sand. The Kalmia soils have yellow or lemon-yellow subsoils, and in the Cahaba soils this layer is yellowish red or light red. The topsoils in these three groups are not dissimilar,

being chiefly grayish brown or brown. In the Bienville soils this material is probably more nearly brown.

The soils of the Leaf, Bell, and Irving series have heavy subsoils. The Leaf soils have mottled red, yellow, and gray subsoils similar to those of the Susquehanna soils of the uplands. The subsoils of the Irving soils are light gray or gray and are very much like those of the Lufkin. The Bell soils have calcareous subsoils similar to those of Houston soils. The material ranges from olive brown to dark gray and black in color. The topsoils of the Leaf soils are grayish brown; those of the Irving soils may be either light gray or gray; and those of the Bell soils are black. The drainage of the Leaf soils is superior to that of either the Irving or the Bell soils.

Four series of soils are found in the first bottoms. The Trinity soils occur in the Trinity River bottoms and in the bottoms of creeks which traverse the region of calcareous soils in the northern part of Henderson County. They have black topsoils and heavy subsoils ranging in color from drab to black and are generally calcareous from the surface downward. The Johnston soils differ from the Trinity mainly in that they are not calcareous within a depth of 3 feet and that the heavy subsoil ranges from gray to black in color. The Ochlockonee soils, which have grayish-brown or brown topsoils and subsoils, are better drained than the Bibb soils which have gray or grayish-brown topsoils and subsoils that may be gray, grayish brown, or mottled gray and brown. The soils of the last two series are composed of sediments derived from the sandy East-Texas timber belt. Along the smaller streams the material is of local origin, but along Neches River it consists largely of material derived from the uplands farther upstream and deposited in its present position during periods of overflow. The material composing the Johnston soils is derived from noncalcareous heavy material occurring north of Henderson County. In it is some admixture of calcareous material which has lost its lime through leaching or other weathering agencies.

The most abundant component material of the soils of the county is quartz sand, as is shown by the extensive occurrence of deep sandy soils.

In some places a noticeable feature of the surface is the occurrence of round or oval dome-shaped mounds from 1 to 3 feet in height and consisting, generally, of fine sand throughout. These mounds occur in different parts of the county, but are most conspicuous on the uplands in the vicinity of Tool and Aley. In some places, they are widely scattered; in others they touch or merge. Their occurrence is not limited to any particular soil, nor to soils of any particular age, for though they occur principally on the uplands they are also found on the terraces and on several small areas on the high first bottoms.

In the following pages of this report the soils of Henderson County are described in detail; the accompanying map shows their distribution, and the following table gives their actual and proportionate extent.

*Acree and proportionate extent of the soils mapped in Henderson County, Tex.*

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Susquehanna fine sandy loam.....	149,248	27.9	Wilson clay.....	3,968	0.7
Deep phase.....	14,848		Cahaba fine sandy loam.....	3,264	.5
Mound phase.....	4,032		Houston black clay.....	1,280	.2
Crockett fine sandy loam.....	20,672	3.6	Bienville fine sand.....	3,200	.5
Mound phase.....	1,088		Kalmia fine sandy loam.....	576	.1
Crockett clay loam.....	512	.1	Kalmia fine sand.....	2,048	.3
Norfolk fine sandy loam.....	2,432	7.0	Leaf fine sandy loam.....	2,496	.7
Deep phase.....	40,192		Mound phase.....	1,856	
Norfolk fine sand.....	159,936	27.2	Lufkin very fine sandy loam.....	1,984	.3
Flat phase.....	4,992		Lufkin fine sandy loam.....	3,264	.5
Norfolk sand.....	1,152	.2	Lufkin fine sand.....	384	.1
Ruston fine sandy loam.....	12,160	4.9	Johnston clay.....	8,640	1.4
Deep phase.....	17,344		Bowie fine sandy loam.....	1,472	.3
Ruston fine sand.....	320	.1	Bell clay.....	576	.1
Greenville gravelly fine sandy loam.....	6,144	1.0	Bibb fine sandy loam.....	3,648	.6
Kirvin fine sandy loam.....	11,072	1.8	Bibb silty clay loam.....	1,472	.3
Kirvin gravelly fine sandy loam.....	4,800	.8	Irving fine sandy loam.....	768	.1
Ochlockonee fine sandy loam.....	63,744	10.5	Portsmouth fine sand.....	512	.1
Ochlockonee very fine sandy loam.....	3,264	.5	Sumter clay loam.....	896	.1
Ochlockonee silty clay loam.....	8,384	1.4	Peat.....	1,216	.2
Trinity clay.....	35,584	5.9	Total.....	605,440	

#### SUSQUEHANNA FINE SANDY LOAM

Susquehanna fine sandy loam has a brownish-gray or grayish-brown topsoil, ranging in thickness from 5 to 16 inches. This grades to a layer, 1 or 2 inches thick, of pale-yellow or grayish-yellow fine sand or loamy fine sand underlain by a heavy clay subsoil, mottled either red and yellow, or yellow, red, and gray. (Pl. 46, fig. 1.) This subsoil is very plastic when wet and hard and compact when dry. On exposure it breaks into clods about an inch in diameter. The substratum consists of gray or yellowish-gray heavy clay, loosely cemented sand, or laminated sand and clay which becomes very hard when exposed. In exceptionally well drained areas, the upper part of the subsoil is red with little or no mottling to a depth of 3 or more feet. The soils in such areas are closely related to the soils of the Kirvin series. Where drainage is not so adequate, yellow mottles may appear at a depth of about 15 inches below the surface, and the gray mottles may increase below that depth. In some places, the red color is entirely replaced by gray and yellow.

In forested areas the undisturbed surface soil is generally grayish brown because it contains some organic matter. The cultivated soil is lighter gray. Where erosion has been active or where there are areas of overwash soil from red clay exposures, the surface soil is distinctly reddish.

Included with mapped areas of this soil are small areas of light-brown or brown soils with a deep-red heavy subsoil extending to a depth of 2 or more feet. Such areas represent a gradation toward the Kirvin soils. The material commonly contains gravel of ferruginous sandstone and in a few places of quartzite. Small areas of the fine sandy loams of the Norfolk, Ruston, and Lufkin series were also of necessity included in mapping. The areas of the two former soils occur on the stream slopes, and the Lufkin soils are found on the flatter divides. Textural variations include the loam and clay loam of the Susquehanna series. These occur in cultivated fields where the subsoil is within plow depth.

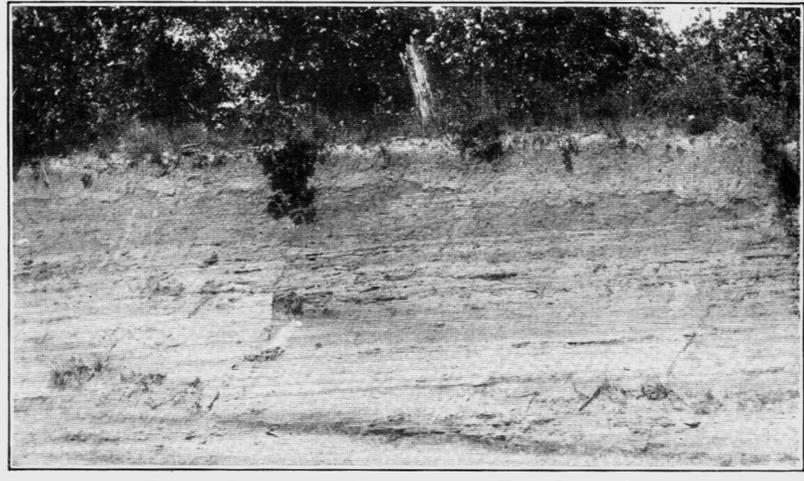
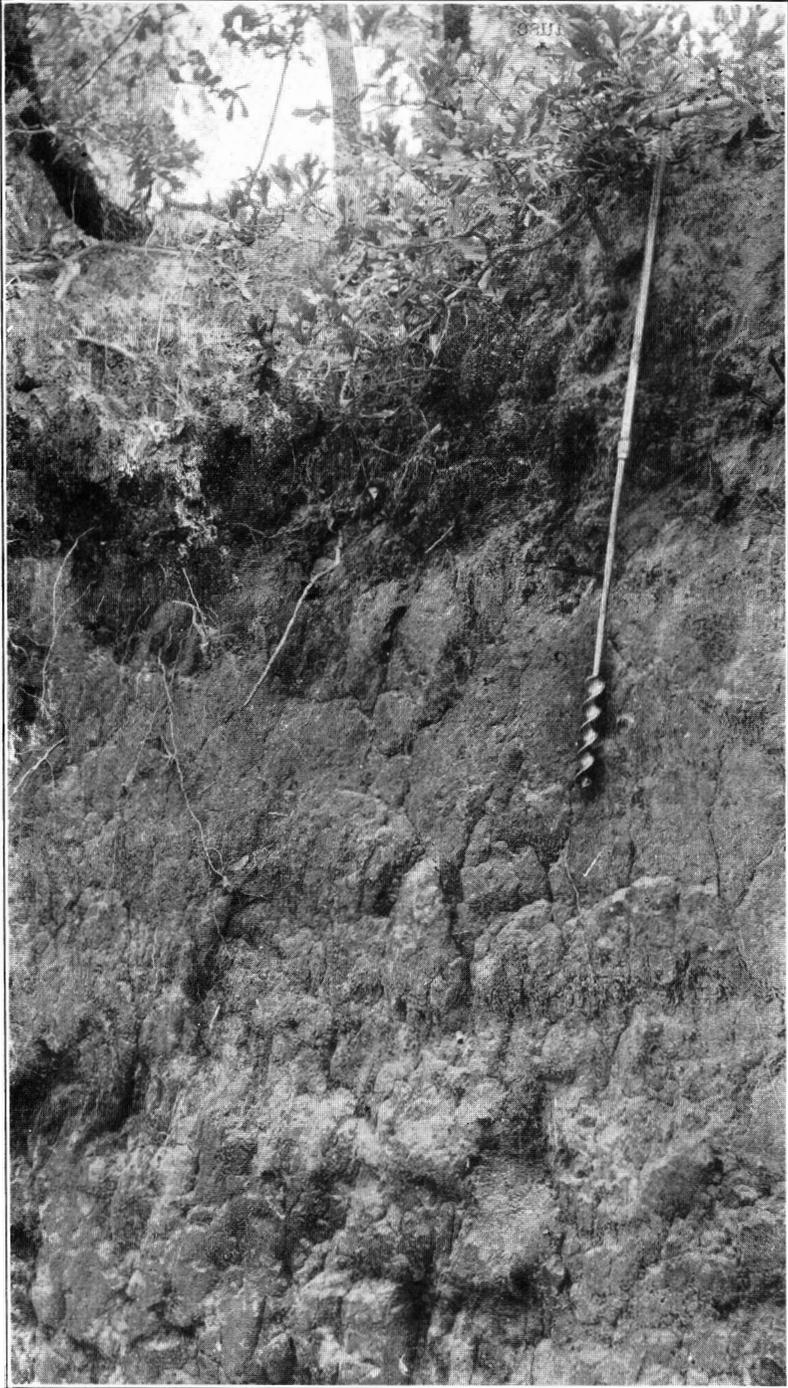


FIG. 1.—PROFILE OF SUSQUEHANNA FINE SANDY LOAM



FIG. 2.—PROFILE OF NORFOLK FINE SAND



PROFILE OF NORFOLK FINE SANDY LOAM

Susquehanna fine sandy loam is locally called "tight land" and "post-oak land," because of the heavy subsoil, the fact that the soil hardens on drying, and the character of the prevailing tree growth.

