

# SOIL SURVEY OF HOUSTON COUNTY, TEXAS.

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## LOCATION AND BOUNDARIES OF THE AREA.

Houston County is situated in the central-eastern part of Texas. It lies about 140 miles north of the Gulf of Mexico and about 80 miles west of the Louisiana State line. It consists of a land area of 762,752 acres, or about 1,192 square miles. The county is irregular in outline, the Neches River forming the eastern and the Trinity

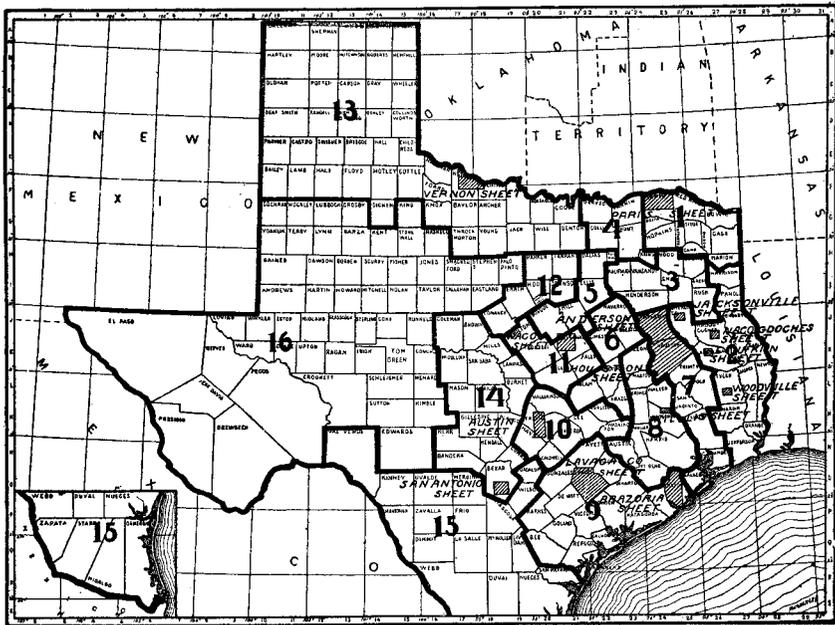


Fig. 22.—Sketch map showing location of the Houston County area, Texas.

River its western boundary. On the north lies Anderson County; on the east, Cherokee and Angelina counties; on the south, Trinity and Walker counties, and on the west, Madison and Leon counties.

## HISTORY OF SETTLEMENT AND AGRICULTURAL DEVELOPMENT.

Houston County is one of the oldest of the east Texas counties. It was formed from a part of Nacogdoches County in 1839, but in 1846 its area was reduced to form Anderson County. Probably the first

settlement in the county was at Crockett about 1835. In the early history of the State all travel from San Antonio to Nacogdoches passed through the county over the old San Antonio trail. The place where Crockett now stands became a favorite camping place with the travelers, and from a camping place it gradually grew into a town as the country round it became settled. The first settlers came from the older southern States, but in those days travel was laborious, immigration scant, and settlement extremely slow. However, with the advent of railroads and better means of transportation, the settlement of the county steadily advanced, until at present the population numbers about 30,000.

Land was easily obtained, liberal allowances of land being offered by the State to settlers. An unmarried man was allowed to homestead one-third of a league, while a married man could homestead a league and a labore.<sup>a</sup> The early settlers lived in a very primitive manner, there being no access to markets or cities except by long, tedious journeys over wagon roads. They paid little attention to agriculture, growing only the small supply of corn and vegetables necessary for the use of themselves and what little stock they possessed. After settlement of the country had begun, however, it was found that it was possible to secure a good yield of cotton on the sandy soils of the uplands and on the creek bottoms, and since that time cotton has been the principal money crop of the county. Corn, sugar cane, and small quantities of fruits and vegetables have been the other leading crops.

Before there were any railroads in the county the nearest markets were Houston, Tex., and Shreveport, La., Houston being 100 miles distant, and Shreveport farther. Cotton and live stock were at first the only products sent from the county. The cotton was hauled and the cattle were driven in small droves to these two markets. From these places the other markets of the world were easily reached by rail and water. This method of marketing was tedious and costly, but prices were good and fair profits were made. Although the county was heavily wooded, it was found that cattle and hogs could be easily raised at small cost, and for many years the production of this kind of stock has steadily increased until at present Houston County probably sends to market more live stock than any other east Texas county.

In 1874 the International and Great Northern Railroad was built through the county, bringing it in closer touch with the larger markets, and since that event the agricultural conditions in the county have greatly improved, settlement has been more rapid, and land, especially along this road, has increased in value. That part of the

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<sup>a</sup> A league is 4,500 acres, and a labore 177 acres.

county, however, which is not near the railroads is still thinly settled, and agricultural development is slower. In the eastern part of the county great forests of pine still exist, and the lumbering interests constitute an important industry. During the last few years the people living near the International and Great Northern Railroad, in the central part of the county, and along the Eastern Texas Railroad in the eastern part of the county have awakened to the possibilities of truck farming and fruit growing, and have been setting out orchards and producing early truck for the large markets. Although these interests are still in an early stage of development, the experimental stage has been passed, and the results seem to warrant the belief that they will become permanent and important factors in the agriculture of the county.

#### CLIMATE.

The climate of Houston County is temperate, and is well suited to the growing of a large variety of agricultural products. The growing season is long, and many crops may be grown during the greater part of the year. The winters, as a rule, are mild, although occasional freezes occur. The coldest months of the year are January and February. Periods of cold weather occur at irregular intervals during the winter, being caused by the cold north winds which sweep over the greater part of the State. These cold winds are known as "northers," and come up very suddenly, causing a rapid lowering of the temperature. However, these periods of cold seldom last more than three or four days. These "northers" are the outward limits of cold waves in the north and northwest. A light snow sometimes falls, but owing to the mildness of the climate, it soon melts. The summers are long, but the heat is seldom excessive, owing to the modifying influence of the Gulf.

The rainfall of Houston County is usually ample for all crops and is well distributed throughout the growing season. Excessive rainfall or long periods of drought are exceptional. Disastrous winds or hailstorms seldom occur.

There is no Weather Bureau station in Houston County. The nearest stations are located at Palestine, in Anderson County, and at Huntsville, in Walker County. Palestine is about 40 miles north of Crockett, and Huntsville is about 50 miles southwest of Crockett. The climatological data obtained at Palestine probably very fairly represents the climatic conditions in the northern part of Houston County, while the records at Huntsville are representative of the climate in the southwestern part of the county.

The following tables show the normal and annual temperature and precipitation, and the dates of first and last killing frosts at Palestine and Huntsville:

*Normal monthly and annual temperature and precipitation.*

Month.	Palestine.		Huntsville.		Month.	Palestine.		Huntsville.	
	Tem- pera- ture.	Precipi- tation.	Tem- pera- ture.	Precipi- tation.		Tem- pera- ture.	Precipi- tation.	Tem- pera- ture.	Precipi- tation.
	°F.	Inches.	°F.	Inches.		°F.	Inches.	°F.	Inches.
January .....	49.8	4.31	50.1	4.78	August .....	80.4	2.68	82.8	3.46
February .....	51.0	3.51	51.8	3.17	September .....	75.7	3.25	77.4	3.23
March .....	57.6	3.98	59.6	3.55	October .....	66.5	3.22	69.0	3.10
April .....	66.7	4.62	67.9	4.10	November .....	56.2	4.45	-----	4.23
May .....	71.3	5.84	74.9	3.90	December .....	51.4	3.81	-----	3.58
June .....	78.2	4.25	80.9	5.14	Year .....	65.5	46.51	-----	45.49
July .....	81.5	2.59	83.4	3.25					

*Dates of first and last killing frosts.*

Year.	Palestine.		Huntsville.	
	Last in spring.	First in fall.	Last in spring.	First in fall.
1896 .....	Mar. 20	Nov. 8	Mar. 20	Nov. 8
1897 .....	Feb. 27	Nov. 2	Feb. 2	Nov. 18
1898 .....	Mar. 24	Oct. 27	Mar. 5	Nov. 21
1899 .....	Mar. 28	Nov. 3	Mar. 7	Dec. 29
1900 .....	Apr. 12	Nov. 12	Mar. 17	Nov. 12
1901 .....	Mar. 6	Dec. 9	-----	-----
1902 .....	Mar. 5	Dec. 4	Feb. 16	Dec. 4
1903 .....	Mar. 1	Nov. 18	Feb. 22	Nov. 18
Average .....	Mar. 16	Nov. 14	Mar. 1	Nov. 24

PHYSIOGRAPHY AND GEOLOGY.

