

U. S. DEPARTMENT OF AGRICULTURE,  
BUREAU OF SOILS.

IN COOPERATION WITH THE TEXAS AGRICULTURAL EXPERIMENT STATION.

---

SOIL SURVEY OF RED RIVER COUNTY,  
TEXAS.

BY

WILLIAM T. CARTER, JR., IN CHARGE, J. O. VEATCH, M. W.  
BECK, H. V. GEIB, H. C. MORTLOCK, AND C. E. DEAR-  
DORFF, OF THE U. S. DEPARTMENT OF AGRICULTURE,  
AND H. W. HAWKER, J. F. STROUD, AND  
W. B. FRANCIS, OF THE TEXAS AGRICUL-  
TURAL EXPERIMENT STATION.

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[Advance Sheets—Field Operations of the Bureau of Soils, 1919.]



WASHINGTON:  
GOVERNMENT PRINTING OFFICE.  
1923.

[PUBLIC RESOLUTION—No. 9.]

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

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

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

Approved March 14, 1904.

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

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## LETTER OF TRANSMITTAL.

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U. S. DEPARTMENT OF AGRICULTURE,  
BUREAU OF SOILS,  
*Washington, D. C., April 15, 1922.*

SIR: I have the honor to transmit herewith the manuscript report and map covering the survey of Red River County, Texas, and to recommend that they be published as advance sheets of Field Operations of the Bureau of Soils, 1919, as authorized by law.

This work was carried on in cooperation with the Texas Agricultural Experiment Station.

Respectfully,

MILTON WHITNEY,  
*Chief of Bureau.*

Hon. H. C. WALLACE,  
*Secretary of Agriculture.*

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### MAP.

Soil map, Red River County sheet, Texas.

## SOIL SURVEY OF RED RIVER COUNTY, TEXAS.

By WILLIAM T. CARTER, Jr., In Charge, J. O. VEATCH, M. W. BECK, H. V. GEIB, H. C. MORTLOCK, and C. E. DEARDORFF, of the U. S. Department of Agriculture, and H. W. HAWKER, J. F. STROUD, and W. B. FRANCIS, of the Texas Agricultural Experiment Station.—Area Inspected by HUGH H. BENNETT.

### DESCRIPTION OF THE AREA.

Red River County lies in the northeastern part of Texas, in the second tier of counties from the eastern boundary. Red River separates it from the State of Oklahoma on the north, and Sulphur River forms the boundary on the south. The total area is 1,039 square miles, or 664,960 acres.

The county comprises three physiographic divisions, viz, the broad central ridge, the bordering belts of flat lands, and the principal stream bottoms.

The central ridge is a broad, smoothly undulating to gently rolling ridge, crossing the county from east to west, with its highest part or drainage divide

approximately parallel to and a short distance north of the Texas & Pacific Railway. This ridge is bordered on both the north and south sides by relatively narrow belts of flat uplands, and these, in turn, are bordered on the outer side by strips of river lowlands or bottom lands. From the major divide the land slopes very gently northward to Red River and southward to Sulphur River. This divide has been cut by numerous streams, which have formed valleys 25 to 50 feet or more deep, with steep slopes and narrow marginal belts of more or less rolling land.

Within a few miles of Red River and Sulphur River the general surface of the interstream areas is flat. Thus for several miles on



FIG. 5.—Sketch map showing location of the Red River County area, Texas.

the south of the Red River bottoms and north of the Sulphur River bottoms there are belts of generally flat lands extending across the county parallel to these larger stream bottoms. There is no sharp line of demarcation between the higher part of the county and these flanking belts of flat lands, but they are separated from the bottoms by narrow, steep slopes. There are also large bodies of isolated flat lands within the central ridge section.

Stream bottoms of varying width occur throughout the county along Red and Sulphur Rivers and their tributaries. These bottoms are flat to very gently sloping. The Red River bottoms are generally level to very gently sloping, the slope being back from the banks of the present river to its former bank. Areas nearest the uplands are often basinlike. There are a number of old low stream channels, with steep slopes leading to higher and older alluvial deposits, which occur on benches 10 or 20 feet higher than the more recently filled in stream beds.

Dome-shaped mounds 25 to 100 feet across and 2 to 3 or 4 feet high occur over most of the forested uplands. In places they are so numerous as to touch; in other places they are scattered, so that not more than one or two occur in an acre. As a rule, these mounds constitute 10 to 40 per cent of the surface of most of the timbered uplands.

The elevation is highest in the western part of the county, just north of Detroit, approximating 500 feet above sea level, and gradually becoming lower along the divide until near the eastern part of the county it is probably about 350 or 400 feet above sea level. The slope of the upland north of the divide is to the northeast, and south of the divide to the southeast. The general slope of the county as a whole is a little south of east. The elevation at Detroit is 482 feet, at Clarksville 442 feet, and at Annona 370 feet above sea level. No figures are available for the Red River and Sulphur River bottoms, but the Red River bottoms are doubtless slightly higher than the Sulphur River bottoms, and both probably lie about 200 feet lower than the higher parts of the divide in the central part of the county.

In the central, southeastern, and southwestern parts of the county there are several prairies, lying mostly in the upland region. The largest lies in the central part around Clarksville, but Blossom Prairie, in the southwestern part, is also several miles across.

The Red River drains a little less than half of the county from the north. The rest of the area is drained by the Sulphur River. The tributaries of these streams have their origin either in the central ridge part of the county or in Lamar County. Those on the north side flow in a general northeasterly direction, and those on the south side in a southeasterly direction. Numerous small intermittent streams reach into the central part of the county and give fairly good

surface drainage, except in the occasional flats. The larger streams cross the flat belts in the northern and southern parts of the county, but the few small streams rising in these flat areas do not give adequate surface drainage. In many places where the sand mounds are numerous the run-off is very much impeded. Nearly all the streams of the county have well-developed bottoms. All these are overflowed at times, but have sufficient natural drainage to allow cultivation. Parts of the Red River bottoms are not overflowed for periods of several years.

The early settlers in the region came principally from the older Southern States. The present population is made up largely of descendants of these settlers and of those coming later from other parts of Texas and from other States. The 1920 census shows a population of 35,829, of which 90 per cent is classed as rural. The rural population, which averages 31.2 persons to the square mile, is densest in the central part of the county, gradually thinning as the northern and southern parts are approached. In the flat belts settlement is sparse. The Red River bottoms have only slight settlement. Negroes constitute a considerable proportion of the population.

Clarksville, the county seat and main town of the county, lies in the central part, on the Texas & Pacific Railway. It has a population of 3,386. Other important, though smaller, towns on the same railroad are Detroit, Annona, Avery, and Bagwell. Bogata, a town of several hundred people, is in the southwestern part of the county on the Paris & Mount Pleasant Railroad. All these towns have cotton gins, some have cottonseed-oil mills, and all are important shipping and trading points. Clarksville and some other towns are noted as cotton markets. A large number of villages throughout the county are interior trading points of importance and many of them have cotton gins.