Susquehanna fine sandy loam occurs most extensively in that part of the county west of Athens, though there are scattered areas throughout the entire county. The surface relief varies from nearly level to gently rolling, and in places slightly hilly. The run-off of surface water is fairly adequate, but the internal movement of moisture is restricted. The dense subsoil favors the development of deep V-shaped gullies locally termed "dugouts," which frequently cut back 100 or more feet during heavy rains. Great care should be exercised to prevent their formation. Seeding Bermuda grass at the heads of the gullies and the construction of dams of brush and logs are the means generally relied on for this purpose, but terracing would be more effective.

It is estimated that about 25 per cent of this soil is under cultivation. The principal tree growth on the forested areas consists of post oak and blackjack oak, with some hickory and elm on the areas of deeper soil.

Cotton is grown on more than 50 per cent of the cultivated Susquehanna fine sandy loam. Yields vary considerably with seasonal conditions, cultural methods, and extent of damage by boll weevils. The average yield probably ranges from one-fifth to one-third bale to the acre, but yields as high as three-fourths bale to the acre have been reported. The largest yields are obtained on land fertilized with 100 to 200 pounds to the acre of commercial fertilizers of different formulas.

Corn ranks next to cotton in importance. Reported yields range from 10 to 25 bushels to the acre. A fair average is about 15 bushels. Oats and rye are grown by some farmers for winter and spring pasturage. Cowpeas are sometimes grown with corn, generally in alternate or third rows. The peas are generally grazed after the corn is harvested. Fair or good yields of hay and peas are usually obtained where peas are sown alone.

Potatoes, sweet potatoes, watermelons, and various garden crops are grown, chiefly on the deeper soils. Peach trees seem to die sooner on this than on soils where the root development is not hampered by a stiff heavy subsoil. Some pear trees are grown on this soil. The heavy, rather shallow subsoil is unfavorable to the growth of pecan trees.

Plowing under a crop of cowpeas or other green manure assists in checking soil erosion, increases the moisture-holding power of the soil, and helps maintain productivity. In the more rolling areas, terracing is necessary to prevent dangerous washing. The shallow topsoil and heavy subsoil render Susquehanna fine sandy loam susceptible to drought, and constant cultivation is necessary to maintain an effective surface mulch for the conservation of soil moisture. This soil is either acid or only neutral, and the application of lime should prove beneficial. Where the subsoil is within plow depth, the productiveness, as well as the tilth, would be improved by turning up thin layers of the subsoil, thus causing the soil to have a heavier texture and permitting the oxidation of the subsoil material.

The value of this soil at the time of the survey (1923) ranged from \$10 to \$35 an acre, depending on location, improvements, acreage cleared, and other factors.

*Susquehanna fine sandy loam, deep phase.*—The topsoil of Susquehanna fine sandy loam, deep phase, consists of grayish-brown or brownish-gray fine sand which may continue to a depth varying from 16 to 22 inches and grade to yellow fine sandy loam or fine sandy clay 2 inches thick, or which may grade, at a depth varying from 3 to 5 inches, to pale-yellow or grayish-yellow fine sand which in turn grades, about 2 inches above the subsoil, to yellow, fine sandy loam or fine sandy clay underlain by the typical Susquehanna subsoil of mottled red and yellow or red, yellow, and gray heavy clay which becomes very hard when dry and very sticky and plastic when wet. The subsoil generally occurs at a depth ranging from 18 to 24 inches, though in some places it is not reached above a depth of 30 inches. The gray mottling generally increases with depth, and in the flatter areas the lower part of the subsoil may consist of mottled yellow and gray heavy clay.

The greater depth of the topsoil of this phase of soil provides better drainage, a greater reservoir in which to store soil moisture, and a greater drought resistance than is found in the typical soil. It is therefore considered a better soil than typical Susquehanna fine sandy loam and is not locally classed as "tight land."

This soil commonly occurs in nearly level or gently undulating areas. Small areas of the deep phase of Ruston fine sandy loam and of Norfolk fine sandy loam because of their close association and the small size of the areas are included with this soil as mapped. Also very small areas of typical Susquehanna fine sandy loam will be found within mapped areas of the phase.

Susquehanna fine sandy loam, deep phase, is better adapted to the production of the general and special crops of the county than the typical soil, and, as a rule, the better drainage and greater supply of moisture are conducive to better yields. Cotton and corn are the chief crops. Most farmers have small fields of oats and rye for winter cover crops and pasturage. Cowpeas are planted both alone and with corn. Some fair-sized peach orchards have been planted and appear to do better than on the typical soil. This soil is well suited to the production of truck crops. With constant cultivation during the dry months, it will be found to retain moisture as well as any soil in the county, except those that have friable subsoils.

*Susquehanna fine sandy loam, mound phase.*—Dome-shaped sandy mounds are scattered over small areas of Susquehanna fine sandy loam principally in the northwestern part of the county, particularly in the vicinity of Tool and Aley. These mounds vary in diameter from 20 to 100 feet and in height from 1 to 4 feet. Although in some places the mounds are so numerous that their edges overlap, they usually occur singly. Where only occasional mounds were found the areas were mapped with the soil on which they occurred.

The soil between the mounds is Susquehanna fine sandy loam. The topsoil may be somewhat deeper than typical, owing to the spreading of material from the mounds, especially in fields where cultivation has tended to level the ground. The mounds and the otherwise nearly level surface of these areas restrict surface drainage.

The subsoil generally has less red and more gray mottling than the subsoil of typical Susquehanna fine sandy loam. The mounds themselves consist of brownish-gray or grayish-brown fine sand, loose as a rule, and subject to wind erosion where cultivated. This sandy material is in most places more than 3 feet deep in the center of the mounds.

It is estimated that only about 10 per cent of this soil is under cultivation. Cultivated fields clearly show the difference in drainage and moisture-holding capacity between the mounds and the intervening fine sandy loam, particularly in dry years when the heavy soil becomes droughty and the sandy mounds still retain moisture. The soil is planted chiefly to cotton and corn, and the yields are generally slightly lower than those obtained on typical Susquehanna fine sandy loam.

The virgin forest growth consists chiefly of post oak, blackjack oak, and elm, with some hickory and some sand blackjack oak on the mounds.

#### CROCKETT FINE SANDY LOAM

The topsoil of Crockett fine sandy loam is grayish-brown, light-brown, or brown loamy fine sand or fine sandy loam from 8 to 15 inches thick, but usually averaging 10 inches. This may be underlain by a layer, a few inches thick, of brown fine sandy clay loam, but it usually rests directly on a mottled dull-red and olive, or dull-red and yellowish-brown stiff heavy clay. At a depth ranging from 16 to 28 inches, the mottling gives way to distinctly olive-colored heavy clay which continues to a depth of 4 or 5 feet. The line of demarcation between the topsoil and the subsoil, as seen in cuts, is uneven and wavelike.

The substratum is nearly everywhere calcareous within a depth of 5 feet of the surface, and in some places the subsoil is calcareous at a depth of less than 3 feet. Lime concretions are numerous in the substratum and in places in the lower part of the subsoil, and large round or oval concretions of arenaceous limestone varying from 6 inches to a foot or more in diameter may be seen in the deep part of the subsoil.

The poorer drained areas closely resemble the Wilson soils. The better-drained areas have a subsoil of pale-red or red and yellowish-brown mottled heavy clay which grades, at a depth of 24 inches, to olive-colored heavy clay which in places is calcareous. There are included patches ranging from 10 to 100 or more feet in diameter, of Wilson fine sandy loam and Wilson clay loam.

Where Crockett fine sandy loam and Susquehanna fine sandy loam are in contiguous association it is difficult to separate them, so that it was necessary in mapping this soil to include some areas of the Susquehanna soil, particularly where this soil occurs near Motelle and west of Payne Springs.

Some areas, mainly in the eastern part of the belt of Crockett soils which extends roughly from Trinidad to the Kaufman-Henderson county line, are very gravelly. This gravel, which is mainly quartzite, is rounded, and varies from 1 to 1½ inches in diameter. It is found mainly on the surface and in the topsoil but does not occur in sufficient quantities to interfere with cultivation. In the more nearly level areas the topsoil may be loamy in texture, and on

slopes above the streams some clay loam has been included with this soil as mapped.

The surface of Crockett fine sandy loam ranges from nearly level to undulating. Drainage is facilitated by the open topsoil but is retarded by the plastic, impervious subsoil. The nearly level areas have a slow run-off of surface water, so that the soil as a whole is not well drained. It is also inclined to be droughty, so that it is necessary to conserve all available moisture. In the flatter areas the fields should be ditched or tilled to assist natural drainage. This would increase the range of moisture conditions under which cultivation could be carried on.

This is the most extensive prairie soil in the county. It is considered very productive and is well supplied with organic matter. It is estimated that 75 per cent of its area is under cultivation. The soil is covered in places by a growth of mesquite and other grasses, and elsewhere by a growth of post oak and bur oak, with a ground covering of broom sedge and other native grasses.

Cotton is the chief crop. Yields average nearly one-half bale to the acre in seasons of normal moisture distribution, and in good years yields of a bale to the acre have been reported. Corn yields from 15 to 35 bushels to the acre, with an average of about 20 bushels. Many farmers grow cowpeas either with the corn or alone. High yields of peas and hay are obtained. Oats yield from 20 to 40 bushels to the acre. A small acreage of wheat is grown, and 10 or 15 bushels constitute an average yield. This soil is well adapted to the grain sorghums, and in dry years the yields of these crops average much higher than those of corn.

Land of this type varies in price from \$35 to \$75 an acre, depending on location and improvements.

*Crockett fine sandy loam, mound phase.*—A small area of the mound phase of Crockett fine sandy loam was mapped in association with the typical soil. It consists of Crockett fine sandy loam on which there are dome-shaped mounds of different size, such as occur on the Susquehanna and Lufkin soils but in less number. The mounds retain moisture longer than the soil between them. In general, this soil is nearly level, and drainage is somewhat restricted.