Houston County lies within that part of the Coastal Plain of Texas known as the East Texas Timber Belt. In general its surface is gently rolling and sloping. The general slope of the county is to the south and east. In the northeastern and northwestern parts of the county the surface is broken and hilly, which is due to erosion having worked out a drainage system whose main outlets are much lower than the surrounding country. In the central part of the county the surface is gently rolling, and, on the whole, the drainage is good. In the southern part of the county the surface, while gently rolling, is more nearly level. This classification of the topography applies to the several portions of the county in a general way, but there are local exceptions.

Houston County has an extensive and intricate drainage system. The Trinity River, on the west, and its tributaries, and the Neches

River on the east and its tributaries make the county in general a well-drained region. The tributaries of these rivers extend from the borders of the county in toward the center, each having many smaller branches which reach into all parts of the county. A few areas, however, are very nearly level, and here drainage is quite poor, though it could be greatly improved artificially, either by open ditches or tile drains.

The largest of the tributaries of the Trinity River, in the western and southern parts of the county, are the North Elkhart, Big and Little Elkhart, Cane, Lost, Kellison, Negro, Tantabogue, and White Rock creeks and Hurricane Bayou. The principal tributaries of the Neches River, in the eastern and southeastern parts of the county, are the Cypress, San Pedro, Hickory, Silver, Camp, and Piney creeks and Cochino Bayou. In the northern part of the county the creeks and branches flow during the whole year, and that region is extremely well watered. In the southern part the creeks are usually sluggish, and in the summer the most of them are quite dry.

Along the rivers the bottoms in Houston County vary in width from one-fourth mile to several miles, while on the creeks the bottoms are from one-fourth to 1 mile in width. The beds of these streams lie from 5 to 20 feet below the surface of the bottoms, but during extended periods of wet weather they are all inundated, sometimes for several days, to a depth of several feet.

In the northeastern and northwestern parts of the county, for several miles south of the Anderson County line, the creek bottoms lie from 50 to 150 feet below the surrounding rolling uplands, and the slopes are sometimes long and gentle and again precipitous and stony. Going southward through the county the topography gradually changes, the stream bottoms are nearer the surface of the surrounding country, and the slopes are more gentle. In the extreme southern part the streams are generally but a few feet below the upland.

A feature of the topography of the southern part of the county is the existence of several small prairies, whose total area does not exceed 50 square miles. These prairies are East, Tyler, Nevill's, and Mustang. They have a gently rolling surface and strongly resemble each other in soil and general structure. At one time they were probably lake beds. Throughout the central part of the county the topography inclines to be somewhat hilly, several of the higher points being locally known as mountains. Of these the most pronounced is Cooks Mountain, which is near Crockett, and which rises about 100 feet above Crockett.

According to Kennedy,<sup>a</sup> the geological formations of Houston County consist of deposits of the Recent, Quaternary, and Tertiary

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<sup>a</sup> Third Annual Report of the Geological Survey of Texas, 1891.

periods. The Recent deposits occupy a considerable extent along the Trinity and Neches rivers, and along the bottom lands forming the flood plains of the larger creeks. The thickness of these deposits probably will not exceed 20 or 30 feet. The remains found in these beds are usually stumps, branches, and leaves of vegetation now growing along the banks of the streams.

The Quaternary deposits occupy the greater proportion of the more elevated areas of the northern part of the county and some areas of the southern part. These deposits are represented by yellow, brown, and gray sands, red sandstones, gravels and conglomerate iron ores in the northern portion; siliceous pebbles, fossil woods, and prairie lands in the southern portion.

The Miocene deposits are represented by gray sands and sandy clays, shaly clays, blue sandy clays, and lignite. These deposits occupy the greater part of the southern and eastern parts of the county. A mine of lignite is operated near Lovelady, and a good local market is found for the entire output.

The Eocene deposits occupy the greater part of the northern region of the county, extending from river to river across the county, and are covered throughout their greater extent by deposits of Quaternary sands and gravels and occasionally by heavy deposits of conglomerate iron ore. The Eocene is composed of glauconitic sandstones, laminated iron ore, fossiliferous sands, green marly clay, and dark clay with lime concretions; also by gray plastic clay, sand, and fossiliferous greensand marls.

Adams<sup>a</sup> classes all the upland part of Houston County as the Eocene Tertiary. That part lying north of a line extending through the county in a northeast and southwest direction and passing through Crockett he correlates with the Lower Claiborne stage or Marine beds. South of this line is found the Jackson stage or Yegua clay; while in the extreme southeastern part of the county are found the Fayette sands.

Many borings have been made in the county in the search for oil, and though none of these has been successful a boring near Lovelady gave a fine flow of artesian water.

#### SOILS.

Houston County is a region of varied soil materials, and includes in its area of 1,192 square miles sixteen distinct types besides Meadow. The texture of these soils ranges from heavy clay to light porous sand, and only the silt loam class is not represented. Members of at least

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<sup>a</sup> Bulletin 184, U. S. Geological Survey, 1901.

four prominent Coastal Plain series are found. The following table gives the name and extent of each of the types mapped :

*Areas of different soils.*

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Lufkin fine sand.....	184,384	24.2	Yazoo loam.....	25,280	3.3
Norfolk fine sandy loam....	145,408	19.1	Orangeburg clay.....	7,488	.9
Norfolk fine sand.....	79,872	10.5	Crockett clay loam.....	5,312	.7
Lufkin clay.....	59,200	7.7	Norfolk sand.....	4,544	.5
Orangeburg fine sandy loam	57,088	7.5	Houston black clay.....	3,200	.5
Meadow.....	52,864	6.9	Sharkey clay.....	3,008	.5
Susquehanna clay.....	50,816	6.6	Yazoo sandy loam.....	2,688	.4
Wabash clay.....	48,768	6.4	Orangeburg fine sand.....	704	.1
Susquehanna fine sandy loam.....	32,128	4.2	Total.....	702,752	-----

#### NORFOLK SAND.

The Norfolk sand consists of about 12 inches of sand, composed of 50 per cent of the medium and coarse grades, and 30 per cent fine sand. The color of the first few inches is gray, but it gradually changes into yellow with depth. The subsoil from 12 to 36 inches is a yellow sand, coarse to medium in texture, and this material sometimes extends to a depth of 40 feet. The Norfolk sand is a very loose and incoherent soil, but where newly cleared it often contains enough organic matter to give it a somewhat loamy texture. By exhaustive cultivation this organic matter is soon dissipated.

There are only a few small areas of this type in Houston County. The largest bodies are located in the vicinity of Grapeland and in the northern part of the county. They are usually surrounded by areas of the Norfolk fine sand, which occupies a lower elevation. The surface is very gently rolling, and the surface drainage is good, while the texture of the subsoil admits of a rapid passage downward of any excess of soil water. The outward limits of this soil are often marked with springs which form stream heads.