The central and southwestern parts of the county are well supplied with railroad transportation. A branch of the Texas & Pacific Railway, extending from Texarkana to Fort Worth, passes through the central part of the county in a general east-and-west direction. The Paris & Mount Pleasant Railroad crosses the southwestern corner of the county. Considerable areas in the northern and southern parts of the county lie from 10 to 20 miles from shipping points. Most of the county is well supplied with wagon roads. A number of roads radiating from Clarksville are graded and graveled for several miles, but the rest are dirt roads. Some of the main roads are graded, but all roads except where graveled get very muddy and are difficult to travel during long-continued wet seasons. Some of the main roads become almost impassable during the winter.

The greater part of the county has rural mail delivery and telephone service. Good schools and churches are located throughout

the more thickly settled sections. The towns in the county are good markets for small amounts of poultry, vegetables, fruit, and dairy products. Some poultry is shipped from the county to the larger towns and cities of northeast Texas. Hogs are shipped to Fort Worth.

There are a number of small sawmills scattered throughout the county which utilize the shortleaf pine and some oak for lumber. Much of the good pine timber has already been cut.

#### CLIMATE.

The climate of Red River County is generally mild. The summers are long and the winters short. From April to October the weather is warm, and from June to September there is considerable hot weather in which the temperature sometimes rises to 100° F. or higher. From December to February there are short seasons of cold weather caused by "northers," cold winds from the north. The "northers" frequently come very suddenly, causing a rapid lowering of temperatures, and are sometimes accompanied by rain, sleet, or snow. Probably not more than two or three snows occur during any one winter, and these are light and soon melt. Light freezes are common during "northers." The cold spells usually last from 3 to 6 days, and rarely a period of more than two weeks passes without some cold or rather cool weather. The lowest temperature recorded at Clarksville is -2° F., and the highest 110° F. The average date of the last killing frost in the spring is March 20, and that of the first in the fall is November 11. This gives an average growing season of 236 days. The latest recorded killing frost in the spring was April 9 and the earliest recorded in the fall October 29. The mean annual temperature is 65.2° F. The winter extremes have ranged from -2° F. to 92° F., and the summer extremes from 52° F. to 110° F.

The average annual precipitation of 51.28 inches is fairly well distributed throughout the year. Generally the rainfall is greatest in the spring and least in the fall. However, dry spells sometimes occur in the late spring and early summer, doing considerable damage to the corn crop. Periods of unusually heavy precipitation occasionally occur, when for months the land is saturated with water and the roads are almost impassable. The total rainfall in the driest year on record (1881) was only 26.37 inches, while in the wettest year (1873) the precipitation was 109.38 inches.

A long growing season and ample rainfall make the climate of Red River County very favorable for the production of many crops. The conditions are also favorable for stock raising and dairy farming.

The table below gives more detailed data for Red River County,

as shown by the records of the Weather Bureau station at Clarksville:

*Normal monthly, seasonal, and annual temperature and precipitation at Clarksville.*

(Elevation, 442 feet.)

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1881).	Total amount for the wettest year (1873).
	° F.	° F.	° F.	Inches.	Inches.	Inches.
December.....	45.4	77	11	4.87	3.50	13.50
January.....	44.1	92	-2	4.12	2.75	1.66
February.....	49.4	86	5	4.32	5.50	10.12
Winter.....	46.3	92	-2	13.31	11.75	25.28
March.....	58.6	92	22	4.41	1.25	1.00
April.....	64.7	90	30	5.88	1.25	2.00
May.....	72.3	100	39	6.20	3.25	19.50
Spring.....	65.2	100	22	16.49	5.75	22.50
June.....	80.0	105	52	4.66	.25	17.75
July.....	83.3	106	58	4.92	.12	15.50
August.....	83.6	110	57	2.50	T.	3.00
Summer.....	82.3	110	52	12.08	.37	36.25
September.....	73.3	105	45	3.46	1.25	8.00
October.....	63.1	97	26	2.94	4.75	4.35
November.....	54.5	92	17	3.00	2.50	13.00
Fall.....	63.6	105	17	9.40	8.50	25.35
Year.....	65.2	110	-2	51.28	26.37	109.38

AGRICULTURE.

Since the beginning of settlement, about 1825, the interests of Red River County have been almost wholly agricultural. The first crops grown along the Red River consisted of corn and vegetables, followed a little later by cotton and wheat. Hogs and cattle were raised and pastured on the open prairie and forest lands. Prior to the Civil War considerable wheat was grown, but later its production was discontinued. The prairie lands were considered useless for cultivation by the early settlers and were utilized only for grazing. Jefferson became the chief trading point, river steamers connecting it with the larger markets of other States.

With the extension of a railroad to the county a short time prior to 1880, lumbering became an important industry, both the pine and oak forests being a source of supply. Much of the oak was

used for crossties. A number of small sawmills are still in operation in the county. The railroad opened up better markets, hastened settlement, and gave impetus to farming.

Practically all of the prairie land of the county has been in cultivation for many years. Probably 40 or 50 per cent of the upland, originally forested, is in farms, and more land is steadily being cleared for cultivation.

Much land is cleared by cleaning out the underbrush and deadening trees, allowing them to stand until they have rotted down. More land, however, is being cleared systematically by first removing merchantable timber and firewood, then burning the residue and allowing the stumps to rot. Probably 75 per cent of the Red River and larger creek bottoms is farmed, but very little of the Sulphur River bottoms is in cultivation.

Soon after settlement was established, cotton became the chief cash crop, and it has remained so to the present time. Probably 60 or 70 per cent of the land farmed is used for this crop. The cotton grown in Red River County has the reputation of possessing superior length of staple and good body. This is due to the good varieties grown and probably also to uniformity of growing conditions. The principal varieties of short-staple cotton are Rowden, Mebane, and Lone Star. These varieties have a longer staple than the average short-staple varieties of the Cotton Belt, such as the King, Simpkins, and many others, and their lint brings a higher price. They may be considered as varieties of intermediate length of staple between the average of short-staple varieties and long-staple varieties or as long-staple short-staple varieties. When grown on good strong soil, such as induces a healthy, normal growth of the plants, Mebane and Rowden give a staple ranging about  $1\frac{1}{16}$  inches in length, and Lone Star about  $1\frac{1}{8}$  inches, which often brings a premium of 2 cents or more per pound.