The agricultural value of this land is not so high as that of the typical soil, and the yields of cotton and corn, the chief crops, are somewhat lower.

#### CROCKETT CLAY LOAM

The topsoil of Crockett clay loam consists of grayish-brown or brown heavy loam or clay loam from 5 to 10 inches thick. The subsoil consists of brownish-red or dull-red stiff clay mottled with olive, yellowish brown, and in places with dark gray. The red and yellow mottles generally disappear at a depth varying from 20 to 30 inches. The lower part of the subsoil consists of stiff, olive-colored clay which continues to a depth of more than 3 feet. In some places, the material within 3 feet of the surface effervesces with hydrochloric acid but in most places such a reaction is not obtained above a depth of 5 or 6 feet. Locally yellowish-brown highly calcareous clay containing lime concretions is present within 3 feet of the surface. Some round or oval concretions of arenaceous limestone, 6 or more inches in diameter, are seen in the deeper part of the subsoil or in the substratum.

In some patches dark-brown clay loam or clay is underlain abruptly by tough heavy clay that is either like the subsoil as described above or is olive with mottles of bluish gray. As mapped, this soil includes small patches of Wilson clay and Wilson clay loam. In the best-drained areas, the subsoil closely resembles that found in the Susquehanna soils.

The stream slopes on which some of this soil is found consist of somewhat eroded areas of Crockett fine sandy loam. There the drainage is good, but on the more nearly level areas it is somewhat restricted. Conservation of soil moisture is limited by the heavy subsoil.

The total extent of Crockett clay loam is not large. Areas occur only in the original prairie section of the county and the individual areas are small. Most of the soil is used for general farm crops, chiefly cotton and corn. Some cowpeas are grown. Yields of crops are somewhat lower than on Crockett fine sandy loam, especially in seasons of little rainfall. This is, however, regarded as a productive soil.

#### NORFOLK FINE SANDY LOAM

Norfolk fine sandy loam has a topsoil of grayish-brown or brownish-gray slightly loamy fine sand, 6 or 8 inches thick. Below this is a gradational zone, in most places from 6 to 10 inches thick, of yellow loamy fine sand. The subsoil of yellow fine sandy loam is continuous to a depth of more than 3 feet. In the more poorly drained areas the subsoil is finely mottled with gray. The substratum occurs 5 or 6 feet below the surface and consists of gray or brown compact sandy clay or sand, mottled or splotched with red. (Pl. 47.)

This soil occurs in conjunction with other soils of the Norfolk series, particularly with the deep phase of Norfolk fine sandy loam, and with the Ruston and Bowie soils. Because of their close association and small extent, small inclusions of these soils were necessary in mapping.

Areas of this soil vary from nearly level to undulating. The soil occurs both on ridge tops and on the stream slopes. Drainage is good, owing to the surface contour, the loose, open topsoil, and the friable subsoil. Both topsoil and subsoil are very retentive of moisture.

Norfolk fine sandy loam is of comparatively small extent in the county. It occurs mainly in small areas. Probably half of it is utilized for general farm and special crops, and the remainder is in a virgin condition and is used for pasture. The principal forest growth consists of blackjack oak, post oak, and hickory, with some elm and other trees.

This soil is adapted to the same crops, and the same cultural practices apply as for deep Norfolk fine sandy loam. Yields are about the same, except in dry years, when those obtained on the deep phase are higher, as a rule, because of the greater reservoir provided for soil moisture.

*Norfolk fine sandy loam, deep phase.*—The topsoil of the deep phase of Norfolk fine sandy loam differs from that of the typical soil in being deeper. In this soil the yellow fine sandy loam subsoil is found between depths of 18 and 24 inches. Areas of this soil vary from nearly level to gently undulating, and the drainage is good. The

moisture-holding capacity is unusually high, especially where the land is cultivated with moisture conservation in view.

This is an extensive soil in Henderson County and approximately 60 per cent of it is under cultivation. The supply of organic matter is generally low, and the addition of organic matter or commercial fertilizers is necessary after the soil has been cropped to clean-cultivated crops for a period of years. Excellent yields of all the crops grown in the county are obtained on new ground or fields in which the supply of organic matter has been maintained. In normal years the production of cotton varies from one-fourth to one-half bale to the acre, though larger yields have been reported where fertilizers were used. Corn yields from 12 to 15 bushels to the acre. Good yields of both peas and hay are obtained from cowpeas.

The power of this soil to retain moisture makes it especially well suited to crops which mature in early summer, at about the time when the rains are too light for proper plant growth. Truck crops and small fruits, particularly, fall within this class. This soil constitutes a considerable proportion of the acreage now devoted to these crops in Henderson County. Strawberries yield from 125 to 150 crates to the acre and blackberries from 200 to 300 crates. Cucumbers yield from 3,500 to 4,000 pounds, and tomatoes from 300 to 350 crates. The yield of peaches depends largely upon seasonal conditions. The special crops are generally fertilized. Peach trees live longer on this than on most soils in the county. The growth and development of papershelled pecan trees show the soil to be well adapted to the production of these nuts.

Where forested, the tree growth is practically the same as on Norfolk fine sandy loam. The forested areas are used to pasture cattle and hogs.

Land used for ordinary agricultural purposes is held at prices varying from \$20 to \$35 an acre, and land planted to berries or peaches sells from \$100 to \$150 or more an acre.

#### NORFOLK FINE SAND

The topsoil of Norfolk fine sand consists of brownish-gray fine sand, from 5 to 8 inches thick. The loose subsoil of pale-yellow fine sand continues to a depth of 3 or more feet without change. In places the soil at the immediate surface feels slightly loamy owing to the organic matter present, but the organic-matter content is in most places low, and the soil is incoherent. (Pl. 46, fig. 2.)

This soil constitutes a large proportion of the area of Henderson County. It occurs chiefly in a belt across the central part of the county. Large unbroken areas are found in the southern part west of Larue, and small areas occur in nearly all parts. The soil is generally closely associated with other Norfolk soils and with those of the Ruston series; and in places, particularly on stream slopes, narrow strips of those soils have been included in mapped areas of Norfolk fine sand.

Areas of this soil vary from nearly level to rolling, and in places to hilly. The porous soil and subsoil provide adequate drainage, as the fine sand subsoil continues to a depth varying from 5 to 15 or more feet and is underlain by a thick layer of slightly consolidated sandy material. The loose surface material gives the effect of a mulch, so

that moisture is present within 3 feet of the surface when the other soils of the county have become dry to a great depth.

The natural productiveness of Norfolk fine sand is low, but good yields of all crops adapted to the soils of the county are obtained on new ground in which a fair supply of organic matter is present, and from soils in which organic matter has been incorporated. Where well drained, this soil warms up early and is well adapted to early spring crops. However, when there has been considerable rainfall the soil may become soggy. Crops can not be planted successfully until this condition is relieved. On some slopes in the sand-hill region a soggy condition is brought about by seepage from the surrounding hills.

Probably 90 per cent of this land is used for pasture. The chief crops are cotton and corn, though truck crops, cowpeas, winter oats, and rye are also grown. Cotton is generally fertilized to some extent. It yields from one-fourth to one-third bale to the acre, the higher yield being obtained in favorable years. The yields of corn range from 8 to 15 bushels. Both cotton and corn are frequently blown out of the ground during the early spring months, especially where the organic-matter content is low, as the newly cultivated soil is exposed to wind action at that time. Cowpeas do well as a rule, either in corn or by themselves. Tomatoes yield from 200 to 300 crates, and cucumbers 3,000 pounds to the acre on new or fertilized soil. Sweet potatoes yield 100 bushels or more to the acre. Blackberries and dewberries do well on this soil.

In locations favored by proper moisture and air drainage, peaches do unusually well, and a large number of the orchards in the vicinity of Athens and Ash are planted on this soil. Fertilizer is necessary for best results. The principal native trees are blackjack oak and sand blackjack oak, but there are also some post oak and hickory trees. On the slopes where seepage occurs, myrtle, holly, and smilax vines thrive. Broom sedge, needle grass, sand spur grass, and Bermuda grass are the principal pasture grasses.

In its virgin state Norfolk fine sand sells for \$8 or \$10 an acre. Cultivated areas bring from \$10 to \$15 or slightly more, depending on location and improvements. Areas planted to peach orchards are held at \$75 or \$100 an acre.

*Norfolk fine sand, flat phase.*—The chief difference between this soil and typical Norfolk fine sand is one of surface relief. The surface of the phase is almost level. The color profile varies but slightly from typical, though in places both the topsoil and subsoil are darker, the topsoil being dark grayish brown and the subsoil deep yellow. Soil of this phase consists of brownish-gray fine sand, underlain at a depth of about 6 inches by pale-yellow fine sand, which, at a depth varying from 20 to 26 inches, grades in color to yellow, in places faintly mottled with rust color. Locally, fine sandy loam material occurs at a depth of approximately 36 inches. This is underlain by sandy clay.

The flat surface impedes run-off of rain water. During periods of normal precipitation the rainfall is readily absorbed, but in wet years the soil is apt to become saturated or soggy and to remain so for some time. In dry seasons the soil retains moisture well, and with the maintenance of a mulch it will withstand droughts of considerable duration.

The largest area of this soil occurs in the southern part of the county, where it is closely associated with typical Norfolk fine sand and with Norfolk fine sandy loam. It is adapted to the same crops as the typical soil. In normal or dry years the yields obtained are very much the same but in wet years are probably not so good. A large proportion of the soil is under cultivation. The supply of organic matter is low, and the soil would be benefited by plowing under cowpeas as green manure.

Cultivated Norfolk fine sand, flat phase, is valued at prices ranging from \$15 to \$25 an acre.

#### NORFOLK SAND

Norfolk sand consists of brownish-gray loose medium sand 6 or 8 inches thick. This grades to yellow or pale-yellow incoherent medium sand which continues to a depth of more than 3 feet. In the hilltop areas the lower part of the subsoil in places assumes a reddish tinge at the edges of slopes. In the same location the underlying reddish or yellowish parent material is in a few places present within 3 feet of the surface.

Although the surface sands of the county are chiefly fine sand, enough coarser material is present in some locations to give the soils a medium sandy texture. This is true of some areas of Norfolk fine sand mapped in the vicinity of Sand Flat School and in the northwestern part of the county.

Areas of this soil range from flat to undulating. Drainage is good, because of the open topsoil and subsoil. With a surface mulch, the soil holds moisture well but not so well as Norfolk fine sand.

Norfolk sand occurs chiefly on the rather flat tops of the high hills extending across the county from Larue to Brownsboro, but several areas occur as ordinary uplands.

Most of this land is used for pasture, but some cotton and corn are grown. Yields are below those on Norfolk fine sand, and the soil is more subject to drought. The forest growth consists of blackjack oak, sand blackjack oak, some post oak, and hickory. Because of the low supply of organic matter, the productivity of the soil is easily exhausted, and for best results fertilization is necessary after cultivated crops have been grown for a few years.