The Norfolk sand is a sedimentary soil, and probably owes its origin to beach deposits. The sand has probably been reworked considerably by the wind since its deposition.

The crops to which this soil is adapted are peaches, small fruits, grapes, berries, and many kinds of vegetables. It is considered a good trucking soil, and is especially suited to sweet potatoes, cantaloupes, and watermelons. Owing to the comparatively slight retentiveness of moisture it is not so well adapted to general farm crops. It is an early soil and is easily worked at all seasons, rarely ever being too wet for cultivation.

Up to a few years ago the only crops grown on this type of soil were cotton and corn, with a few vegetables and some fruit for the use of the farmer and his family. In recent years the farmers living near the railroad have begun to produce some early truck for shipment, while extensive peach orchards are being planted. When first cleared, in favorable seasons, the Norfolk sand will produce from one-fourth to one-half bale of cotton and 15 to 25 bushels of corn per acre. Sweet potatoes yield 100 to 150 bushels per acre, tomatoes 100 bushels, watermelons 1 carload, and cantaloupes one-fourth carload per acre. Plums and berries do well. Within a few years, however, if no attempt is made to maintain the productiveness of the soil, the yields gradually become less, probably because of loss of organic matter. The deficiency may be easily remedied by the plowing under of cowpeas.

The uncultivated soil is covered with a natural growth of "sand-jack" oak, with some black-jack and post oak. This type of soil may be bought for \$5 to \$15 an acre, depending upon the location and state of improvement.

The following table shows the results of mechanical analyses of typical samples of the Norfolk sand:

*Mechanical analyses of Norfolk sand.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
12943.....	Soil.....	0.1	10.6	40.0	29.5	6.1	9.7	3.6
12944.....	Subsoil....	.1	30.0	39.0	29.1	5.3	9.3	3.9

NORFOLK FINE SAND.

The Norfolk fine sand consists of about 10 inches of a fine, somewhat loamy sand, gray on the surface, but changing to yellow at the depth of a few inches. The subsoil is a yellow fine sand which, at a depth of from 3 to 20 feet, passes into a yellow sandy clay.

Areas of this type are found in all sections of the county, but the largest one is in the northern part of the county, extending from the Anderson County line to several miles south of Grapeland, on the International and Great Northern Railroad. The surface in general consists of gently rolling uplands, having a general elevation of 400 to 500 feet above sea level, and the type is one of the best drained soils in the county. The rolling surface allows the rapid removal of surface water, while the sandy subsoil permits the ready movement of the soil water. The type may be cultivated under a wide range of moisture conditions and is rarely too wet to plow. It is sedimentary in origin, being the remains of old beach deposits of Tertiary age.

The Norfolk fine sand is especially adapted to the growth of early

truck crops and is more productive than the Norfolk sand. Grapes, sweet potatoes, and melons do especially well, as do small fruits, such as plums and berries. Peaches do fairly well, but the trees, it is believed, will be comparatively short lived on this type.

In Houston County this type has for years been chiefly utilized for general farming purposes. Cotton, the staple crop, in good seasons yields from one-third to one-half bale per acre. Corn yields at the rate of 15 to 25 bushels per acre. While the adaptation of this soil to the production of vegetables and fruit has long been recognized by the farmers, except for home use it has been utilized for growing truck only near the railroad.

The Norfolk fine sand is deficient in organic matter, although when first cleared it has a small accumulation, and when cropped for several years this is removed and the land deteriorates in productiveness. Organic matter could be added and a higher degree of productiveness maintained by the plowing under of such crops as cowpeas.

Where this type is uncultivated its natural growth consists principally of "sand-jack" oak, with some hickory, "black-jack" and post oak. These oaks, especially the "sand-jack," produce good yields of mast, which is utilized to a considerable extent as feed for hogs.

During recent years some attention has been paid to the production of early truck for shipment to northern markets. The large area of this soil in the northern part of the county is the one upon which this interest has developed, the extension taking place along the International and Great Northern Railroad. The truck growers have been generally successful, and there seems to be no reason why the industry should not become much more important than at present. From 150 to 200 bushels of sweet potatoes, 50 bushels of Irish potatoes, and 100 bushels of tomatoes per acre are fair average yields, and good yields of melons and cantaloupes are also secured.

At the time of making this survey land composed of the Norfolk fine sand, near enough to the railroad to make it available for trucking, could be bought for prices ranging from \$5 to \$15 an acre, depending upon the state of improvement.

The following table gives the average results of mechanical analyses of typical samples of the Norfolk fine sand:

*Mechanical analyses of Norfolk fine sand.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
11435, 12945, 12947.	Soil .....	0.0	3.1	9.3	58.6	9.1	14.1	5.1
12946, 12948. ....	Subsoil .....	.0	2.4	7.9	60.3	8.4	12.2	8.2

## NORFOLK FINE SANDY LOAM.

The soil of the Norfolk fine sandy loam consists of a loamy fine sand, ranging from 12 to 30 inches in depth, the average being about 24 inches. The soil for a few inches is gray, but with increasing depth it gradually assumes a pale yellow color. The subsoil consists of a yellow fine sandy loam grading into a sandy clay. The soil and subsoil often contain a small amount of fine sandstone fragments.

The Norfolk fine sandy loam occupies a large part of the county, and is also an important soil west of the International and Great Northern Railroad, in the southwestern part of the county. The largest connected areas are located south of Augusta and Neches, while other large bodies occur southeast of Reynard and around Porter Springs.

The soil occupies a large proportion of the rolling uplands of the county. The surface for the most part is gently rolling, but some areas in the western part of the county are nearly level. The level areas are usually in close proximity to areas of the Lufkin clay or Susquehanna clay, and sometimes the soil merges gradually into these types.

Owing to its rolling and gently sloping topography the greater part of the Norfolk fine sandy loam has excellent surface drainage. The soil itself is of such a loose texture that water readily percolates through it, and in general the underdrainage is good. On the other hand, the sandy clay subsoil is capable of retaining a considerable supply of water during extended periods of dry weather, and the crops on this type withstand drought very well.

The Norfolk fine sandy loam has been formed from the sandy clays of the Jackson stage of the Eocene Tertiary. Erosion has influenced considerably the formation of this soil.

Although the texture of this type of soil is too light for the best results in general farming, it is nevertheless well adapted to the production of a wide range of agricultural products. It is especially adapted to truck, to some extent to peaches, and to a variety of small fruits. In general farming the principal crops grown are cotton and corn, with some oats. Vegetables, tree fruits, and small fruits are grown in a small way, and principally for home consumption. In favorable seasons cotton yields from one-half to three-fourths bale, and corn from 20 to 30 bushels per acre. The yield of oats is moderate, but as the crop is not thrashed definite figures can not be obtained.

This soil is locally called "gray land," and is esteemed by farmers on account of its relatively high productiveness, ease of cultivation, and general utility. The soil responds quickly to fertilization, the effects of which are said to be lasting.

In its virgin state the Norfolk fine sandy loam supports a forest of "black-jack" oak, post oak, hickory, and pine, with other miscellaneous small growth.

Some areas of this soil, located near the railroad, are valued at from \$5 to \$20 an acre, while those some distance from the railroad may be bought cheaper, depending upon the state of improvement and the value of the timber growth. Where this soil has been used for trucking it has been found to produce, without fertilization, 60 to 100 bushels of Irish potatoes, 100 to 150 bushels of tomatoes, and 200 to 300 bushels of sweet potatoes per acre, and other truck crops in proportion. Handling the soil as is generally done in older trucking districts, these yields should be increased decidedly.