Varieties brought from other sections are said to show improvement in the quality of the lint when grown here. This could be caused by a yearly increase of mixed seed of the good local-grown varieties at the gins; but good uniform growing conditions, which would include uniformity in the variety of the seed, cultural methods, and good soil conditions, probably account for some measure of this improvement. In other words, the staple approaches the standard of length for that type as the seed becomes purer and as ideal growth upon good soil properly handled is approximated.<sup>2</sup>

Long-staple cotton has been grown to a considerable extent here, giving a staple ranging from  $1\frac{3}{8}$  to  $1\frac{1}{2}$  inches or a little longer. The

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<sup>2</sup> See Bulletin, Bureau of Plant Industry, United States Department of Agriculture, No. 159, "Local Adjustment of Cotton Varieties."

principal variety of long-staple is Snowflake. Acala is becoming very popular. With a staple of  $1\frac{3}{16}$  to  $1\frac{1}{4}$  inches, it is classed as long-staple cotton.<sup>3</sup>

Long-staple, however, is not grown nearly so extensively as the short-staple varieties, partly because the yield is lighter and partly because the pickers prefer to pick the short-staple cotton. Some years a considerable premium is paid for long-staple by cotton buyers, while in other seasons the price received approximates closely the price received for short-staple. This has resulted in discouraging the growers, and the past year (1919) very little was planted. During the fall of 1919 the ordinary short-staple cotton grown on the strong soils here sold for more than 50 cents a pound and the highest price paid for long-staple was 80 cents a pound.

The stronger soils of the county produce, as a rule, it is said, the longest and firmest staple. The alluvial soils, according to the prevailing belief, produce, on the whole, the best staple as well as the largest yields. Next in value, both as regards quality and yield of product, are the Houston black clay and the Wilson clay, in the central part of the county. It is said that the Wilson clay in the southwestern part of the county does not produce the long, firm staple so much desired, but to what extent this may be due to lack of favorable growing conditions, including permanency of seed purity, can not be stated. The other types of Wilson soil do not produce the long staple as a rule.

The soils of the Susquehanna, Ruston, Bowie, and Lufkin series produce a fairly long staple where the soil is kept in good productive condition. Where they are run down, that is, where they have been cultivated exhaustively for a long time, or until crop yields have become light, the lint is said to be shorter and of poorer body. Where the soils have been handled so that the yields are good the staple is said to be fairly long and of good quality. There appears to be a close relation between the productiveness of the soil and the length and quality of the staple, or in other words, between the development of a good normal cotton plant and the length and quality of the staple. As the rainfall is considerable and the altitude not high, there is considerable moisture in the atmosphere most of the time, and a moist condition of atmosphere and soil plus a good productive soil seem to give a combination favorable to length and quality of cotton staple in this county. The lighter deep sandy upland soils do not produce a very good staple of cotton, according to local information.

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<sup>3</sup> Staple of  $1\frac{1}{2}$  inches length is considered the dividing line between short-staple cotton and long-staple cotton.

The production of cotton in Red River County for the past 10 years has been as follows:

Year.	Bales.	Year.	Bales.	Year.	Bales.
1910.....	33,289	1914.....	40,466	1917.....	41,723
1911.....	51,152	1915.....	23,140	1918.....	42,000
1912.....	42,718	1916.....	40,936	1919.....	46,263
1913.....	44,929				

The census of 1920 reports 135,272 acres devoted to cotton in 1919 and an average yield of about 0.29 bale per acre. There are 43 cotton gins in the county.

Corn is grown on most farms in the county, ranking next in importance to cotton. About one-half as much land is devoted to corn as to cotton, though many farmers plant less. The acreages and yields reported by the last four censuses were as follows: 1919, 67,520 acres, 1,870,692 bushels; 1909, 45,200 acres, 1,506,616 bushels; 1899, 60,034 acres, 1,324,060 bushels; 1889, 34,840 acres, 859,172 bushels. Corn is grown primarily for feeding on the farm, the surplus, if any, being sold. Many farmers, however, do not produce sufficient corn for home use. The soils of the county are capable of producing fair yields of corn, but, with attention largely centered on the cotton crop the land for corn is often inadequately prepared and the crop not thoroughly cultivated, so that the yields are commonly rather low. Seed selection should also be more generally practiced. Frequently dry weather in June and July damages the corn crop. The alluvial soils are best suited to corn.

Oats are grown by some farmers on the prairie lands, and a small acreage is sown on the forested sandy soils for pasturing. The census shows 4,198 acres sown to oats in 1919, with a production of 80,618 bushels. The crop occupied 2,087 acres in 1909, yielding 35,666 bushels, and 3,268 acres in 1899, yielding 86,210 bushels. The oats are used for feeding farm stock, but the production is not enough to meet local needs. The heavier upland soils, especially the prairie soils, are best adapted to this crop.

A few farmers have grown small amounts of wheat on some of the prairie soils in the last few years, but yields have been very light.

Hay and forage are produced in the county in considerable quantities, although not always in amounts large enough to meet the local demand. Some sorghum is grown for forage and Johnson grass is cut for hay. Bermuda grass is grown by many farmers in a small way and is the chief hay crop. It does well on all the soils, but best on the alluvial soils. A very small amount of alfalfa is grown. Red clover is grown on a few farms on the dark prairie soils in conjunction with Bermuda and other grasses, and good yields

of hay are obtained. In 1919, according to the census, 5,475 acres in the county were devoted to tame or cultivated grasses (chiefly Bermuda grass), producing 6,766 tons of hay. A ready market is found locally for all the hay produced.

Cowpeas are grown chiefly for soil improvement. In some cases the vines are cut for hay. According to the census there were 515 acres in annual legumes in 1919, with a total production of 405 tons of hay.

Sweet potatoes are grown for the market by some farmers, and a few towns have drying and curing houses capable of storing several thousand bushels. The sandy upland soils are well suited to this crop. Peaches, pears, plums, grapes, other small fruits, berries, and vegetables are grown for home use and to supply the local markets.

Many wild pecan trees grow in the bottoms and constitute a substantial source of income on the farms. Doubtless this industry could be made more important.

Considerable sirup is made from sorghum and sugar cane in small mills on the farm. A part of the sirup is sold in the local markets.

Peanuts are grown in a small way by many farmers on the sandy soils. Some of the nuts are harvested and sold, but usually hay is made from the vines and hogs are turned into the fields to gather the nuts left in the ground. This crop adds nitrogen to the soil, the vines give a valuable forage crop, and the nuts are valuable in fattening hogs. A good market is readily found for the peanuts harvested.