#### RUSTON FINE SANDY LOAM

The topsoil of Ruston fine sandy loam is grayish-brown fine sand, slightly loamy in places, from 8 to 12 inches thick. Beneath this is a layer of yellowish-red or brownish-red loamy fine sand or fine sandy loam from 3 to 5 inches thick, which grades to the subsoil of yellowish-red or light-red sandy loam or fine sandy clay. This continues without change to a depth of more than 3 feet and is underlain by similar material spotted with yellow in places. The parent material occurs at a depth between 4 and 6 feet. This consists of gray compact sandy clay, mottled and spotted with yellow and brown, or of brownish sandy clay or clay, mottled with yellowish brown or rust brown.

As mapped, Ruston fine sandy loam includes some patches of fine sandy loam with a deeper red subsoil than typical, and also some areas in which the subsoil is more compact and more spotted. Reddish-brown ferruginous gravel is scattered over the surface in

places and the larger areas of gravelly soil are shown on the soil map by gravel symbols. The quantity of gravel is never sufficient to interfere with cultivation, or to exert a marked influence on the agriculture of such areas. In the more poorly drained areas a hardpan of gravel commonly occurs at a depth ranging from 2 to 3 feet.

Areas of this soil vary from gently undulating to rolling. Small areas occur over the entire county, generally in narrow strips on slopes. The more nearly level soil has a deeper topsoil and constitutes the deep phase. It is estimated that 40 per cent of this soil is under cultivation.

In its natural condition Ruston fine sandy loam is forested with post oak, blackjack oak, red oak, hickory, elm, and other trees.

The oak and hickory mast furnish considerable fall pasturage for hogs. Bermuda grass and broom sedge are the principal grasses.

Cotton, corn, and cowpeas give good yields on this soil, as do also some of the special crops. In seasons of normal rainfall, cotton yields from one-fourth to one-half bale to the acre. The yield of corn varies from 12 to 18 bushels to the acre. Winter oats and rye are used for winter and early spring pasturage. Peaches and papershelled pecans do well.

The price of land of this kind varies with its location and the agricultural value of the associated soils. This soil rarely constitutes entire farms.

*Ruston fine sandy loam, deep phase.*—In the deep phase of Ruston fine sandy loam, the sandy clay lies at a greater depth than it does in the typical soil. The profile shows a surface layer of grayish-brown or brown fine sand underlain, at a depth of about 8 inches, by buff or reddish-yellow fine sand. The yellowish-red friable fine sandy clay subsoil occurs at a depth ranging from 18 to 24 inches and continues to a depth greater than 3 feet. The subsoil, in places, begins as fine sandy loam and grades to fine sandy clay that may be rather compact. The substratum consists of the same material as underlies Ruston fine sandy loam.

Where the subsoil is rather stiff, it is red or dull red in color and is similar to that of the Kirvin soils; where surrounded by hills covered with the Kirvin soils, as in the eastern part of the county, the soil material has a slightly reddish tinge caused by wash from the hills. The material in these valleys is slightly reddish gray and varies from fine sand to loamy fine sand, grading at a depth of 12 or 15 inches to light-red or yellowish-red fine sand and, at a depth varying from 24 to 36 inches, to yellowish-red or light-red fine sandy loam.

The subsoil of deep Ruston fine sandy loam becomes very hard on drying but is friable when moist. It lends itself readily to the movement of internal moisture, affording good subsurface drainage and retaining a favorable moisture supply under average conditions. Land of this phase, as of the deep phase of Norfolk fine sandy loam, retains moisture longer than most of the soils of the county in dry weather.

Areas of this soil are commonly gently undulating. Probably about one-third of the land is cultivated. The remainder is forested with a growth very similar to that on Ruston fine sandy loam. More of this soil is found in the eastern than in other parts of the county.

This soil is well adapted to the general and special crops common to the region. A considerable acreage of special crops and peaches

is grown. Cotton yields from one-fourth to more than one-half bale to the acre, and corn, from 12 to 20 bushels. Cucumbers yield from 3,500 to 4,000 pounds to the acre and tomatoes from 300 to 350 crates. The yield of strawberries is from 100 to 150 crates to the acre, and of dewberries and blackberries from 200 to 300 crates. In normal years thrifty peach trees yield from 100 to 250 bushels to the acre. Yields are, however, largely governed by seasonal climatic conditions.

Current values for this land for ordinary agricultural purposes vary from \$20 to \$35 an acre. Peach orchards and lands on which berries have been planted are valued much higher.

#### RUSTON FINE SAND

Ruston fine sand, to a depth of 10 or 15 inches, consists of grayish-brown fine sand which becomes slightly tinged with red in the lower part. This material grades to yellowish-red fine sand which continues to a depth greater than 3 feet. The texture is generally loamy as the depth approaches 3 feet.

Areas of the soil vary from gently rolling to gently undulating. The soil occurs on slopes in the parts of the county where Norfolk fine sand is found and on ridge tops in parts where the Ruston soils predominate. Some small areas of this soil have been mapped with the deep phase of Ruston fine sandy loam, and some Ruston sand has been mapped with Ruston fine sand in the vicinity of Myrtle Springs School and on the rather flat mountain tops.

The greater part of this land is forested with a growth very similar to that on Norfolk fine sand. Cotton and corn are the chief crops, and yields are similar to those obtained on Norfolk fine sand. The more nearly level areas are well suited to special crops and peaches, especially where the reddish-yellow fine sandy loam occurs at a depth of about 3 feet. This soil retains moisture well under cultivation.

#### GREENVILLE GRAVELLY FINE SANDY LOAM

The topsoil of Greenville gravelly fine sandy loam consists of reddish-brown or light brownish-red fine sandy loam from 6 to 10 inches thick. Below this is red or deep-red fine sandy loam, fine sandy clay, or, in places, clay loam, which continues to a depth of 3 or more feet. The lower part of the subsoil may be slightly lighter in color. A moderately large amount of angular ferruginous gravel is present on the surface, in the topsoil, and in places in the upper part of the subsoil. Similar gravel in seams 1 or 2 inches thick, may be present in the deeper part of the subsoil and in the substratum, but in most places there is little change in the material to a depth of 6 or 8 feet.

This soil occurs in the valleys between the mountains in the eastern part of the county. It is found on slopes from the base of the hills to the stream channel. The drainage is good. A favorable supply of moisture is usually maintained and is often increased by seepage. The character of the subsoil causes it to be very retentive of soil moisture, especially where a surface mulch is maintained. During heavy rains, bad gullies are sometimes formed and the crops are damaged or destroyed by wash from the hills.

This soil is used for growing cotton, corn, tomatoes and, to some extent, cucumbers. Its supply of organic matter is fairly high, and

with normal moisture distribution, yields are good. Cotton yields from one-third to one-half bale to the acre, though yields of three-fourths bale are not uncommon. Corn yields from 15 to 25 bushels. In favorable seasons tomatoes yield from 300 to 500 crates and cucumbers from 3,500 to 4,000 pounds to the acre. This soil is rarely fertilized for the general farm crops, and only a small quantity of fertilizer is used for special crops. Peaches do well. Terraces should be constructed to prevent erosion.

Land values vary from \$25 to \$35 or more an acre, depending on location, extent, and improvements.

#### KIRVIN FINE SANDY LOAM

Kirvin fine sandy loam has a topsoil which ranges in color from grayish brown to slightly reddish brown, and in texture from fine sand to loamy fine sand. The material grades, at a depth of 8 or 10 inches, through a thin layer of reddish-brown or red fine sandy loam or loamy fine sand to a subsoil of red, dull-red, or brownish-red clay. The clay is moderately stiff and compact, especially in the upper part of the layer. It continues to a depth of 3 or more feet, but in some places the material is slightly more friable below a depth of 24 inches and in others is mottled or splotted with yellow or yellowish brown at this depth. It is, however, more friable than the subsoil of the members of the Susquehanna series. Ferruginous gravel may be scattered over the surface in places and some platy fragments of ferruginous rock are found between the topsoil and subsoil. Some small areas of Kirvin gravelly fine sandy loam have been included with mapped areas of this soil.

Areas of this soil vary from nearly level to undulating or slightly rolling, the latter relief being more prevalent. On the steeper slopes the soil is subject to erosion. It is generally poorly supplied with organic matter, and this condition and the structure of the subsoil favor erosion. Crops suffer in dry weather more than on the soils having more friable subsoils.

This soil is of rather small extent, but is found in small areas over the entire county. Less than 50 per cent of it is under cultivation. The remainder is forested with the more common upland trees.

Cotton does well on Kirvin fine sandy loam. The average yield commonly varies from one-fourth to three-eighths bale to the acre. Corn yields from 10 to 15 bushels to the acre, with slightly higher yields in years of well-distributed rainfall. Cowpeas thrive and peaches do well with sufficient moisture, but suffer in dry years.

Land of this kind is valued at prices ranging from \$15 to \$35 an acre, depending on improvements and location.

Some very stony areas are shown on the soil map by stone symbols. The soil in such areas consists of grayish or reddish-brown fine sandy loam, containing a sufficient quantity of fragments of ferruginous sandstone in the topsoil to interfere seriously with cultivation. Some areas are too stony for any cultivation. Because of their small extent some very hilly areas of Kirvin fine sandy loam, occurring on steep slopes and rolling crests in the "mountainous" country east of Brownsboro and Larue, have been included in mapping. In these the soil is seldom more than 8 inches thick.

## KIRVIN GRAVELLY FINE SANDY LOAM

The topsoil of Kirvin gravelly fine sandy loam varies in color from grayish brown to reddish brown and in texture from fine sand to loamy fine sand. It contains a large quantity of ferruginous rock fragments and concretions. At a depth of 6 or 8 inches, this grades through a thin layer of reddish-brown or red fine sandy loam into red or brownish-red clay, commonly stiff and compact. This continues to a depth of 3 or more feet without change, except for some yellow or yellowish-brown splotches which may occur in the lower part. In places the subsoil below a depth of 24 inches is less tenacious and contains more sand, but the material is compact throughout. Some gravel is present in the upper part of the subsoil, but rarely in the lower part. Where there is gravel, yellowish stains characterize the dry soil. In places, broken platy ferruginous rock fragments are found between the soil and subsoil. These fragments appear to have been formed in place by the cementing action of iron salts. Some gravel-free areas have been included in mapping.

This soil occurs on slopes from upland to stream bottoms, on rounded ridges, and on hilltops. It is found in small patches over the entire county but is most extensive in the vicinity of Athens and north and east of Larue. The surface is undulating or hilly, and the drainage varies from good to excessive. The restriction of internal movement of soil moisture by the rather heavy subsoil and the limited capacity of the comparatively shallow topsoil for the storage of moisture tend to make the soil rather droughty. Terracing is necessary to prevent serious erosion in cultivated fields. The soil is poorly supplied with organic matter.