The following table gives the average results of mechanical analyses of the soil and subsoil of the fine earth of the Norfolk fine sandy loam:

*Mechanical analyses of Norfolk fine sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
12949, 12951	Soil	Tr.	1.2	3.8	60.2	18.5	11.9	5.7
12950, 12952	Subsoil	Tr.	.2	2.1	46.9	10.7	6.2	33.

#### ORANGEBURG CLAY.

The Orangeburg clay consists of 0 to 4 inches of red, fine sandy loam, underlain by a heavy though slightly sandy clay. Considerable of the type has the clay exposed on the surface, and in fact, little of the type has as much as 4 inches of surface soil. The surface is usually partially covered with ferruginous sandstone fragments, varying from one-fourth inch to several inches in diameter, and like material also occurs throughout the soil and subsoil.

This soil is very limited in extent. Small areas of it are found in the northeastern and northwestern parts of the county, in the vicinity of Augusta, Weches, and Dalys, and in the north-central part around Oriole.

The topography of the Orangeburg clay consists usually of rather steep slopes. These slopes lie between the Norfolk fine sand and the Orangeburg fine sandy loam and are generally denuded of the surface soil by the action of erosion, the soil covering becoming deeper as the slope becomes more gentle, until it merges into the Orangeburg fine sandy loam. Owing to the character of surface the Orangeburg clay is excessively drained, as is evidenced by its usually eroded condition. During dry weather the soil becomes very hard and bakes so that cultivation is difficult.

The Orangeburg clay is a sedimentary soil, derived from Eocene marl deposits, the weathering of which has taken place to a considerable depth. Later erosion has been an important factor in producing the type.

Owing to the fact that most of this type has had its soil removed by erosion little of it is in cultivation. The most of it is covered with a natural growth of red oak, post oak, black-jack oak, and hickory. Where typical it is well adapted to a variety of products. It is quite probable that the better areas of the Orangeburg clay would produce a high-grade domestic filler tobacco.

The Orangeburg clay when cultivated is utilized principally for the production of cotton and corn. In good seasons it produces from one-half to three-fourths bale of cotton and from 20 to 35 bushels of corn per acre. Oats will yield at the rate of 40 bushels per acre. The best phases of the soil would probably produce good yields of wheat. Peaches do well and other fruits would doubtless thrive. It is known as a very early soil, and early vegetables are easily grown. Of course all these statements apply to the areas having a good depth of sandy surface soil and not to the eroded and very stony areas, which constitute the greater part of this soil in the area.

The areas of this type, occurring as they do in long, narrow strips and on usually steep slopes, have no separate money value, but are sold in connection with other adjacent soils.

The following table gives the average results of mechanical analyses of typical samples of the fine earth of the soil and subsoil of the Orangeburg clay:

*Mechanical analyses of Orangeburg clay.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
12957.....	Soil.....	1.4	3.1	3.7	40.6	18.4	16.2	16.6
12958.....	Subsoil....	.6	2.0	2.4	25.3	10.9	11.1	47.1

ORANGEBURG FINE SANDY LOAM.

The Orangeburg fine sandy loam consists of a red, brown, or gray fine loamy sand or fine sandy loam, with a depth of 4 to 15 inches, underlain by a rather heavy red sandy clay. The soil often contains from 1 to 20 per cent of small ferruginous sandstone fragments, and these same fragments occur to some extent in the subsoil. The greater part of the type has a red surface soil and is locally known as "red land," or where the sandstone fragments are abundant, as "red gravelly land."

The Orangeburg fine sandy loam is found mainly on the uplands in the northern and central parts of the county. Large areas are situ-

ated in the vicinity of Dalys, Reynard, and Crockett. The topography is rolling to gently sloping, the surface rarely being level. The soil often occupies the broad and gentle slopes leading down to the larger creek bottoms. The surface is nowhere so rough as to hinder cultivation.

The surface drainage of the Orangeburg fine sandy loam is very good. The gentle slopes allow a ready but not too rapid flow of surface water and erosion is seldom severe, and the light open texture of the soil admits a ready downward passage of soil water. The clay subsoil is retentive of water, and with thorough cultivation the soil retains enough moisture to supply the growing plants during all but the most extended droughts. The land can be worked a short time after ordinary rains and does not become so saturated as to make cultivation impracticable except in extremely wet periods.

The Orangeburg fine sandy loam is derived from marine deposits of the Jackson stage of the Eocene. The removal of the finer particles of the surface soil in the drainage waters has given the light fine sandy loam covering, resting on the original material, a sandy clay, as subsoil.

This type of soil is the strongest and most productive general farming soil in the uplands, and one adapted to a wide range of crops. It responds quickly to good cultivation, being retentive and durable. That it will produce a cigar filler tobacco of excellent aroma and good body has been demonstrated, and that it is also especially adapted to the production of peaches and pears and truck is well known. It is probably the earliest soil in the county and therefore a valuable type to use in the production of vegetables for the northern markets.

Most of the Orangeburg fine sandy loam heretofore has been utilized for general farming purposes, cotton and corn being the principal crops. In favorable seasons cotton yields one-half to three-fourths bale and corn from 25 to 40 bushels per acre. Most of the areas are too far from the railroad to allow best results in truck farming, though in the central part of the county there are relatively large bodies that might be used in this industry. While little trucking has been undertaken on this soil as yet, the results have generally been satisfactory. The principal truck crops grown commercially up to this time are Irish potatoes, yielding from 100 to 150 bushels per acre, tomatoes from 100 to 150 bushels per acre, and cabbage, onions, and sweet potatoes in proportion.

The greater proportion of this soil is in cultivation. The uncultivated land is covered with a forest growth of red oak, black-jack oak, hickory, and some smaller growth. While the most highly prized soil in the county it can be bought for from \$6 to \$30 an acre, depending upon the distance from the railroad and the state of improvement.

The following table gives the average results of mechanical analyses of the fine earth of typical samples of soil and subsoil of the Orangeburg fine sandy loam:

*Mechanical analyses of Orangeburg fine sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
12953, 12955	Soil	0.9	1.2	3.6	54.6	15.6	14.5	9.5
12954, 12956	Subsoil	.2	1.0	2.1	26.0	12.8	13.9	42.9

ORANGEBURG FINE SAND.

The Orangeburg fine sand consists of from 16 to 36 inches of a red or gray loamy fine sand, underlain by a very sandy red clay or heavy red sandy loam. The soil and subsoil contain small amounts of small ferruginous sandstone fragments or gravel.

The type of soil is limited in extent, one small area being located in the western outskirts of Crockett, and several other small areas, of but few acres each, in the central part of the county.

The Orangeburg fine sand is a very gently rolling and high upland soil. It is well drained on the surface, and the subsoil retains moisture quite well. While the soil is not as productive as the Orangeburg fine sandy loam, it is similar in topographic and drainage features.

This type of soil is derived from the same material as the Orangeburg fine sandy loam, the fine material having in these areas been removed to a greater depth.

The Orangeburg fine sand, although not so strong as the Orangeburg fine sandy loam, is well adapted to a variety of crops. It is probably best adapted to fruit and truck farming, although fair yields of other crops are produced. It is quite probable that this soil is adapted to the production of a high grade of domestic wrapper and filler tobacco.

With good seasons one-third to two-thirds of a bale of cotton and 20 to 25 bushels of corn per acre can be produced on this soil. Large yields of all kinds of vegetables and small fruits are produced. However, owing to the limited extent of this soil in Houston County, it is not an important type.

SUSQUEHANNA CLAY.

The soil of the Susquehanna clay consists of a gray fine sandy or silty loam having an average depth of 6 to 8 inches and being usually free from stone or gravel. The subsoil consists of a heavy red clay, very impervious, and having a rather peculiar greasy feel. This subsoil may be mottled with gray immediately below the soil, or it may grade into a mottled red and gray clay at a depth of from 24 to

36 inches. The proportion of gray clay increases with depth, and at a depth of several feet it is often distinctly stratified. On the surface of the soil small quantities of sandstone fragments or smooth, water-worn quartz gravel are occasionally found. Sometimes the subsoil consists of a heavy yellow clay, which, at a depth of 18 to 24 inches, grades into a heavy mottled yellow, red, and gray clay.