The crops and systems of farming do not vary much with the character of the soils. Cotton is raised on practically all types of soil. Some oats are grown on the Houston and Wilson prairie soils, usually with cotton and some corn and a little hay. On the forested upland soils, mainly the Susquehanna, Bowie, and Ruston very fine sandy loams, with smaller areas of other types of these and the Lufkin series, the crops are somewhat more diversified, although even here cotton is the main crop. Corn, peas, peanuts, sweet potatoes, and Bermuda grass are also grown on these upland soils. The soils of the creek and river bottoms, consisting mainly of types of the Yahola, Miller, Portland, Ochlockonee, Trinity, and Catalpa series, are used principally for cotton, corn, and Bermuda grass. Nearly all of the farms in river bottoms are operated by tenants, as well as a very large proportion of the cultivated upland area.

A few farmers practice fall plowing, especially on the prairies, but often they are too busy to do much plowing before the winter and early spring months. As a rule, the land for corn and cotton is bedded and smoothed down for planting, the beds being prepared over the middles—that is, the spaces between the ridges of the preceding year. Some farmers bed in the winter and rebed in the spring just

before planting. Little of the land is flat-broken. Flat-breaking the land in the fall or winter, as practiced by some farmers, has proved to be the best method of land preparation for all crops. The flat-broken land, however, is plowed up into beds for corn and cotton rows in the winter and spring, and these beds are smoothed off before planting. Only the flat bottom lands are so poorly drained as to require high beds for cotton and corn.

Land is flat-broken for oats, which are usually sown early in the spring, or from January to March.

Corn is usually planted in bedded rows from early March into April. Some late corn is planted in June on a level soil bed or in the water furrows. Cowpeas are grown by some farmers with the corn and the vines plowed under or used in part for grazing and hay. This practice is of great benefit to the soil. Some corn fodder is made from the leaves, but generally the fodder is left in the field and grazed down by stock during the winter.

Cotton is planted on beds, usually from early in April to May 10. When several inches high the cotton is "chopped"—that is, the grass is hoed out and the cotton plants thinned to a stand. Cotton is cultivated shallow with shovels, sweeps, and cultivators several times and is kept free from grass and weeds. The last cultivation of the cotton is usually early in July. Picking begins in August and continues throughout the fall and winter.

The suitability of the soils of the county for the production of forage crops, together with the mildness of the climate, indicates that stock raising could be practiced successfully on a much larger scale than it is at present. Dairy farming could also be practiced successfully near the railroads.

Beef cattle, mostly unimproved stock, are raised in a small way by a few farmers. There were 7,993 cattle of this class in the county in 1920. Hogs are raised more extensively, most farmers raising enough to supply the home and have a small surplus for sale. Many hogs are pure bred. Poultry is raised on most of the farms and a large part of the poultry products is shipped out of the county. In 1919 the total value of domestic animals on farms in the county was \$3,262,068. The value of dairy cattle was \$529,888, and the number 14,705, of which 8,768 represented cows and heifers 2 years old or over.

No well-defined system of crop rotation is used in the county. Cotton and corn are grown many years on the same land, with occasional alternation. This is more particularly true on the bottom-land and prairie soils. On the forested upland soils the land may be planted more frequently with cowpeas, peanuts, sorghum, and sweet potatoes. On the prairies some farmers who raise oats practice a somewhat

general but not systematic rotation of cotton, corn, and oats. Systematic rotations are not absolutely necessary. The main thing is to include at frequent intervals a humus-supplying crop, preferably a legume, in rotation with such crops as cotton and corn. Cotton itself supplies much humus where the stalks are plowed under.

Practically no commercial fertilizers are used in the county. However, at various times a few farmers have used small amounts for corn and cotton on the upland sandy soils. Results have been more or less satisfactory, and on the whole the opinion prevails that the use of commercial fertilizers would result in considerably increased production on the thin or run-down soils of the upland. The use of fertilizers may be said to be in the experimental stage in this county, with but few growers interested. The commercial fertilizers used are of various brands or grades. Some cottonseed meal is used. Best results are apparently obtained with nitrogenous and phosphatic fertilizers. Many farmers apply small amounts of barnyard manure to their fields and find it very beneficial on the upland soils, especially where yields have diminished as a result of long-continued cropping. Liberal applications of barnyard manure on the heavy prairie soils have given decided increases in the yields of cotton, corn, and grass. The sandy soils all respond readily to the use of manure.

On the farms operated by owners there are many substantial dwellings, but there are also many cheaply constructed houses, especially on rented farms. Barns are usually small, but of sufficient size to house the work stock and store the feed crops. Fences are generally very good, many being of woven wire. Improved farm implements, consisting chiefly of small walking plows and cultivators, are in general use. The most up-to-date farm machinery is found on the farms operated by owners. The work stock generally consists of light to medium weight horses and mules. Automobiles are in general use, and trucks are employed to some extent for hauling when the roads are in good condition.

The greater part of the farm labor is done by negroes. Labor is hired principally for chopping and picking cotton. During the last few years labor has been scarce. In the spring of 1919, \$2 to \$3 a day was paid for chopping and \$1.50 to \$3 per 100 pounds for picking cotton.

The census of 1920 reports 57.9 per cent of the area of the county in farms.<sup>4</sup> The average size of the farms is 66.1 acres, 44.9 acres of which is classed as improved land.

Farms range in size from 50 to 1,000 acres or more. Many of the larger holdings are leased to tenants in tracts of 25 to 100 acres.

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<sup>4</sup>The census classes each tenancy as a farm.

The 1920 census shows 64.9 per cent of the farms operated by tenants. Farm land is generally rented on the share system. Usually the landlord furnishes the land, house, work stock, and seed, and the tenant the labor, each receiving half the crop. When the landlord furnishes only the land and house, he receives one-fourth of the cotton and one-third of the corn produced.

The price of farm land has advanced rapidly in the last few years and continues to increase. There is a considerable demand for land on account of the higher prices obtained for cotton produced in this county. Selling prices depend mainly on the character of the soil, location with reference to roads and railroads, distances from towns, and the farm improvements. The less desirable forest uplands bring the lowest prices, from \$15 to \$50 an acre. Improved upland farms in the forest section sell for \$40 to \$100 an acre. Farm land on the prairies sells for \$150 to \$300 an acre and improved bottom land for \$50 to \$100 an acre.

#### SOILS.<sup>5</sup>

Red River County lies entirely within the Coastal Plain region of Texas. The upland soils are derived from beds of noncalcareous sand, sandy clay, and heavy clay, and from calcareous clays and chalks. They show a close relationship to the parent material, but weathering and erosion have effected differences in texture, color, depth, and topography. The soils are classified into types on the basis of texture, which is determined by their contents of sand, silt, and clay, and are grouped into series on the basis of similarity in topography, drainage, color, structure, and origin. The upland soils derived from beds of sand and sandy clay are grouped in the Bowie, Ruston, and Norfolk series. The heavy clays have given rise to soils of the Susquehanna, Lufkin, Crowley, and Wilson series, though doubtless the sandy members of these series have been derived in part from sandy clays. The calcareous clays and chalk have produced the

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<sup>5</sup> Red River County is bounded on the east by Bowie County, the soils of which were mapped in 1916. The two maps agree for the most part in classification of the soils along the common boundary, and in most of the cases of disagreement the matter is simply one of slight textural difference.