Cotton and corn are the leading crops. Cotton yields from one-fourth to one-third bale and corn from 12 to 15 bushels to the acre. These yields are materially reduced in dry years. Cowpeas do well on this soil.

Less than 50 per cent of the Kirvin gravelly fine sandy loam is under cultivation. The forested areas are covered with blackjack oak, post oak, red oak, hickory, and other trees, and are used for pasture.

Land of this kind is valued at prices ranging from \$15 to \$35 or more an acre depending on location and improvements.

## OCHLOCKONEE FINE SANDY LOAM

The topsoil of Ochlockonee fine sandy loam consists of grayish-brown, yellowish-brown, or light-brown loamy fine sand or fine sandy loam which grades to brownish-gray or brown fine sandy loam or clay loam, commonly mottled with rust color, yellowish brown, or gray as the subsoil is approached. The subsoil is generally highly variable in color and texture. In many places layers of materials of different textures and colors are interstratified. Small areas of the Bibb soils and of the very fine sand, fine sand, and sand of the Ochlockonee series have been included with this soil as mapped, because of their close association and intermixture.

Ochlockonee fine sandy loam occurs on first bottoms along the larger streams of the county. It consists of alluvial material deposited during overflow. Along the margin of the bottoms, the soil is mixed with some colluvial material from the near-by uplands.

Such areas are in most places slightly higher than the remainder of the land. The soil is subject to periodic overflow, most frequent in the winter and spring, during which the greater part of the surface receives new alluvium. This accounts for the mixture and interstratification of material of different textures and colors. The largest area of this soil occurs in the Neches River bottoms.

Areas of Ochlockonee fine sandy loam are nearly level but slope slightly toward the streams and in the direction of stream flow. Drainage is only fairly well established.

In the forested areas, which comprise more than 95 per cent of the total area of this soil, the principal growth consists of hardwoods and underbrush. Some cane grows in the eastern part of the county and is prized for pasturage.

This is considered a productive soil. It is comparatively rich in organic matter and is generally fairly well supplied with moisture throughout the year. Most of the higher areas in the smaller bottoms, especially those which have received colluvial material from adjacent uplands, are under cultivation, either to cotton or corn. In normal seasons the yield of cotton is from one-fourth to one-half bale to the acre and that of corn is from 15 to 35 bushels.

A fair acreage of this land is occupied by hay meadows, chiefly of Bermuda grass though a few Johnson-grass meadows were seen. Two and sometimes three cuttings of hay, each cutting ranging from one-half to 1 ton to the acre, are obtained from these meadows. Some Sudan grass is grown on the higher areas. From this two and sometimes three cuttings, yielding from three-fourths to 1 ton to the acre a cutting, are obtained. The acreage of Sudan grass could be profitably increased, as the local markets readily accept any excess of hay the farmer may produce. Bermuda, carpet grass, broom sedge, and a variety of moisture-loving grasses are found on the virgin soil, which is well adapted to pasture grasses.

Current values for this soil range from \$10 to \$25 an acre.

#### OCHLOCKONEE VERY FINE SANDY LOAM

The topsoil of Ochlockonee very fine sandy loam consists of grayish-brown very fine sandy loam or loamy very fine sand 8 or 10 inches thick. This grades into brownish-gray or yellowish-brown material, which varies from silty clay loam to silty clay. In places, yellowish and rust-brown mottles appear in the subsoil. In most places the clay subsoil is stiff and heavy and very plastic when wet. It contains interstratified material ranging in texture from sand to clay, and in color from gray to black. In places the soil closely resembles the Bibb soils, which are distinguished from the Ochlockonee by their gray color and poorer drainage. Small patches of the Bibb soils and of Ochlockonee silty clay loam and silt loam have been included with this soil as mapped. If the soil is plowed when wet, it puddles easily and bakes into hard clods. It is rich in organic matter and is very productive. Periodic overflows cover it with layers of sediments.

This soil occurs in the first bottoms of the larger streams west of Athens, where heavy subsoils predominate. It is subject to overflow, which limits to a large degree its utilization for crops. The areas are flat or nearly level. This soil occurs at a lower level than

the fine sandy loam of this series and is less well drained. In sloughs and depressions which dissect areas of Ochlockonee very fine sandy loam the soil generally consists of Ochlockonee silty clay loam or of Bibb silty clay loam.

Less than 5 per cent of this soil is under cultivation. The remainder is forested with a growth similar to that on Ochlockonee fine sandy loam. Cotton and corn comprise the chief crops, and there are some Bermuda-grass meadows. Sudan grass would do well on the higher, better drained areas. Yields are about the same as on Ochlockonee fine sandy loam.

#### OCHLOCKONEE SILTY CLAY LOAM

The topsoil of Ochlockonee silty clay loam consists of grayish-brown or brown silty clay loam which, at a depth of 6 or 8 inches, grades to heavier material of similar color, underlain at varying depths by brownish-gray, gray, or bluish-gray heavy silty clay mottled with rust color and yellowish brown. In the subsoil there is some interstratification of material of other colors and textures characteristic of this series. The strata consist generally of gray or brownish-gray fine sand.

This soil occurs in the first bottoms of the larger streams of the county. It is associated with other soils of this series and with the Bibb soils, and as mapped includes small areas of these soils. It occurs at a lower level than any other soils of this series and is subject to overflow. The largest areas are in the Cedar Creek bottoms. Here it is, in a few places, covered with black silty clay or clay less than an inch deep. This is Johnston soil material lately deposited over the original Ochlockonee material. The soil is well supplied with organic matter and is strong and productive. Unless leveed, crop production is hampered by the overflows to which the areas are subject, and planting is delayed until this danger is past. Owing to the heavy topsoil and subsoil and to the flat surface, drainage is poor, and water stands in depressions for long periods after heavy rains or overflows.

Less than 5 per cent of this soil is under cultivation. The tree growth is similar to that on Ochlockonee fine sandy loam, and the land supports a fair growth of Bermuda grass and some switch cane which is of considerable value for winter pasturage for cattle. The forested areas are used for pasture.

In normal seasons, cotton yields from one-third to one-half bale to the acre, and corn from 15 to 30 bushels. Crops frequently make an excessive growth and fail to fruit properly in seasons of excessive moisture.

#### TRINITY CLAY

Trinity clay consists of compact black clay, from 8 to 12 inches thick, which grades to bluish-black, jet-black, slate-colored, or dark-gray clay. In the more poorly drained areas the subsoil may show fine mottling with brown or rust brown throughout, but especially in the lower part. In some places, the material is black heavy clay to a depth of 3 feet, and in others the subsoil below a depth of 24 inches consists of brown, dark-brown, or grayish heavy clay. In areas adjoining the uplands or the sandy terraces the topsoil in many places

is dark-brown clay loam, the coarser texture resulting from the addition of colluvial material. The typical topsoil assumes an ash-gray color on drying and tends to crumble, but the subsoil is very hard. Both topsoil and subsoil are very sticky and plastic when wet.

This soil occurs in the first bottoms of Trinity River and extends for some distance back along the larger streams which enter the bottoms from the upland. It is subject to overflow during high water. During these overflows new material is added in some places and removed in others.

Characteristically, Trinity clay occurs on flat or nearly flat areas but has a slight slope toward the stream and in the direction of the stream flow. The natural drainage is poor or only fair, and ditching to insure the removal of rain and flood waters is necessary in many places before the land can be farmed. A number of sloughs and lakes in depressions in the bottom lands hold water throughout the year.

The soil is mainly calcareous from the surface downward, except near the edge of the uplands where the material is somewhat older and has been altered to some extent by the addition of colluvial material. In many places minute lime concretions are seen in the subsoil and in a few places in the topsoil. In the yellowish-brown or brown clay substratum, which occurs at a depth varying from 5 to 8 feet below the surface, some of these concretions are an inch in diameter and the material itself is highly calcareous. The heavy, waxy soil does not retard cultivation so much as might be expected, as the soil flocculates on drying and assumes the desirable crumbly structure. Even where the soil does not effervesce with hydrochloric acid, it crumbles on drying. The supply of organic matter is good and aids in maintaining a desirable tilth.

Only the higher areas of Trinity clay which are less subject to overflow and areas which have been protected by levees are cultivated. Several thousand acres of this soil have been leveed in the northwestern part of the county and are planted to cotton and corn. The remainder of the soil is heavily forested with the hardwoods common to the county. Sweet gum, sycamore, and honey locust are found in many places, and black walnut and pecan trees flourish in the better drained situations. The forested areas are used mainly as pasture for cattle and hogs.

Cotton and corn are the leading crops. Cotton ordinarily yields from one-half to three-fourths bale to the acre, and corn from 20 to 40 bushels. Yields of 1 bale of cotton and of 50 bushels of corn to the acre have been reported. The productiveness of the soil warrants the extension of the levee system to make intensive agriculture safe.

On areas unprotected by levees it is generally necessary to delay cotton planting until danger of spring floods is past, and in seasons of heavy boll-weevil infestation there may be considerable damage due to late planting. Cotton root-rot also causes considerable damage on this soil, especially in wet years.

Land values range from about \$10 to \$20 an acre, and for areas protected by levees are as much as \$150 or \$200 an acre.

## WILSON CLAY

Wilson clay has a topsoil of dark-gray, dark-brown, or almost black clay. At a depth of 8 or 10 inches this is underlain by dark-gray, almost black, or ash-gray, stiff, tough clay. In most places this is continuous to a depth of 3 feet, but at a depth of about 24 inches the color may change to gray or olive brown. The soil is not generally calcareous within a depth of 3 feet of the surface although a few small patches were found to be calcareous at a depth of about 18 inches. Lime concretions are found in a few places in the topsoil and subsoil, though neither contains free lime. When dry the upper few inches of the topsoil become crumbly and the subsoil becomes very hard. When wet, both topsoil and subsoil become sticky and plastic. The subsoil is almost impervious to soil moisture. The soil is well supplied with organic matter. Very small areas of Wilson fine sandy loam, too small in extent to be shown upon the soil map, have been included with this soil in mapping.

Areas of this soil are level or nearly so, and the drainage, both because of the flat surface and the dense subsoil, is only fair or is poor. In the areas having the poorest drainage the subsoil is black or dark gray. In a few places along stream slopes the subsoil shows dull-red mottling. In such areas this soil is similar to soils of the Crockett series.

Wilson clay occurs in the western and northwestern parts of the county. It is fairly extensive, and the greater part is under cultivation. It is locally referred to as "black land." It is forested mainly with a thin growth of mesquite, though in places the tree growth is post oak and bur oak. Bermuda grass and broom sedge are the chief grasses.

Heavy draft equipment is necessary for effective cultivation of this soil. Because of its texture and poor drainage it can be worked only under certain moisture conditions, as it clods if plowed when too wet and becomes very hard when dry. Water stands in depressions for long periods after rains.