Large areas of the Susquehanna clay are situated in the central part of the county, in the vicinity of Crockett, and west of Crockett there is an extended area containing 15 or 20 square miles. Just south of Belott there is another large area, and the type also occurs in the vicinity of Porter Springs, in the western part of the county. A large and important tract is found in the extreme eastern part of the county northeast of Ratcliff. Small areas are located throughout the central part of the county.

The greater proportion of the Susquehanna clay occupies flat, wooded areas, although some of it adjacent to the streams has a rather rolling topography. It is locally known as "post-oak land," or "post-oak flats."

The Susquehanna clay on the whole is not well drained, although it is so situated that it may be easily drained, either by shallow ditches or by the use of tiles. While streams rarely flow through the areas, there are many which owe their origin to the surface water flowing from this type. These streams are intermittent, but after heavy rains they become swollen with the surface water, little of the rainfall finding its way into the heavy clay subsoil.

The Susquehanna clay has been derived from the underlying clays. These clays were deposited in quiet waters and probably represent a transition from the Jackson to the Lower Claiborne stage of the Eocene.

The uncultivated areas of this soil are covered with a heavy growth of post oak, with some pin oak and small pine. They also support a good growth of wild grass, which is valuable for grazing. The type, it is said, will give a better yield per acre of cotton, where the boll weevil is active, than any other soil in the county, excepting possibly the Lufkin clay. This is due to the fact that the stalk does not make a rank growth, and the rays of the sun penetrate the foliage of the plant, affording the insects no protection from the hot sun, and also to the fact that the ground becomes very hard in dry weather, which, it is claimed, proves disastrous to the weevils, preventing their escape from the hot sun by entering the soil.

The Susquehanna clay is not cultivated to any great extent. Its best yields are obtained only after the land has been in cultivation for two or three years, and, in case of the poorly drained areas, by artificial drainage. In favorable seasons a yield of one-half to three-fourths bale of cotton and 25 to 35 bushels of corn per acre can be

secured. Well-drained areas of this type will produce fair yields of peaches, pears, and vegetables. The Susquehanna clay is valued at \$3 to \$10 an acre.

The following table gives the average results of mechanical analyses of the soil and subsoil of the Susquehanna clay:

*Mechanical analyses of Susquehanna clay.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
12939.....	Soil.....	1.1	1.7	0.8	7.7	11.4	40.3	37
12940.....	Subsoil....	1.7	2.3	.6	6.0	7.6	23.0	58.8

LUFKIN FINE SAND.

The Lufkin fine sand consists of about 10 inches of a gray fine silty sand, underlain by a subsoil of much the same color and texture to a depth of 36 inches. At a depth of from 36 inches to 6 feet the underlying material is a heavy gray or mottled gray and yellow clay, which at lower depths is often stratified. Quartz gravel, rounded and smooth, are sometimes found on the surface or just at the line of contact of the sand and clay several feet beneath the surface, and in the latter position silicified wood is often found.

There are some areas of this soil that are low lying and flat, and here the silt content is larger, the soil somewhat darker colored, and the subsoil somewhat sticky and often mottled with yellow. This heavier phase is found in Nevills, Tyler, and East prairies, and elsewhere as low-lying pine-woods land.

The Lufkin fine sand exists in large connected areas, covering the greater proportion of the southern part of the county and extending over the line into Trinity County. Lovelady, Kennard, Holly, Weldon, and Antioch are surrounded by large areas of this soil.

The Lufkin fine sand occupies gently rolling and nearly level uplands, having an elevation of 200 to 400 feet above sea level. The surface drainage is usually adequate, although considerable areas, level or slightly depressed, become saturated during heavy rains, and the water from these tracts drains off very slowly. The drainage conditions would be greatly improved by ditching. Many small streams originate in this soil, and, combining, form large sluggish streams with broad bottoms, which overflow frequently during the spring, the water moving off very slowly.

The Lufkin fine sand, which is sedimentary in origin, is believed to be derived from the Fayette sands. It is not improbable that the prairie areas of the type were within comparatively recent times the beds of lakes or marshes subject to long-continued inundation, and that the sandy material forming the soil was washed from the surrounding land into these lakes or depressions.

The greater part of the Lufkin fine sand is covered with a forest of pine and an admixture of black-jack oak, red oak, and hickory. The prairie areas, however, are practically all under cultivation. Much of the pine timber is quite valuable.

The Lufkin fine sand is easily tilled usually, though some of the low areas become rather hard in dry weather. It responds readily to fertilization and is much improved by the plowing under of leguminous crops.

It is not a very early soil, though the poorly drained areas can be improved in this respect by ditching. While used mainly for cotton and corn, it is best adapted to fruit, truck, and sugar cane. Cotton yields from one-half to two-thirds bale, corn from 12 to 25 bushels, and sugar cane from 150 to 300 gallons of sirup per acre. Small quantities of fruit and vegetables are grown for home use. Peaches do well, but it has been the experience of some that the trees are short lived. After two or three years of cultivation the soil declines in productiveness unless it is manured. This is particularly the case where sugar cane is the crop grown.

The greater part of this type is not near the railroads, for which reason it has not been possible to develop the trucking and fruit-growing industries to any great extent. However, the farmers in the eastern and southern parts of the county, in the vicinity of the International and Great Northern Railroad, and also in the region about the Eastern Texas Railroad, have begun to grow such truck as tomatoes and potatoes for shipment, with good results.

The timbered land of the type is valued at \$5 to \$8 an acre, and the improved land at \$10 to \$15 an acre, depending largely upon the location and distance from railroads.

The following table gives the results of mechanical analyses of the soil and subsoil of the Lufkin fine sand:

*Mechanical analyses of Lufkin fine sand.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
12174.....	Soil.....	0.2	0.3	1.0	25.2	56.5	15.4	1.3
12175.....	Subsoil.....	.0	.4	1.0	28.5	52.4	15.2	2.3

SUSQUEHANNA FINE SANDY LOAM.

The Susquehanna fine sandy loam consists of 8 to 20 inches of a gray fine sandy loam, underlain by a heavy mottled red and gray clay which has a peculiar greasy feel. Usually the gray color in the subsoil increases with the depth. The soil is generally free from stones, but sometimes a small quantity of sandstone fragments or smooth quartz gravel occurs on the surface and throughout the profile.

This type of soil exists in some large and small areas throughout the central and eastern parts of the county. The largest connected areas are located in the eastern part of the county near Tadmor. The topography is usually gently rolling, and the type often occupies gentle slopes adjacent to creek bottoms, and in this case has a surface similar to that of the Orangeburg fine sandy loam. Many small bodies of but a few acres each occur as slightly elevated ridges or moundlike areas.

Owing to the rolling or sloping surface the type is usually well drained. The subsoil is a very impervious clay, which retains water for a long time. This, together with the fact that the sandy surface soil, if cultivated properly, acts as a kind of mulch during dry weather, enables the crop to withstand drought fairly well.

The subsoil of the Susquehanna fine sandy loam is probably derived from the weathering of the Yegua clays, or Lower Claiborne, while the sandy surface soil is probably the remains of the superimposed Fayette sands.

This type is a productive soil and adapted to a large number of crops. The principal crops grown are cotton and corn. In favorable seasons cotton will yield one-half to three-fourths bale and corn from 20 to 30 bushels per acre. Peaches and pears, as well as all kinds of small fruits and vegetables, make good yields, but as much of this type is distant from the railroads little of it is utilized for the production of these crops.