A very small area of Oktibbeha clay about 1 mile northeast of Lydia joins with Susquehanna very fine sandy loam in Bowie County, and in about the same locality a small area of Oktibbeha clay joins with Oktibbeha clay loam. About 2½ miles north of Lydia an area of Lufkin very fine sandy loam joins with Lufkin silt loam in Bowie County, and just north of this area is an area of Bowie very fine sandy loam joining with Lufkin silt loam in Bowie County. An area of Susquehanna very fine sandy loam joins with Bowie very fine sandy loam in Bowie County. Along the slope of Anderson Creek very narrow strips of Norfolk very fine sand join with Norfolk fine sand in Bowie County. A little north of the Texas & Pacific Railway some Susquehanna fine sandy loam joins Susquehanna very fine sandy loam in Bowie County. Three miles northeast of Avery an area of Lufkin very fine sandy loam joins with Lufkin silt loam in Bowie County, and about 2¼ miles from Henrietta Church a small area of Lufkin silty clay loam joins with Susquehanna silt loam in Bowie County.

Houston soils, and the Oktibbeha soils are derived, in part at least, from calcareous clays.

The Bowie, Ruston, and Norfolk soils have brown to grayish-brown or gray surface soils and friable sandy clay or fine sand subsoils. The subsoil of the Bowie series is yellowish in the upper part and mottled red and gray, or red, yellow, and gray in the lower part. The lower subsoil of the Bowie series resembles that of the Susquehanna in color, but differs in being a friable sandy clay rather than a stiff heavy clay. The Norfolk soils have a yellow or pale-yellow, friable subsoil and the Ruston soils a reddish-yellow, yellowish-red, or light-red friable subsoil.

The types in the Susquehanna series have brown to grayish surface soils and a mottled red and gray, or mottled red, gray, and yellow, stiff, plastic clay subsoil.

The Lufkin types have gray surface soils and a gray, bluish-gray, or mottled gray and yellow, heavy clay subsoil, which is compact and impervious in the lower part of the 3-foot section. Drainage on these soils is usually poor.

The Crowley soils occupy prairies and have brown to grayish surface soils and a heavy, stiff clay subsoil, mottled red or yellow and bluish gray. The lower subsoil is tough and impervious.

The Wilson series is represented by dark-colored noncalcareous prairie soils; at least the material does not contain enough free lime carbonate to effervesce with acid. The surface soils are dark brown to black and the subsoil is brown or bluish gray, slightly mottled with yellow.

The Houston soils are black calcareous prairie soils resting at depths of a few inches to several feet on white or blue chalk or chalky clay, high in free lime carbonate. The surface soils are dark brown to black, while the subsoil where the chalk is deep is black or dark bluish gray to greenish yellow. Where the chalk lies within 3 to 5 feet of the surface the subsoil is brown to grayish in the lower part and in places mixed with greenish-yellow clay and whitish chalky material.

The Oktibbeha soils resemble the Susquehanna soils on the surface, but differ from the latter in having a calcareous lower subsoil or substratum.

There are a number of second-bottom soils derived from deposits laid down by streams when they flowed at higher levels than at present. These soils occupy terraces now above overflow. They are noncalcareous, with the exception of the Bastrop, and are made up of material washed from the upland soils. They are correlated with the Kalmia, Myatt, Leaf, Brewer, Cahaba, Teller, and Bastrop series.

The types of the Kalmia series have grayish to yellowish surface soils and a mottled yellow and gray subsoil.

The types included in the Myatt soils have gray surface soils and a gray or mottled gray and yellow heavy clay subsoil. They are poorly drained. The Leaf soils have gray to brown surface soils and a heavy mottled gray and red subsoil. The types in the Brewer series have black to dark-brown surface soils and a brown to bluish-gray subsoil. The Cahaba series comprises types with brown to grayish surface soils and a light-red, yellowish-red, or reddish-yellow friable subsoil. The surface soils of the Teller series are brown to grayish, and the subsoil consists of a yellowish-red friable sandy clay.

Second-bottom soils derived from old Red River alluvium are included in the Bastrop series. They have chocolate-brown surface soils and a chocolate-red subsoil. The material is calcareous, typically at least in the subsoil.

The recent-alluvial or stream-bottom soils in the county vary in characteristics according to the source of material. They consist of sediments washed from upland soils. The bottoms are subject to overflow and still receive sediments from overflow waters. The recent-alluvial soils are included in the Trinity, Ochlockonee, Catalpa, Yahola, Miller, Portland, and Pledger series. The four last named occur only along the Red River.

The Trinity series consists of types with dark-colored to black surface soils and a brown to mottled gray and yellow subsoil. They are made up in part or largely of the sediments washed from the calcareous prairie or Houston soils. The typical Trinity material effervesces with acid in the lower subsoil, but some of that mapped does not show much free lime carbonate.

The Ochlockonee soils are brown, with a brown, light-brown, or mottled grayish and brownish or yellowish subsoil. The soils are made up of sediments washed from the noncalcareous upland soils, consisting largely of Susquehanna, Bowie, Lufkin, Ruston, and Wilson types.

The Catalpa soils are formed in part from material washed from the calcareous prairies, but also contain noncalcareous sediments. These soils differ from the Trinity in color, being brown in the surface soil and grayish or mottled gray and yellow in the subsoil.

In the alluvial soils along Red River much of the material comes from the Indian-red soils of western Texas and Oklahoma. At least it contains enough of this Indian-red transported material to have a characteristic brownish-red or chocolate-brown color. Such material gives rise to the Yahola and Miller series. The types of these series have similar surface soils, but differ in that the lower subsoil of the Yahola series contains more light or sandy material than the upper subsoil, while the Miller subsoil is not lighter in texture in the

lower part. The soils of the Miller and Yahola series are brownish red in soil and subsoil, though the sandy members may in places have a chocolate-brown surface.

The Portland soils, which are also derived from Red River alluvium, are chocolate brown in the upper part and brownish red in the subsoil. In this county some large, poorly drained areas have bluish-gray and brown mottled subsoils.

The Pledger soils, also occurring in the Red River bottoms, are black on the surface, grading below into brownish-red material. The Portland and Pledger soils have been formed in part from sediments transported from the Indian-red soils of western Texas and Oklahoma, and in part from soils drained by tributaries of the Red River. The darker color may be due to poorer drainage.