Cotton and corn are the leading crops. Cotton yields from one-fourth to one-half bale or more to the acre in normal seasons, and yields of 1 bale to the acre have been reported by some farmers. Corn yields from 15 to 30 bushels to the acre, though some higher yields were reported. The grain sorghum crops, such as milo, kafir, and hegari do better than corn in dry years. Grass crops suffer as the soil cracks badly when dry, causing root damage. Grain crops are inclined to grow rank and to lodge, especially in wet seasons. Small areas affected by cotton root-rot were observed on this soil.

Land values vary from \$35 to \$75 an acre.

## CAHABA FINE SANDY LOAM

The topsoil of Cahaba fine sandy loam is grayish-brown, yellowish-brown, or light-brown fine sand or loamy fine sand. At a depth varying from 10 to 18 inches, a transitional layer, a few inches thick, of reddish-yellow loamy fine sand separates the topsoil from the yellowish-red or light-red subsoil of friable fine sandy loam or fine sandy clay which is continuous to a depth of 3 or more feet. In some level patches of soil in slight depressions the subsoil is slightly heavier and

more compact and consists of heavy fine sandy clay with yellow or gray mottling. Some very small patches having a topsoil from 24 to 30 inches deep and some areas of Cahaba fine sand were included in mapping as they were too small to be shown separately.

Areas of this soil vary from nearly level to somewhat billowy. Drainage, as a whole, is fair or good. Near the river are small areas underlain with gravel where the drainage is good or excessive. Slight depressions too small to map are noticeable in places. The soils of the depressions consist, as a rule, of either Irving of Leaf fine sandy loam. The Leaf soil is found in better drained areas.

The supply of organic matter in this soil is fairly high, and where properly cultivated the soil retains moisture for a long time.

Cahaba fine sandy loam occurs on the terraces of Trinity River and to a smaller extent along Neches River. Fairly large areas are in the vicinity of Trinidad.

It is estimated that 50 per cent of the Cahaba fine sandy loam is under cultivation, chiefly to cotton and corn. Cotton yields from one-fourth to one-half bale to the acre, and corn from 10 to 20 bushels. Cowpeas, sweet potatoes, and all truck crops do well. Winter oats and rye grow well and provide early spring pasturage.

Current prices of Cahaba fine sandy loam range from \$20 to \$35 or more an acre, depending on location and improvements.

#### HOUSTON BLACK CLAY

Houston black clay consists of black heavy clay, which in places continues to a depth of 3 or more feet without much change. In other places it grades, at a depth ranging from 10 to 24 inches, into bluish-gray or olive heavy clay, which prevails to a depth of 3 or more feet. Lime concretions are often present on the surface, in the topsoil, and in the subsoil, especially in the latter. Both topsoil and subsoil are generally high in lime carbonate. The substratum is highly calcareous, and consists of dark-olive or yellowish-brown material which varies from heavy clay to clay shale, from which the soil is derived.

When dry the soil has an ashy cast. To a depth of a few inches from the surface it crumbles into small clods. Following droughts it cracks badly. If it is plowed too dry, it forms large compact clods which break down when moistened by rains. When wet the soil is very waxy and plastic, and has been given the name "black waxy land." It can not be cultivated when it is wet enough to be sticky.

Drainage is poor, owing to the flat or nearly level surface and to the heavy texture of the topsoil and subsoil. In order to conserve moisture for the use of plants during dry seasons, it is necessary to plow deeply and keep down all weed growth. This soil is fairly resistant to drought.

Houston black clay occurs only in that part of the county west of Aley. Its total area is not large, but it is a valuable soil. Practically all of it is under cultivation, principally to cotton and corn. Cotton yields one-half bale or more to the acre and corn, in good seasons, yields from 20 to 35 bushels. In dry years grain sorghums yield better than corn. Cotton on this soil is frequently attacked by the root-rot fungus, the greatest damage occurring in a wet season.

Current values of this land vary from \$50 to \$100 an acre, depending on location and improvements.

## BIENVILLE FINE SAND

Bienville fine sand consists of fine sand 3 or more feet thick. It changes in color, at a depth of 8 or 10 inches, from brown or grayish brown at the surface to light brown, and, at a depth varying from 15 to 20 inches, to yellowish brown. In places the material below a depth of 3 feet has a reddish cast.

Areas vary from nearly level to billowy, and a few small mounds and depressions occur in places. The depressions are not well drained. A few small areas of *Kalmia* fine sand have been mapped with this soil, because of their close association and small size.

Bienville fine sand occurs on the Trinity River terraces, where it is well above overflow.

Except in depressions, this soil is well drained and retains moisture well. It is fairly well supplied with organic matter. After utilization for a number of years for clean-cultivated crops, the supply of organic matter decreases, and the soil becomes grayish brown or brownish gray and subject to wind erosion. The maintenance of the supply of organic matter by the incorporation of barnyard or green manure is essential.

It is estimated that 35 per cent of this soil is under cultivation, principally to cotton and corn. Cotton yields from one-fourth to one-half bale to the acre and corn from 10 to 20 bushels. Cowpeas grow well and their acreage should be increased. Sweet potatoes and watermelons thrive on this soil. In its virgin state this land is covered with a forest growth of blackjack oak, sand blackjack oak, post oak, bur oak, elm, sweet gum, some hickory, and other trees.

## KALMIA FINE SANDY LOAM

*Kalmia* fine sandy loam grades, at a depth varying from 12 to 18 inches, from a topsoil of fine sand or loamy fine sand to a subsoil of friable fine sandy loam. The surface soil is grayish brown or light brown, the subsurface soil is pale yellow, and the subsoil is pale yellow or yellow. In poorly drained areas the subsoil consists of gray fine sandy loam mottled with yellow and reddish yellow at a depth varying from 30 to 36 inches. A few included mound areas consist of Cahaba fine sandy loam and other small patches are of Irving fine sandy loam.

The total extent of this soil in Henderson County is small. It is found on the terraces of Trinity and Neches Rivers, as a rule occurring well above overflow. Areas are level or nearly level, and the drainage is fairly good in the topsoil and upper part of the subsoil but is poorly developed below a depth of 2 feet in depressed areas. The soil is retentive of moisture and withstands drought for long periods.

Cotton, corn, sweet potatoes, and watermelons are the leading crops. Cotton yields from one-fourth to one-half bale to the acre and corn from 12 to 18 bushels. High yields of sweet potatoes and watermelons are obtained in seasons of sufficient rainfall, and fair yields even in dry years. Cowpeas do well and should be grown as green-manure crops. The soil is well adapted to small fruits and truck crops.

## KALMIA FINE SAND

Kalmia fine sand consists of light grayish-brown or grayish-brown loose fine sand, from 6 to 12 inches thick. Below this pale-yellow or yellow incoherent fine sand prevails to a depth of 3 or more feet.

Areas are generally level or nearly level, but some, probably because of wind action, are slightly billowy, especially in cultivated fields. In part of the area are a number of low mounds.

This soil occurs on terraces along Trinity and Neches Rivers, generally well above overflow, although some small areas are subject to overflow by high water. Other small areas are adjacent to the uplands along the larger creeks of the county, where the addition of colluvial material from the uplands is largely accountable for their being above overflow. The material in some of the lower areas closely resembles Ochlockonee fine sand.

Less than 25 per cent of this soil is under cultivation. Cotton, corn, sweet potatoes, and watermelons comprise the principal crops. Cotton yields from one-fourth to one-half bale to the acre, and corn from 10 to 16 bushels in seasons of normal rainfall. Cowpeas do well, and good yields of sweet potatoes and watermelons are obtained. The soil retains moisture well.

Where forested, blackjack oak, post oak, some sand blackjack oak, elm, and hickory comprise the principal growth. In the eastern part of the county shortleaf pine and sweet gum are also found.

Current values of this land range from \$15 to \$20 or more an acre, depending on location and improvements.

## LEAF FINE SANDY LOAM

Leaf fine sandy loam consists of a layer, from 6 to 15 inches thick, of grayish-brown or yellowish-brown fine sandy loam or loamy fine sand underlain abruptly by red, stiff, heavy clay mottled with yellow and, in places, with gray. This clay is very plastic when wet and hard when dry. The red color usually decreases with depth and the gray becomes more prominent. Except in the better drained areas the subsoil, at a depth varying from 18 to 25 inches, consists of mottled gray, red, and yellow, stiff plastic clay. At a depth of 36 inches the red is commonly entirely absent, and the subsoil consists of mottled yellow and gray, or gray, heavy plastic clay. This is locally called tight land.

Leaf fine sandy loam occurs on the terraces of Trinity and Neches Rivers, particularly along the former. Typical areas are south of Trinidad, where they lie well above overflow. A few small areas in the vicinity of Stephens Lake may be inundated for short periods during exceptionally high water.

Areas of this soil are nearly level, and the drainage is sluggish or deficient. In places, strips of this soil are interlaced with very narrow strips of Irving fine sandy loam which act as drainage channels. In small rounded depressions water stands for some time after rains.

From 25 to 30 per cent of this land is under cultivation, mainly to cotton and corn. Cotton yields from one-fourth to one-third bale to the acre and corn from 10 to 15 bushels. Cowpeas yield well. Crop yields are decreased by continued dry weather, as the moisture-storing capacity of the soil is low. Constant cultivation is necessary to conserve a maximum of soil moisture.

In its virgin condition, this land is heavily forested with post oak, blackjack oak, bur oak, sweet gum, sycamore, elm, hickory, and other trees common to this region.

Current values of Leaf fine sandy loam range from \$15 to \$25 an acre.

*Leaf fine sandy loam, mound phase.*—This soil differs from typical Leaf fine sandy loam in that there are a sufficient number of low mounds to form a billowy surface. Most of the mounds are smaller than those in upland areas. At the margins there is a layer, from 12 to 20 inches thick, of grayish-brown fine sand overlying the heavy subsoil. In the center of the mounds there may be fine sand from 18 to 24 inches thick over a subsoil similar to that of Kalmia fine sandy loam, or the soil may consist wholly of grayish-brown fine sand more than 3 feet deep. The soil between the mounds is chiefly Leaf fine sandy loam, with some areas of Irving fine sandy loam.

Soil of this phase occurs on the Trinity River terraces above normal overflow and in a few small areas in the vicinity of Stephens Lake. The latter are subject to overflow during extraordinarily high water. The total area is not large, and only a comparatively small portion is under cultivation.

The surface is nearly all level and the drainage is poor, owing both to the surface relief and the heavy subsoil. The intermound soil is droughty during continued dry weather, but the mounds are better drained and retain moisture better.

Cotton and corn are the chief crops grown. Yields are lower, as a rule, than on typical Leaf fine sandy loam.