The natural growth of this type of soil is black-jack oak, post oak, hickory, and pine.

The Susquehanna fine sandy loam is valued at \$5 to \$20 an acre, depending upon situation with regard to markets and transportation facilities and on the character and condition of the improvements.

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

*Mechanical analyses of Susquehanna fine sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
12935.....	Soil.....	0.1	0.3	0.2	54.4	23.9	15.7	5.2
12936.....	Subsoil....	.2	.2	.1	27.7	13.5	17.1	41.4

WABASH CLAY.

The soil of the Wabash clay consists of about 12 inches of a very dark drab or black clay, underlain to a depth of several feet by a heavy clay which usually has the same color as the soil, but which sometimes is a brownish-yellow or mottled yellow clay. The soil and subsoil are free from stones or gravel. Occasional small areas near

the river are slightly more sandy, but the sand content is never so great as to modify materially the marked clayey texture of the soil.

This type of soil is found in the western part of the county, and extends from the northern to the southern boundary in an almost continuous strip of low, flat bottom land, from one-fourth to several miles in width, along the Trinity River and between that stream and the uplands. The topography is very nearly level, although the land near the river banks is usually slightly higher than that farther back, making large areas of land slightly basin shaped.

Owing to this level and depressed surface the type is rather poorly drained, and in rainy seasons or after overflows the soil remains for some time too wet for cultivation. A number of creeks and branches flow through the bottoms and offer facilities for drainage by ditching. At present the water all drains off without assistance, so cultivation is possible without artificial drainage, but many areas could be cultivated to better advantage if a system of ditching or tile draining were introduced. Overflows do not occur every year and sometimes not during several years in succession. They may occur, however, at any season of the year, though seldom, except during the winter and early spring months, and even then the water may cover only a small part of the type. Usually the floods recede in time to allow crops to be grown. The soil is inundated for periods ranging from a day to several days, and the depth of water ranges from a few inches on some of the higher lying areas to several feet in the basins next the uplands.

The Wabash clay is alluvial in origin and is derived from the deposition of mineral and organic matter contained in overflow waters of the Trinity River. Most of the materials come from the Black and Grand Prairie regions of north Texas. The decay of vegetable matter, such as leaves, etc., has given a generous admixture of organic matter in the soil and has contributed largely to its productiveness.

The Wabash clay is a very strong and productive soil, and although a large percentage of it is still uncultivated some large plantations consist largely of this type. Where uncultivated it is covered with a heavy growth of ash, elm, pecan, burr oak, and other trees, while some rather open areas, locally called "prairies," have a scattering growth of thorn apple. A good growth of mesquite grass is sustained on this type. This soil is especially adapted to the production of cotton and corn, but since the boll weevil has appeared much damage to the cotton crop is done by the pest, which is thought to be due to the luxuriant growth of the cotton stalk, which shades the ground and protects the weevil from the hot sun.

The crops grown on the Wabash clay consist chiefly of cotton and corn, with the following yields in good seasons: Cotton, 1 bale or

more per acre; corn, from 40 to 70 bushels per acre. The yield of cotton stated can be secured only where the boll weevil is not active. The corn yields would be higher if more attention were paid to proper cultivation.

The excellent grazing and heavy yield of mast on the unimproved soil makes the Wabash clay valuable for stock raising. A considerable number of cattle and hogs are marketed from these river bottoms yearly. Alfalfa would probably do well on the best drained areas.

The Wabash clay at present has a low valuation, owing to its distance of 14 to 20 miles from the railroads, and may be bought in large tracts at \$3 to \$10 an acre, depending upon the state of improvement.

The following table gives the average results of mechanical analyses of the samples of the soil and subsoil of the Wabash clay:

*Mechanical analyses of Wabash clay.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
12965, 12967	Soil	0.0	1.1	1.3	6.3	3.5	33.9	53.2
12966, 12968	Subsoil	Tr.	1.1	.8	4.4	2.8	31.8	56.6

YAZOO SANDY LOAM.

The soil of the Yazoo sandy loam consists of about 12 inches of brown sandy loam, underlain by a brown light sandy clay. The texture is not uniform, and the soil is not typical in this county, as it is made up of heterogeneous mixtures of sand with the Wabash clay, the surface soil usually being more sandy than the subsoil.

The Yazoo sandy loam occurs in a few small areas in or near the outward margins of the Trinity River bottoms, the largest areas being situated near Clapps Ferry, in the southwestern part of the county. The areas are associated with the Wabash clay and the Sharkey clay.

The topography of the Yazoo sandy loam varies from level to very gently rolling, the surface being slightly higher than the surrounding Wabash clay. The drainage is fairly good, although the surface may be overflowed for a short time in unusually high floods.

The Yazoo sandy loam is formed in the same way as the Wabash clay, with the difference that the suspended material was deposited from more swiftly moving currents. Some areas of this soil have been formed by the sand of the immediate uplands being washed down onto the Wabash clay.

This type of soil is adapted to the production of cotton and corn. Cotton will yield from  $\frac{3}{4}$  to 1 bale, and corn 30 to 50 bushels per

acre. These yields show the type to be naturally productive, though it is not so desirable as the Wabash clay. Vegetables and fruit should do well upon it, but for these crops the sandy soils of the uplands are better. The Yazoo sandy loam is relatively unimportant agriculturally, because of its limited extent. It is held at about the same price as the Wabash clay.

#### YAZOO LOAM.

The Yazoo loam consists of a brown loam or silty loam, sometimes rather heavy in texture to a depth of about 12 inches, underlain by a heavy brown loam or clay loam, and again extending to a depth of 3 feet or more with little change of texture. The heavy loam phase is found only in the Trinity River bottoms. The river bottom phase is very limited in extent, the most of it being situated near Clapps Ferry in the southwestern part of the county. The greater part of the type occupies the broad bottoms of the Hurricane Bayou, Tantabogue, White Rock, Gail, Cane, and other creeks in the southern part of the county.

The surface is level and usually low lying and the water stands on it for a considerable time after floods, though the natural drainage is such as to fit the land for cultivation. Crops produce the best, however, on areas where the drainage is assisted by open ditches. The creek bottoms are overflowed much oftener than the river bottom, but the areas of this type are covered with the water for only a few hours at a time.

The Yazoo loam is alluvial in origin, being derived from the deposition of sediment from rather more swiftly moving overflow water than that from which the Wabash clay was laid down.

The soil is essentially adapted to the production of cotton and corn, and though the boll weevil is very destructive these are the two principal crops grown. Cotton when not attacked by the weevil yields about 1 bale per acre and corn from 40 to 60 bushels per acre. On the lighter-textured creek-bottom areas sugar cane is grown, yielding from 200 to 400 gallons of sirup per acre.

Some of the Yazoo loam is well located with reference to transportation facilities, while other areas of it, especially those in the river bottoms, are from 15 to 20 miles from the railroad.

A great part of this type of soil is not in cultivation, but is covered with a heavy growth of sweet gum, pin oak, water oak, ash, elm, etc. It brings from \$5 to \$10 an acre. In some localities it is valued more highly than the adjacent upland soils.

#### LUFKIN CLAY.

The Lufkin clay consists of from 3 to 8 inches of a gray silty or fine sandy loam, underlain by a heavy gray or mottled gray and yel-

low clay. The soil occasionally contains a small amount of iron concretions. Considerable quantities of siliceous gravel and silicified wood are found on the surface in certain localities. This soil is locally termed "post-oak flats," or "post-oak swags," from the timber growth and topography.

The Lufkin clay exists in many large and small areas in the western and southern parts of the county. The "post-oak swags" are located in the western part of the county on the uplands near the Trinity River bottoms. Some areas are found in Nevills Prairie in the southwestern part of the county, and here the subsoil is sometimes quite dark in color. In the vicinity of Lovelady also some large areas occur.