Riverwash is the term applied to low-lying areas along the Red River where the soils are so mixed that they could not be separated as types. It is of little value and is subject to frequent overflow.

The following table gives the names and the actual and relative extent of the soils mapped in Red River County:

*Areas of different soils.*

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Susquehanna very fine sandy loam.....	143,872	26.9	Myatt very fine sandy loam....	7,104	1.1
Mound phase.....	35,456		Lufkin silt loam.....	6,656	1.0
Trinity clay.....	54,400	8.2	Susquehanna clay.....	5,376	.8
Lufkin clay.....	45,632	6.9	Susquehanna fine sandy loam..	4,928	.7
Bowie very fine sandy loam....	45,184	6.8	Wilson silt loam.....	4,352	.6
Lufkin very fine sandy loam....	18,048	6.8	Crowley silt loam.....	3,968	.6
Mound phase.....	27,008		Cahaba very fine sandy loam....	3,776	.6
Lufkin silty clay loam.....	42,240	6.3	Oktibbeha clay.....	3,392	.5
Houston black clay.....	35,136	5.4	Brewer clay.....	2,688	.4
Shallow phase.....	832		Miller clay.....	2,624	.4
Wilson clay.....	35,328	5.3	Yahola clay.....	2,496	.4
Yahola very fine sandy loam....	17,472	2.6	Pledger clay.....	2,368	.4
Ochlockonee very fine sandy loam.....	16,256	2.4	Portland very fine sandy loam..	1,984	.3
Ochlockonee silty clay loam....	16,064	2.4	Riverwash.....	1,792	.3
Ruston very fine sandy loam....	14,528	2.2	Bastrop clay.....	1,664	.3
Norfolk very fine sand.....	12,416	1.9	Teller very fine sand.....	1,472	.2
Portland clay.....	10,624	1.6	Chalk (Houston material).....	1,280	.2
Wilson silty clay loam.....	9,920	1.5	Leaf very fine sandy loam.....	1,024	.2
Catalpa silty clay loam.....	9,216	1.4	Myatt silty clay loam.....	768	.1
Oktibbeha clay loam.....	7,680	1.1	Kalmia very fine sand.....	704	.1
Bowie fine sandy loam.....	7,232	1.1			
			Total.....	664,960	.....

**BOWIE FINE SANDY LOAM.**

The soil of the Bowie fine sandy loam consists of about 4 inches of a grayish-brown or brown fine sand or loamy fine sand grading into reddish-brown or yellowish fine sandy loam or loamy fine sand, which

continues to a depth of 12 to 18 inches. The subsoil is a friable sandy clay, mottled red, yellow, and gray, or red and gray, which usually becomes more friable with depth, but in places is heavy and plastic at 30 to 36 inches. The subsoil in many places resembles that of the Susquehanna types in color, but differs in that it is friable and contains more sand. Mounds of Norfolk and Ruston fine sand occur over the surface of this type, but they are not so numerous as on the Bowie very fine sandy loam. Areas of the type, as mapped, include also small spots of the Norfolk, Ruston, and Susquehanna fine sandy loams. Some rounded quartzite and chert gravel is present on the surface. Occasional patches have a slight reddish tinge in the surface material.

The Bowie fine sandy loam is not an extensive type. It occurs in a number of small widely separated areas throughout the forested region of the county. Some of the largest areas lie a few miles east of Bogata, in the southern part, and in the vicinity of Woodland, in the northwestern part of the county.

The type occupies gently undulating swells and gentle slopes. It has good surface and internal drainage.

This soil was originally forested with shortleaf pine, red oak, hickory, post oak, and other trees of less importance. Most of the type is now in cultivation. The crops grown are the same as on the Bowie very fine sandy loam, and the yields are approximately the same or slightly lower. The methods recommended for improving the soil and increasing crop yields given for the Bowie very fine sandy loam apply equally well to the fine sandy loam.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Bowie fine sandy loam:

*Mechanical analyses of Bowie fine sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
445344.....	Soil.....	1.1	13.6	14.5	44.6	13.1	10.1	3.0
445345.....	Subsoil.....	.2	8.7	11.0	29.3	7.3	7.8	35.5

BOWIE VERY FINE SANDY LOAM.

The surface soil of the Bowie very fine sandy loam consists of 3 to 6 inches of light-brown to grayish loamy very fine sand grading into yellow or mottled yellow and gray very fine sandy loam, which passes at 10 to 18 inches into a subsoil of mottled red and gray or mottled red, yellow, and gray friable sandy clay. The upper part of the subsoil is in places yellow or reddish yellow, but the grayish mottlings soon appear with increase in depth. This type resembles the

Susquehanna soils in color, especially in the subsoil, but differs in that the subsoil is more sandy and more friable. It includes small areas of Susquehanna very fine sandy loam, too small to map separately.

Practically all of the type has a scattering of dome-shaped mounds over the surface. These may be very few or they may in places occupy 25 or 30 per cent of the surface. These mounds are 20 to 50 feet or more across and 1 to 4 feet high, and consist principally of deep phases of the Ruston and Norfolk very fine sand and very fine sandy loam, the mottled clay subsoil lying at 3 to 5 feet below the surface of the crests of many of the mounds.

The Bowie very fine sandy loam occurs in a great many small to fair-sized areas throughout the central-eastern and other forested parts of the county. Some of the larger areas lie at and near Avery.

The surface of the type is, as a rule, very gently undulating, gently sloping, or nearly level. In places the type occupies the higher ridgelike swells between the streams. The surface drainage is for the most part fairly good, but on the more nearly level areas drainage is imperfect, and during wet seasons the soil between the mounds becomes saturated. The underdrainage of the soil is fairly good, owing to the friable subsoil.

The Bowie very fine sandy loam is a valuable soil for agriculture, and probably 80 per cent of it is cleared and cultivated. The forest growth consists mainly of shortleaf pine, post oak, red oak, and hickory. Sweet gum grows in places, and where mounds are abundant there is considerable blackjack oak. Most of the merchantable pine timber and much of the more valuable oak have been cut.

The principal crops are cotton, corn, Bermuda grass, sweet potatoes, and sorghum. Vegetables, berries, peaches, pears, and plums are grown in a small way, mainly for home use. Cotton is the main cash crop, yielding ordinarily from one-fourth to one-half bale. Corn yields 12 to 25 bushels per acre. Usually all the corn is used on the farm, though in some years a surplus is sold locally. Bermuda grass yields 1 to 2 tons of hay per acre, and sorghum makes good yields. These crops are grown mainly for feed for the farm stock, though some sorghum is used for making sirup. Some farmers grow sweet potatoes for the market. The fields include from 1 to 10 acres and the yield ranges from 100 to 250 bushels per acre. Oats are grown by a few farmers, mainly for pasture.