#### LUFKIN VERY FINE SANDY LOAM

Lufkin very fine sandy loam consists of a topsoil of gray or dark ash-gray very fine sandy loam from 5 to 8 inches thick, and a subsoil of gray or yellowish-gray, stiff, heavy clay which is plastic when wet. In some places, the yellowish-gray color of the subsoil vanishes at a depth less than 3 feet and the ash-gray color reappears; in others, the subsoil is gray, mottled with dark red and yellow in the upper part. Generally yellowish-brown or rust-colored iron stains are found within 3 feet of the surface, and in places small iron concretions occur where the soil and subsoil merge or in the lower part of the subsoil. In an area at Malakoff the surface material consists of gray very fine sandy loam with a few small black concretions underlain, at a depth of 5 or 6 inches, by light-gray very fine sandy loam also containing a few small concretions. This, at a depth of about 18 inches, is underlain by yellowish or ash-gray stiff, heavy clay, which becomes more yellowish with depth.

Small areas of Lufkin fine sandy loam are included with this soil as mapped. Although the main difference between these two soils is in texture, the fine sandy loam contains a high percentage of very fine sand and, in places, a fair percentage of silt.

When it is dry the soil is distinctly ash-gray, and darker when wet. Areas of Lufkin very fine sandy loam are flat, and drainage is poor. Water frequently stands on these areas for some time following rains. The soil is found in many of the flats about the heads of streams.

The area under cultivation is rather small. With drainage improved by ditching, fairly good yields are obtained, but without

improvement of the drainage condition the crop yields are restricted by moisture conditions. When thoroughly wet, the soil is boggy and if worked in this condition, it puddles and bakes, forming intractable clods that interfere with subsequent cultivation.

Areas of this soil are known locally as post oak flats, but the forest growth includes some blackjack oak, pin oak, willow oak, and elm.

Cotton and corn are the leading crops. Except in seasons of well-distributed moisture, yields are normally somewhat below those on Susquehanna fine sandy loam.

#### LUFKIN FINE SANDY LOAM

Lufkin fine sandy loam occurs mostly in small areas in the same localities as the mound phase of Susquehanna fine sandy loam. Its billowy surface makes it strongly resemble the latter soil. The chief difference between the two soils lies in the poorer drainage of the areas between the mounds on Lufkin fine sandy loam. The same stage of oxidation has not been reached in this as in the Susquehanna soil. In areas of Lufkin fine sandy loam the soil between the mounds consists of gray fine sand or loamy fine sand, from 5 to 10 inches thick, underlain abruptly by dark-gray, ash-gray, or yellowish-gray heavy clay which is very stiff when dry and plastic when wet. The subsoil, near a depth of 3 feet, is generally gray or ash gray and contains, as a rule, rust-colored iron stains and iron concretions, some of which may also be found between the soil and subsoil. The upper part of the subsoil is slightly mottled in some places with yellowish brown or rust color, and in other places with dark red. When dry, most of the soil is ash gray, particularly in cultivated areas where it is deeper, owing to leveling by cultivation and plowing. In some small areas, the soil contains enough very fine sand to make it strongly resemble very fine sandy loam.

This soil occurs on nearly level areas, and the impervious subsoil of the intermound flats, together with the flat surface, result in imperfect drainage. The mounds themselves are well drained and under cultivation retain soil moisture for a long time, though the fine sand of the mounds is subject to wind action to some degree.

Only a small portion of this land is under cultivation, chiefly to cotton and corn. Yields of cotton range from one-fourth to one-half bale to the acre and of corn from 10 to 20 bushels. Post oak, blackjack oak, and elm constitute the principal tree growth, and some hickory grows on the mounds.

#### LUFKIN FINE SAND

The topsoil of Lufkin fine sand consists of rather dark gray fine sand, faintly loamy in places, owing to the presence of organic matter. It is underlain, at a depth varying from 3 to 5 inches, by a subsoil of light-gray fine sand. In dry weather the sand tends to compact and become very hard. Gray clay is commonly present at a depth below 3 feet.

This soil occurs on flat areas, chiefly about the heads of drainage ways, in the sand-hill section. It is commonly surrounded by higher areas of Norfolk fine sand, seepage water from which keeps some of the areas wet much of the time.

This soil is not cultivated, and its total extent in the county is small. It is forested chiefly with post oak, willow oak, pin oak, myrtle, and elm, though in places it occurs as open grass-covered glades in the forest. In the seepy areas patches of myrtle closely interwoven with smilax vines are common.

#### JOHNSTON CLAY

The topsoil of Johnston clay consists of black, stiff clay which cracks badly on drying and becomes very sticky and plastic when wet. This is underlain, at a depth varying from 12 to 18 inches, by dark-brown, dark-gray, or dark bluish-gray stiff heavy clay, which either is continuous without change to a depth of 3 or more feet or shows yellowish-brown mottling in the lower part. Both topsoil and subsoil are noncalcareous.

In the bottoms of lower Cedar Creek, from a point several miles north of the Athens-Corsicana Road south to Trinity River, the soil consists of black Johnston material from 3 to 18 inches thick, over material resembling the brown Ochlockonee or the gray Bibb soils. This area was included with Johnston clay in mapping.

Johnston clay occurs almost entirely in the first bottoms of Cedar Creek. It is frequently inundated for considerable time during the winter and spring floods. For this reason the greater part has remained in forest. Less than 5 per cent is under cultivation. The forest growth consists of locust, oaks, elm, walnut, and pecan, together with other trees common to the county.

The flat or nearly level surface of Johnston clay is relieved by the depressions formed by abandoned stream channel cut-offs and lakes in which water stands most of the year. The drainage is poor, owing both to the lack of relief and the denseness of the soil.

For safe crop production this soil must be protected by levees, and fields must be ditched to assist in the removal of rain water. If plowed in the proper moisture condition the soil is easily managed, though heavy draft equipment is necessary. The soil readily acquires good tilth, and on drying, the material to a depth of 2 inches crumbles into fine fragments. The supply of organic matter is high and the soil is productive. Late planting is necessary to avoid the spring overflows. If crops are not subjected to overflow, good yields are obtained. Several hundred acres under levee protection in the northern part of the county are under cultivation to cotton and corn. Cotton yields from one-half to 1 bale and corn from 20 to 40 bushels to the acre. The best yields are obtained in years of normal moisture distribution. Sorghum for hay grows well.

In its natural state this soil is used principally for pasture. The pasture grasses consist chiefly of Bermuda grass and broom sedge.

Current values of Johnston clay range from \$10 to \$15 an acre. The values of lands under levee protection are said to range from \$100 to \$200 an acre.

#### BOWIE FINE SANDY LOAM

Bowie fine sandy loam has apparently reached a stage of oxidation between that of the Ruston and Norfolk soils, with which it is associated. The stage of oxidation is greater than in the Norfolk but not so great as that in the Ruston soils. To a depth varying from 8 to 20 inches, the material consists of grayish-brown or brownish-

gray fine sand, in places slightly loamy in the upper part. This grades through yellow loamy fine sand into yellow fine sandy loam mottled or splotched with red, which occurs at a depth varying from 14 to 24 inches. In places this subsoil is fine sandy clay. Gray mottling is present in the more poorly drained areas.

In some areas this soil is grayish-brown or brownish-gray fine sand or loamy fine sand, underlain at a depth of about 8 inches by pale-yellow or yellowish-brown loamy fine sand or fine sandy loam. This material is underlain, at a depth varying from 14 to 16 inches, by yellow friable fine sandy clay containing red ferruginous friable material and reddish splotches, especially in the middle and lower parts of the subsoil. Just above a depth of 3 feet there is some grayish mottling. Some patches closely resemble areas of Norfolk fine sandy loam, but even these contain reddish concretionary material or show reddish splotches in the lower part of the subsoil.

Areas of this soil range from nearly level to undulating. On some slopes this soil occurs between Ruston soils, at the top, and Norfolk soils, at the base. Drainage is adequate and both topsoil and subsoil are retentive of moisture. The soil retains moisture for a long period of time after rainfall.

For agricultural production Bowie fine sandy loam is regarded as the equal of the deep phases of the Norfolk and Ruston fine sandy loams. It is adapted to the same crops, and the yields are about the same. Special crops and peaches will be found to do as well as on the soils mentioned. About 50 per cent of the soil, which is of small extent in the county, is under cultivation.

#### BELL CLAY

Bell clay consists of black clay which may either continue without change to a depth of 36 or more inches or may be underlain by dark-gray or slate-colored heavy clay at a depth of about 12 inches. The topsoil is calcareous in places, and the subsoil is generally calcareous above a depth of 3 feet from the surface. In places the subsoil, below a depth of 12 inches, consists of olive-colored or yellowish-brown heavy calcareous clay containing an abundance of lime concretions. Locally, lime concretions and shells are present on the surface. Areas are nearly level or gently undulating, and the drainage is fair or good.

The total area of Bell clay mapped in Henderson County is small. The area mapped directly east of Stephens Lake is more nearly typical than any other in the county. It occurs on a high terrace well above overflow.

About 75 per cent of the Bell clay is cultivated. It is regarded as a productive soil. Cultivation is restricted by moisture conditions, as the soil clods if plowed when wet and breaks into hard clods if plowed when too dry. The surface material generally crumbles into small clods on account of the lime carbonate present in the soil.

Where forested, the growth consists of the various oaks common to the county, and of elm, hickory, locust, walnut, and pecan trees. Cotton and corn are grown, and high yields are obtained in seasons of well-distributed rainfall. Normal yields are about one-half bale of cotton and 18 bushels of corn to the acre.

The presence of soil of this type increases the value of the farms on which it occurs.

## BIBB FINE SANDY LOAM

Bibb fine sandy loam, to a depth varying from 5 to 8 inches, is fine sandy loam or loamy fine sand of gray or grayish-brown color mottled in places with yellowish brown, or rust color. The bluish-gray or gray subsoil is mottled throughout with yellowish brown, reddish brown, or rust color and varies in texture from heavy fine sandy loam to clay loam or even clay. It is mushy when thoroughly wet and resembles a true hardpan when dry. In some places, the subsoil consists of successive strata of materials varying in texture, thickness, and color, in others, dark and rust-colored concretions are numerous.

This soil occurs chiefly along Neches River and the larger creeks where the bottoms widen out or join those of the streams of which they are tributary. Areas are level or nearly so, and the drainage is very poor. Water from rains or overflows stands on the surface for long periods. Both this soil and Bibb silty clay loam occur at lower levels and are more subject to overflow than the Ochlockonee soils.

Only a small acreage of this land is under cultivation. Some of the cultivated area is protected by low levees. By late planting, damage by overflows is avoided as the low levees do not generally give sufficient protection from the high spring overflows. Cotton and corn are the chief crops, cotton yielding from one-fourth to one-half bale to the acre and corn from 12 to 18 bushels.