This type of soil usually occupies low, flat, and poorly drained areas, although sometimes the surface is gently rolling. The "post-oak swags" in the western part of the county are low basin-shaped areas, which, after heavy rains, form the beds of small lakes.

The surface drainage of the Lufkin clay is generally poor, while the heavy clay subsoil is very impervious and allows little or no passage of water downward, causing water to stand on the surface for days at a time. Many areas may be easily drained by ditching, as numerous small streams, which slowly drain the water from the surface, are available as outlets. Tile drainage would be of great benefit, but ordinarily ditching would be sufficient.

The Lufkin clay has been derived from the underlying clays. Kennedy considered these clays as lacustrine in origin, probably representing old lake beds, which at a still earlier time formed a part of the bed of some river.

Some small areas of this soil on the rolling prairies have had the surface soil removed by erosion, and here the productiveness of the soil is greatly impaired. These eroded spots are termed "putty land." A large proportion of the type is not in cultivation, but is covered with a heavy growth of post oak, interspersed with small pine and in the lower places some pin oak.

On account of the poorly drained condition of the Lufkin clay it was for a long time considered almost worthless agriculturally, but in recent years the true value of the soil and its natural productiveness have begun to be appreciated. When first cleared it is in a sour and cold condition, but after two or three years of cultivation it produces quite well, the improvement being mainly due to the aeration of the soil effected through the removal of the excess of water.

It has been found that this soil, like the Susquehanna clay, will produce some cotton in spite of the boll weevil, which is explained by the lack of protection afforded the insects on account of the small

growth of the cotton stalk and by the compact condition of the soil. The principal crops grown are cotton and corn, with some oats. In good seasons cotton yields one-half to three-fourths bale, corn from 20 to 30 bushels per acre, and oats in proportion. Peaches, small fruits, and vegetables do fairly well on this soil, but it is not best adapted to these crops.

Much of this type is far from the railroad. It is valued at \$3 to \$10 an acre, depending upon location and improvements.

The following table gives the average results of mechanical analyses of samples of the soil and subsoil of the Lufkin clay:

*Mechanical analyses of Lufkin clay.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
12170, 12172, 12959.	Soil .....	0.2	0.5	0.7	18.8	30.0	34.9	14.5
12171, 12173, 12960.	Subsoil ....	.1	.2	.4	11.6	18.7	27.8	40.5

CROCKETT CLAY LOAM.

The Crockett clay loam consists of 12 to 18 inches of a dark-brown or black clay loam, underlain by a mottled drab and red, and sometimes yellow, clay loam. The soil and subsoil contain a small proportion of fine, smooth gravel or iron concretions. At a depth of several feet is found a brittle gray material, which has much the same texture as soft soapstone rock and which is sometimes stratified.

Only a few areas of the Crockett clay loam are found in Houston County, the largest of which, containing between 4 and 5 square miles, occurs several miles southwest of Crockett, forming the greater part of Mustang Prairie. Two other smaller areas are found about 1 mile southeast of Crockett. Some of this type is also found near Percilla and Augusta, in the northern part of the county.

The topography of the soil is gently rolling to level, and surface drainage is fairly good, though some areas could be improved by ditches or tile drains. However, the type can be successfully cultivated without artificial drainage.

The origin of the Crockett clay loam is not well understood, but it is probable that the soil was formed by the weathering of some calcareous material, perhaps an impure limestone. It seems to have many points in common with the Houston black clay. It often merges into the Susquehanna clay, and is sometimes termed "black post-oak land."

Excepting the small areas in the vicinity of Percilla, which, it is claimed, are not adapted to the production of cotton, this type of soil is best adapted to cotton, corn, grain, and grass. The principal crops

grown are cotton, corn, and oats. Cotton yields from one-half to 1 bale, and corn from 20 to 30 bushels per acre. The yield of oats is about 40 bushels per acre. It would be well to try alfalfa on this soil, as it is thought this legume would do well. Fair yields of wheat could also be grown, as well as, in all probability, some other grains. Grass is also a crop well adapted to the type, and some excellent grazing is afforded at present.

The Crockett clay loam ranges in value from \$8 to \$20 an acre, depending upon location.

The following table gives the results of mechanical analyses of the fine earth of soil and subsoil of the Crockett clay loam:

*Mechanical analyses of Crockett clay loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
12931.....	Soil.....	0.8	2.0	1.2	12.0	20.2	37.3	26.3
12932.....	Subsoil.....	.7	2.1	1.2	10.7	15.3	39.4	29.8

#### HOUSTON BLACK CLAY.

The Houston black clay consists of 12 to 18 inches of a brown or dark-gray clay, underlain by the same material or by a yellow clay. Sometimes lime concretions are found in the soil and subsoil.

But a limited area of this soil is found in Houston County. It is all in the western and southwestern parts of the county on the upland slopes adjacent to or near the Trinity River bottoms. The largest area, including about 4 square miles, lies in the extreme southwestern corner of the county, which, with a few small areas, comprises all of this soil encountered in this survey.

The topography of the Houston black clay is gently rolling and sloping. Its surface drainage is good, but ditching is necessary in some places to secure the best results.

The Houston black clay is probably derived from the weathering of a soft limestone, although the soil was weathered to a considerable depth and no underlying rock was noticed. It is especially adapted to the production of cotton, corn, and grain, and the principal crops grown are cotton, corn, and oats. Cotton yields one-half to 1 bale and corn 20 to 30 bushels per acre. Good yields of oats are produced, and wheat, other grain, and alfalfa, if grown, would, it is thought, produce well.

The Houston black clay is valued at \$10 to \$15 an acre, depending upon the state of improvement.

The following table gives the results of mechanical analyses of the soil and subsoil of the Houston black clay:

*Mechanical analyses of Houston black clay.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
12933.....	Soil.....	0.4	1.6	1.2	6.7	4.9	35.8	49.2
12934.....	Subsoil.....	.6	1.3	1.1	6.3	4.3	32.6	53.3

The following samples contain more than one-half of 1 per cent of calcium carbonate ( $\text{CaCO}_3$ ): No. 12933, 3.22 per cent; No. 12934, 4.85 per cent.

#### SHARKEY CLAY.

The Sharkey clay consists of a few inches of gray silty loam, underlain by a very heavy waxy yellow or mottled yellow and gray clay, or it may have the yellow clay exposed on the surface. It is a soil of limited extent in Houston County, and exists in small areas in the Trinity River bottoms, in the vicinity of Reynard and Cains Ferry.

The areas are low and basin-shaped, and overflow waters stand for a long time after the floods have receded from the surrounding Wabash clay areas.

The Sharkey clay has been formed by deposition of the finest particles carried by the Trinity River. Owing to the poor drainage conditions the type is not cultivated, and as it is so unimportant and the texture is so variable no samples of it were taken. If well drained this soil might produce good crops of cotton and corn, but now it is considered almost worthless.

#### MEADOW.

The Meadow has little uniformity of texture, but more often consists of a light silty or fine sandy loam, having a depth of 3 feet or more. It occupies the bottom lands of many of the creeks and their larger branches. The largest areas are found along the Elkhart, San Pedro, Hickory, and Piney creeks, and Cochino Bayou. These bottoms range from one-eighth to three-fourths of a mile in width. The soil along the smaller streams is quite sandy, but along the larger streams, which have wider bottoms, the sand content of the soil is not nearly so great; in other words, the sandy texture of the soil is proportional to the size of the stream along which it occurs.

The topography of this soil is quite level. At times the drainage conditions are poor, but the soil can be cultivated with comparatively little ditching, or even without artificial drainage. The Meadow is subject to overflow at any season of the year, though this rarely occurs except in winter or early spring. These overflows seldom cover the surface for more than a few hours at a time.