The Bowie very fine sandy loam is prepared for cotton and corn by bedding. Usually this is done in the spring, though some farmers bed in the fall and winter and rebed in the spring. A small amount of barnyard manure is used by some farmers with excellent results. A little commercial fertilizer has been used, but fertilization of

the fields is not general. Fairly good results have been obtained from the use of commercial fertilizers, especially nitrogenous and phosphatic fertilizers.

Land of this type in farms sells for \$40 to \$75 an acre and uncleared land for about \$20 to \$30.

Crop yields on this type vary; on newly cleared land yields are very good, but on land that has been farmed a number of years they are lower and on old farms they are sometimes very light. The productiveness of the soil can be maintained and increased by the use of barnyard manure, and by the growing of cowpeas, peanuts, or other legumes, especially where they are grown in rotation with cotton and corn. Some flattish areas without drainage outlet would be improved by ditch or tile drains, though the question of artificial drainage is not so important on this soil as on some others.

The Bowie very fine sandy loam is adapted to the crops grown. It is especially suited to the production of vegetables, berries, and small fruits. Peaches, pears, plums, and berries, particularly strawberries, could be grown commercially where transportation facilities are favorable. The soil is well suited to Bermuda and other grasses, and dairying could be carried on successfully if markets for dairy products were available.

#### RUSTON VERY FINE SANDY LOAM.

The surface soil of the Ruston very fine sandy loam is a brown, grayish-brown, or slightly reddish brown loamy very fine sand or very fine sandy loam, 6 to 15 inches deep. The subsoil is a reddish-yellow or yellowish-red friable sandy clay becoming slightly heavier with increasing depth and slightly mottled with gray at about 30 to 36 inches. In places the subsoil at a depth of 6 to 12 inches is a yellowish or reddish-yellow very fine sandy loam or loamy very fine sand. Small sand mounds occur throughout the type, occupying in places 50 per cent of the surface. These mounds consist of Ruston very fine sand or a deep phase of the Ruston very fine sandy loam, while the depressions may consist of the Bowie very fine sandy loam or Susquehanna very fine sandy loam.

The Ruston very fine sandy loam occurs in a number of small areas throughout the northern and southern parts of the county, as well as in other parts of the forested sections.

The surface of the type is gently undulating, the areas in many places occupying smooth ridges or swells. The drainage is very good, though in some places the depressions between the mounds are wet and soggy in periods of considerable rainfall. The type also is developed on long, gentle slopes adjacent to the larger stream valleys.

The Ruston very fine sandy loam is cultivated extensively, probably 75 per cent being utilized for farming. Where uncultivated, much of the original forest remains. It consists of shortleaf pine, post oak, red oak, black oak, and hickory.

The crops grown on this type are cotton, corn, saccharine sorghum, peanuts, and sweet potatoes. There are also small vegetable gardens and small orchards of peaches, pears, plums, and berries. Cotton averages one-fourth to one-third bale per acre, and in especially favorable years considerably more. Corn yields 15 to 30 bushels per acre. Bermuda grass does well, furnishing good pasture and yielding 2 or 3 tons of hay per acre. Peanuts do well, the yield ranging from 20 to 50 bushels per acre. Sweet potatoes yield 100 to 300 bushels per acre. The soil is well suited to vegetables, fruits, and berries.

The Ruston very fine sandy loam responds readily to applications of barnyard manure. Plowing under organic matter improves the soil, and by growing cowpeas, peanuts, or other legumes the productiveness of the soil can be increased.

The selling price of the Ruston very fine sandy loam ranges from \$25 for unimproved land to \$50 or more for land cleared and in cultivation.

Some areas of Ruston very fine sand have been included with the Ruston very fine sandy loam as mapped, on account of their small extent. The surface soil in these areas is a brown very fine sand about 6 inches deep, and the subsoil to 36 inches a light-red, yellowish-red, or reddish-yellow very fine sand. These included areas occupy gentle ridges or swells in interstream areas where mounds are most numerous. One of the largest areas occurs about 1 mile north of Cherry in the central part of the county. Drainage for the most part is good, though some of the depressions between the mounds hold water on the surface for some time during wet seasons. Most of the land was originally forested, the growth consisting principally of post oak, some pine, blackjack oak, and hickory. Probably 75 per cent of it has been cleared and is in cultivation. The leading crops are cotton and corn, although sorghum, vegetables, and fruit are also grown.

#### NORFOLK VERY FINE SAND.

The surface soil of the Norfolk very fine sand is a light-brown to grayish-brown or yellowish-brown very fine sand, 4 to 8 inches deep. The subsoil is a yellow, loose, very fine sand. This type is marked by dome-shaped mounds, 2 to 4 feet high and 20 to 100 feet across, which in places are so close that they merge. These mounds constitute 50 to 75 per cent of the surface of the type. The intermound areas or depressions contain very fine sandy loam of the Susquehanna and Bowie series, and in places a very small amount of Norfolk very fine sandy loam.

Many mounds of the Norfolk very fine sand occur throughout other sandy types in the county, but they are too small to map separately. Where the mounds are so numerous as to occupy the greater part of the surface, the areas are mapped according to the soil of the mounds.

The Norfolk very fine sand is not extensive in the county. It occurs in small areas in various parts of the county in close association with the Bowie and Susquehanna soils.

The type usually occupies nearly level areas or gently undulating interstream divides. The numerous mounds give in detail a billowy surface. Drainage is good on the mounds, though water may stand for some time after heavy rains, or the soil be very wet between the mounds.

The Norfolk very fine sand was originally a forest soil. One-half or more of the type is now cleared and farmed. The forest growth consists mainly of blackjack oak, post oak, pine, and hickory. The abundance of blackjack oak on the mounds of the type is characteristic.

The type is farmed with adjoining soils in the same way and to the same crops as the Susquehanna very fine sandy loam, although it is somewhat less productive. Cotton, corn, and sorghum are the principal crops. The soil is deficient in humus and would be improved by applying barnyard manure, growing cowpeas, and plowing under green-manure crops. The soil is well adapted to the production of vegetables, small fruits, and berries.

A number of small areas of Norfolk fine sand are included with the very fine sand. These occur in various parts of the county, the larger lying 2 or 3 miles northwest of Boxelder. The soil differs from the very fine sand in being a little coarser grained and looser.

The Norfolk fine sand occupies ridges and slopes in the heavily forested section of the county. Surface and internal drainage are good. The land is now mostly in forest, though a few small patches are cleared and in cultivation. The forest trees include shortleaf pine, hickory, blackjack oak, and some post oak. The soil when freshly cleared will produce one-fifth to one-fourth bale of cotton and 10 to 15 bushels of corn per acre, but if no manure is supplied, the yields of all crops soon decline. The soil requires the addition of a large amount of organic matter to produce fair yields. This soil is especially suited to peaches, pears, plums, berries, and vegetables.