The tree growth of the forested areas consists of oaks, gums, sycamore, hackberry, holly, and some walnut and pecan trees. There is generally a rank undergrowth of brush. Good pasturage is provided by Bermuda and carpet grasses. The mast from the trees is utilized for hog pasture.

## BIBB SILTY CLAY LOAM

The topsoil of Bibb silty clay loam consists of bluish-gray silty clay loam, mottled with yellow or rust brown, underlain, at a depth varying from 5 to 8 inches, by light-gray or bluish-gray silty clay, mottled with pale yellow and rust brown. The soil below a depth of 20 or 30 inches is compact and impervious and, in some places, consists of plastic clay. Layers varying in color from light gray to light brown and in texture from fine sandy loam to clay loam, occur through the subsoil of these areas. Rust-colored and black concretions are present in some places, especially in the compact substratum.

This soil occurs in flat areas and depressions in the bottoms of Neches River and the larger creeks. It is the most poorly drained alluvial soil in the county. Rain and flood waters stand on it until they are removed by evaporation. None of the soil is utilized for farming.

Some small glade areas are covered with water-loving grasses, and some Bermuda grass grows on the higher areas. The forest growth consists of swamp white oak, black gum, willow oak, willow, and black and red haw. The soil is best suited to forestry and grazing. Lespedeza could be established with proper seeding.

## IRVING FINE SANDY LOAM

Irving fine sandy loam consists of gray or grayish-brown fine sandy loam underlain, at a depth of 6 or 8 inches, by gray heavy clay containing some rust-colored and yellowish mottles just above a depth of 3 feet. There is generally a sharp demarcation between

the topsoil and the subsoil. A few small areas of very fine sandy loam and of silty clay loam have been included with this soil in mapping. The soil is neutral or acid in reaction.

This soil occurs only on the terraces of Trinity and Neches Rivers. Most of the areas are small, and the total extent is not large. The surface is nearly level, except for a few minor depressions. In winter and in periods of heavy rainfall the surface is frequently covered with water, or the soil becomes saturated and boggy and very plastic and sticky. Ditching would aid drainage. During dry weather the soil becomes very hard and compact. Proper moisture conditions are essential for successful cultivation.

The greater part of this soil is forested, largely with post oak and elm. The principal crops are cotton and corn. Yields of cotton range from one-fourth to one-third bale to the acre and of corn from 10 to 18 bushels. Both cotton and corn suffer from drought in dry years, as the conservation of moisture by this soil is limited. Cowpeas and sorghum grow well.

#### PORTSMOUTH FINE SAND

Portsmouth fine sand, to a depth of about 12 inches, is dark-gray fine sand or loamy fine sand containing a large quantity of partly decomposed organic matter. When the soil is wet it appears black. The underlying material consists of gray fine sand, which fades in color to light gray or dirty white at a depth of about 3 feet. Some rust-colored iron stains and concretions of black oxide of iron are found in some places.

The total extent of this soil in Henderson County is small. It occurs at the heads and along the slopes of drainage ways in the sand-hill section of the county. The surface is generally fairly level and the soil is nearly always wet. The water table is high, owing to seepage waters from the surrounding higher hills. The high organic-matter content is due, as a rule, to wash from the hills, though the soil itself supports a fairly heavy growth of carpet grass, sedges, and other water grasses, as well as of myrtle and other shrubs. Where forested, water oak, swamp oak, pin oak, and sweet gum are the most numerous trees. This soil is nonagricultural and is used principally for pasturage for cattle and hogs.

#### SUMTER CLAY LOAM

Sumter clay loam consists of brown clay loam underlain, at a depth varying from 4 to 8 inches, by yellowish-brown or brownish-yellow clay, which is very plastic when wet and stiff when dry. This generally continues to a depth of more than 3 feet without change. In places, however, at a depth of about 3 feet, the material is olive-colored heavy clay or clay shale. Some gray mottling is present in the subsoil in some areas. Both topsoil and subsoil crumble readily upon drying, in spite of their heavy texture. This is undoubtedly due to the fact that both contain considerable lime carbonate. Lime concretions are present on the surface in places, and are generally found in the soil and subsoil. Concretions of arenaceous limestone, 6 or more inches in diameter, and fragments of this material are numerous in the lower part of the subsoil or in the substratum.

This soil is of minor extent and importance in Henderson County. It is mapped in the prairie section on slopes leading from the upland to the stream bottoms. Drainage is good. The soil erodes badly and is chiefly nonagricultural. It supports a growth of stunted elm and mesquite, with a few post oaks and bur oaks. The grass growth consists chiefly of Bermuda grass and broom sedge.

#### PEAT

Land classified as peat includes beds of partly decomposed vegetable matter. It occurs in poorly drained natural depressions where the water table remains at a high level the greater part of the year.

To a depth of 1 or 2 inches, the dark-brown fibrous material contains a small quantity of fine sand or clay washed in from the adjacent higher soils. Below that depth it may continue unmodified to a depth of 3 or more feet or may be underlain, at a depth ranging from 12 to 24 inches, by sand, clay, or a mixture of sand, clay, and partly decomposed organic matter. At the edges of the depressions the content of mineral matter is higher than elsewhere, and here the material in the few inches of soil nearest the surface, is dark brown or nearly black, is nonfibrous, and contains more or less fine sand. Layers 1 or 2 inches thick of nearly black or dark-brown somewhat fibrous and nonfibrous peat are commonly found in the brown fibrous peat where this continues to a depth of 3 or more feet. In a few places near the edges of the depressions, gray fine sand or gray clay is present at a depth of less than 3 feet.

When peat is wet the surface is springy, and when it is dry the material burns readily.

None of this land has been drained and placed under cultivation. Some carpet grass grows at the edges of depressions, but most of the land is covered with rushes, water sedges, arrow weed, water lilies, and other aquatic plants, and with clumps of myrtle. This land is generally covered with water during the winter and early spring. The areas of peat in Henderson County are comparatively small and are found as a rule in depressions in the sand-hill section.

#### SUMMARY

Henderson County, which has an area of 946 square miles, is in east-central Texas. Athens, the county seat, is about 80 miles southeast of Dallas.

The county is extensively dissected by streams, and the surface ranges from nearly level to hilly. The elevations range from 300 to 550 feet above sea level, the eastern part presenting the greatest range in elevation. The county is drained by Trinity and Neches Rivers and their tributaries. Trinity River forms the western and Neches River the eastern boundary of the county.

Henderson County lies within the general region known as the east-Texas timber belt. The western part, though now largely tree covered, was developed under prairie conditions.

Early settlement of the county began between 1835 and 1845, but real immigration did not commence until the latter date when several settlements were established. Athens, the present county seat, was settled in 1850. The population of the county in 1920 was 28,327, of which 11.2 per cent is classed as urban. The negro population

was 4,860 at that time. The greater part of the population is native white. Athens, Chandler, and Malakoff are the largest towns.

The county is served by two railroads. The highways consist of both graded and ungraded dirt roads. Some improved modern highways are being constructed.

There is no Weather Bureau station in Henderson County, but the records of near-by stations indicate that the mean annual rainfall is about 40 inches, and the mean annual temperature about 65° F. The frost-free season averages about 244 days, which is sufficient for all crops. Northers, accompanied by sudden drops in temperature, are a feature of the late fall, winter, and early spring seasons. Cool breezes from the Gulf of Mexico modify the summer extremes of temperature.

The early agriculture was influenced largely by that of the country from which the settlers came, their own needs, and the distance to markets. Cattle and hog raising were important until 1885 or later. Cotton and corn are the chief crops, but lands unprofitable for farming and bottom lands subject to serious overflow are used for livestock raising at present. Some wheat and oats are grown. Oats and rye constitute the principal winter pasturage. Bermuda grass and Johnson grass are the chief meadow grasses cut for hay. These are supplemented by Sudan grass and sorghum. Corn is topped to provide feed.

The cotton acreage in 1919 constituted more than half of the cultivated area. The average yield was 0.23 bale to the acre. The acreage of corn increased more than 10,000 acres during the years from 1909 to 1919.

Considerable attention is paid to special crops, such as small fruits and truck crops. Cowpeas are becoming more common, and their acreage should be increased.

High-class, full-blooded sires of both cattle and hogs are becoming more common, and the grade of both is being improved. Attention has lately been given to better poultry, high-class strains of which are being developed.

Recommendations for improved agriculture include crop rotations, increase in acreage devoted to cowpeas, building up of soils by incorporation of green manures, terracing to prevent erosion, and better selection of tenants.

Henderson County lies within the geological division known as the Gulf coastal plain.

Its upland soils are classified in 12 series, the terrace soils in 6 series, and the recent-alluvial soils in 4 series.



[PUBLIC RESOLUTION—No. 9]

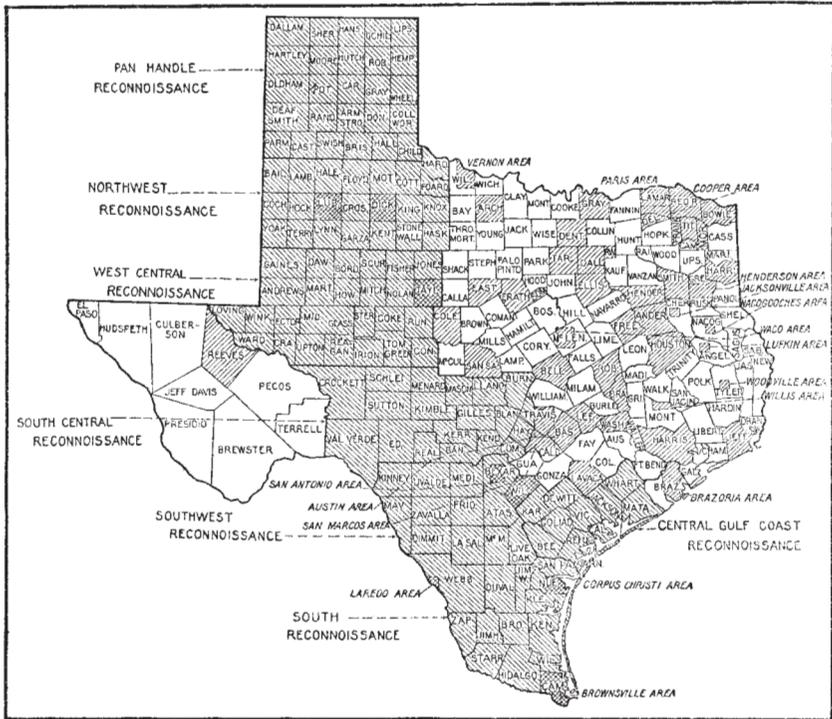
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

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

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

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils, and on July 1, 1927, the Bureau of Soils became a unit of the Bureau of Chemistry and Soils.]



Areas surveyed in Texas, shown by shading

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- (3) email: [program.intake@usda.gov](mailto:program.intake@usda.gov).

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