The Meadow is alluvial in origin, representing deposits from overflow of material gathered from the surrounding upland soils of the country.

The greater proportion of this type is not cultivated, but is covered with a heavy growth of sweet gum, water oak, pin oak, elm, ash, and other smaller growth. Where cultivated it is highly prized as a cotton, corn, and sugar-cane soil. The boll weevil, however, is very destructive to cotton on this type. Crops are seldom damaged by overflow, and were it not for the boll weevil a bale of cotton could easily be secured per acre. Corn will yield 40 to 60 bushels, and sugar cane 300 to 500 gallons of sirup per acre. The Meadow areas are especially adapted to sugar cane, and nearly all the sirup manufactured in Houston County is from cane grown on the Meadow soil. It is made by the farmers and is of very fine quality, finding a ready sale at 40 to 50 cents a gallon, and constituting a considerable source of revenue to many farmers. Sorghum is not planted to any great extent on this soil, but on the various upland soils.

The Meadow is valued highly, and in some sections of the county the price is higher than for the adjacent upland soils. In other places it may be bought for \$3 to \$8 an acre, depending upon its improvement.

No samples of this type were collected for analysis, as the classification is based on the position and drainage conditions rather than on the texture.

#### AGRICULTURAL CONDITIONS.

The agricultural resources of Houston County are by no means developed. In a total area of 762,752 acres, or nearly 1,192 square miles, but 425,167 acres, or something over half, is included in farms, and of this area only 174,444 acres is improved. In other words, not quite 23 per cent of the area of the county has been brought under the plow. The remainder, which is largely in forest of some description, is not without value to the farmer, however, as it affords pasture for cattle and hogs.

One reason, probably the main reason, why a larger proportion of the land of Houston County is not cultivated is the lack of transportation, many parts of the county lying from 15 to 20 miles from the two railroads now available, but even near these railroads, although great progress has been made along certain special lines, the opportunity for profitable investment and for greater returns from the land has not been exhausted.

So favorable are the soil and climatic conditions for agriculture in general, and for stock raising in particular, that the farmer can make a living with a minimum of exertion and expense, and this is responsible for a certain contentment among the farming class that

does not make for rapid progress or the acquirement of independent fortunes. Nevertheless, the more ambitious farmers are meeting with financial success, especially where their farms are situated near the shipping points and where specialties like fruit growing and trucking have been taken up.

According to the Twelfth Census the value of the farm land and improvements, except buildings, was \$2,080,760, and the total value of buildings on farms \$680,000. The buildings generally consist of small unpainted structures, although many comfortable houses, with well-kept surroundings, are scattered through the county. The size of the farms in the uplands ranges usually between 150 and 400 acres, though often the actual area under cultivation is only 25 to 60 acres, the remainder consisting of woodland and pasture. A few large plantations in the bottoms of Trinity River comprise many hundreds, and some of the largest several thousand, acres, all under cultivation.

About one-half the farms are operated by the owner. Where worked by tenants some system of shares is the usual arrangement. Two prevailing plans are locally known as the "half" or the "third and fourth systems." Under the former arrangement the owner furnishes the land, buildings, stock, and farming implements, the tenant supplying only the labor, the basis of settlement being one-half of all crops. In the "third and fourth" system the owner furnishes only the land and buildings, the tenant everything else, and in this case the rent is one-third the corn and one-fourth the cotton produced. A cash rent for the use of land is sometimes paid, the price per acre being \$3 a year. Many of the tenants shift from place to place each year, but a few stay year after year on the same farm. Tenants of the latter class are more desirable, as they take greater interest in keeping the farm in good condition.

The value of the live stock in the county in 1899 was over \$850,000, the most of this representing the work stock and other farm animals on each farm, few individuals owning large herds.

The cotton produced in 1900, 27,619 bales of 500 pounds each, averaged a little less than one-half bale per acre, but since the appearance of the boll weevil the average yield has declined considerably. The average yield of corn was nearly 14 bushels.

The labor on the farm in this county is drawn principally from the negro race, although some white labor is used. Some farmers with their families do their own work during the whole year or the greater part of it, hiring help only during very busy seasons—that is, in the spring when the cotton is chopped (thinned and hoed) and in the fall when the cotton is picked. At these times negro men, women, and children are employed, being paid by the day for the chopping and at a stated price per hundred pounds for picking.

Labor is paid from 50 to 75 cents per day with partial board, and sometimes more than this. A few farmers hire help by the month during the entire year, paying for such labor about \$15 a month with board. Good labor is often scarce and much difficulty is sometimes encountered by the farmers in obtaining help at the proper time.

The principal crops grown in Houston County have always been cotton, corn, and a small amount of oats. Some vegetables and fruits have been grown for home use, principally Irish and sweet potatoes, tomatoes, turnips, cabbage, etc., and peaches, pears, plums, grapes, and berries. In recent years the production of fruit and truck for northern markets has gradually increased in the vicinity of shipping points along the railroads. Considerable quantities of Irish potatoes are shipped from Crockett and other railroad points every spring, and large orchards of peaches and pears are being set out.

The stock-raising industry has been followed since the early history of the county, and still constitutes an important source of revenue. The stock raised consists principally of hogs and cattle, which are shipped from the county in carload lots. The value of the poultry products is also an important item, large shipments of chickens and eggs to the near-by cities constituting a source of considerable revenue.

On the other hand, a considerable quantity of hay is imported into the county, which might well be produced locally, and there is here excellent opportunity for profitable extension of agriculture along a line heretofore but little followed.

Although it has long been generally recognized by the farmers that the soils of Houston County are adapted to a wide range of crops, the conditions of marketing, labor, and commercial wages have compelled the making of cotton and corn the chief crops. It is generally understood that the soils of the Orangeburg and Norfolk series are best adapted to the production of fruit and truck crops; that the soils of the bottom lands are best adapted to cotton and corn; that the Houston black clay is best adapted to cotton and grain, and that the Meadow soil is especially adapted to sugar cane.

Experiments recently made by the Bureau of Soils have demonstrated that the Orangeburg soils are adapted to growing a superior quality of domestic cigar filler tobacco, and present indications seem to point to the establishing of this industry on a commercial basis.

The International and Great Northern Railroad runs through the county in a north and south direction, the main shipping points being Crockett, Grapeland, and Lovelady, with Latexo, Paso Switch, and the Natalie Plantation Switch of less importance. In the eastern part of the county the Eastern Texas Railroad reaches as far as Kennard, about 15 miles of the line being in Houston County. The ship-

ping points on this railroad are Kennard, Kennard Mill, Fife Switch, and Druso Switch. These railroads afford connections with many important markets.

Dirt roads lead out of Crockett in all directions. In rainy seasons all of them, except those in the sandy areas, are in bad condition. With the available supplies of sand and clay it is possible to have a fairly good road system in the county. Better roads would aid greatly in improving the agricultural conditions generally by affording easier and quicker communication with the markets and railroads, and the value of the land all over the county would be greatly increased by the same means. There are several rural free delivery mail routes operated out of Crockett, Grapeland, and Lovelady.

There are no large markets in Houston County, although Crockett, Grapeland, and Lovelady consume a part of the produce. Crockett is the county seat and the largest town, having a population of about 3,000. The nearest large markets are Houston, Galveston, Dallas, and Fort Worth, which are easily reached by rail. Good connections are made with railways reaching the larger markets in the North and East.

Kennard Mill, a sawmill town on the Eastern Texas Railroad, is the site of a sawmill, one of the largest in the South, with a capacity of 300,000 feet of lumber a day. The company operating the mill owns large tracts of land in the eastern part of the county and employs a large force of men.

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