#### SUSQUEHANNA FINE SANDY LOAM.

The surface soil of the Susquehanna fine sandy loam to a depth of 2 to 6 inches is a gray or brownish-gray or light-brown fine sand, grading abruptly into a yellow or yellowish-brown loamy fine sand or fine sandy loam which continues to a depth of 12 to 20 inches. The

subsoil is a heavy mottled red and gray clay, extending to a depth of 36 inches or more. Dome-shaped mounds of Norfolk and Ruston fine sand occur over the surface, constituting in places as much as 25 per cent of the area.

The Susquehanna fine sandy loam is developed in a few small areas scattered over the forested section of the county. The type occurs principally in the vicinity of Bogata. The surface is gently undulating and the drainage fair.

This type was originally in forest, but probably more than 75 per cent is now cultivated. The forest growth consists mainly of post oak, pine, blackjack oak, hickory, and red oak. The soil is farmed with associated soils in the same way and to the same crops as the Susquehanna very fine sandy loam and approximately the same yields are obtained.

#### SUSQUEHANNA VERY FINE SANDY LOAM.

In virgin areas the surface soil of the Susquehanna very fine sandy loam to a depth of 2 to 6 inches is a loamy very fine sand, gray in color, and in places mottled with brown or yellow. In cultivated fields the color is brown or light brown. The gray surface layer quickly gives way to a yellow loamy very fine sand, which in turn grades at 6 to 8 inches into a yellow very fine sandy loam extending to a depth of 14 to 18 inches. Below this the subsoil begins rather abruptly; it consists of a heavy plastic clay, mottled red and gray. The heavy mottled red and gray clay is typical, but there are slight variations in color. In some places there are yellow mottlings in the subsoil, and in others the material is very dark bluish gray. On slopes the soil layer of yellow very fine sand or very fine sandy loam may not be over 6 or 8 inches thick, and where the surface has been washed the clay subsoil may be very near the surface. As a rule the red mottling predominates in the upper part of the subsoil, the gray mottling becoming more prominent with depth. Small dome-shaped mounds occur over this type, but are not abundant enough to classify it as a mound phase. These mounds consist of very fine sand of the Norfolk and Ruston series or in places of the deep phase of the Ruston, Susquehanna, Bowie, or Norfolk very fine sandy loams. A slight scattering of gravel is present in places on the surface and here and there in the subsoil. This gravel is rounded or subangular and consists mainly of quartz and chert.

The Susquehanna very fine sandy loam is the most extensive type in the county. It occurs in large areas in all sections, and is a very important agricultural soil. Much of the type is gently undulating, and in the broad interstream areas a considerable part is nearly level. Near streams the surface is commonly gently rolling, but there are

some slopes rather steep. Drainage is good to fairly good over the greater part of the type, but in nearly level areas water may stand for some time during wet seasons in the depressions between the mounds. This is largely due to the relatively impervious clay subsoil, and to inadequate drainage outlets. On slopes that are rather steep the surface where unprotected is likely to suffer severe erosion, especially in cultivated fields.

Much of the Susquehanna very fine sandy loam is cleared and in cultivation, some of it having been farmed continuously for 50 years or more. Possibly 30 per cent remains in forest, but the greater part of the more valuable timber, pine and oak, has been cut and sold. The forest growth consists mainly of shortleaf pine, post oak, red oak, blackjack oak, and hickory. There are also some sweet gum, dogwood, huckleberry, haw, and other small trees and shrubs. A bush called "French mulberry" grows extensively in places, and there is considerable sparkleberry.

The leading crops are cotton and corn. Sorghum, sweet potatoes, peas, and peanuts are also grown. Vegetables, peaches, pears, plums, small fruits, and berries are grown in a small way for home use and for sale locally. When cleared this soil is quite productive, and fair yields of corn and cotton are obtained, but under continued cropping without rotation and without fertilizing the yields decrease. Where land has been in cultivation only a few years, cotton yields one-third to one-half bale and corn 20 to 35 bushels per acre, but on many farms cotton yields only one-fifth to one-third bale and corn 12 to 20 bushels per acre. Bermuda grass makes splendid pasture, and yields 2 or 3 tons of hay per acre. Sweet potatoes yield 100 to 250 bushels per acre. Many farmers are beginning to grow sweet potatoes for shipment to outside markets. This type is farmed in much the same manner as the Bowie very fine sandy loam. Small amounts of commercial fertilizers have been used with varying success. The use of fertilizer is in rather an experimental stage, although it is generally conceded to have increased yields. Various kinds have been used, but nitrogenous and phosphatic fertilizers have apparently given the best results. The soil would be greatly improved by liberal applications of barnyard manure and by plowing under other forms of organic matter. The slopes in cultivated fields should be terraced and cultivated with the contours to prevent erosion, and flat areas should be drained by ditching.

Unimproved land of this type sells for \$20 to \$30 an acre, and improved land brings from \$40 to \$75 an acre.

The cotton grown on this soil is said to have a slightly shorter staple than that grown on the bottom soils or black prairie lands. However, it is better on the more productive farms of the type than on the run-down farms.

Included with the Susquehanna very fine sandy loam are a number of small areas of Susquehanna silt loam. The principal areas of this description lie 3 to 5 miles south and southwest of Lydia. They normally occur as forested and sparsely forested areas adjoining prairies of Crowley silt loam.

The Susquehanna silt loam to a depth of 6 to 8 inches is a grayish-brown, brown, or gray silt loam, in places showing rusty-brown mottlings. The subsoil consists of a mottled red and gray heavy clay, though in places at depths ranging from 8 to 15 inches it is a yellow or mottled yellow and gray silty clay loam. A small number of low dome-shaped mounds of deep Bowie and Susquehanna very fine sandy loam occur on the surface. The surface is very gently undulating to nearly level and the drainage is poor, though sufficient to allow of cultivation. The timber consists chiefly of post oak, with some blackjack oak, willow oak, hickory, and red oak. Very little of this land is in cultivation, as most of it lies some distance from railroads in a section where large areas of land are uncleared. The soil is well suited to cotton, grass, sorghum, and oats. Drainage would be improved by ditching. The land is held for \$15 to \$30 an acre.

*Susquehanna very fine sandy loam, mound phase.*—The mound phase differs from the typical Susquehanna very fine sandy loam mainly in the greater abundance of mounds of Norfolk and Ruston very fine sand. The soil between the mounds is practically the same as the typical Susquehanna very fine sandy loam, though in places the subsoil lies a little deeper. There are also small areas of Lufkin very fine sandy loam or soil that resembles that type in its general characteristics. The mounds of very fine sand on this phase in places occupy 50 per cent or more of the surface.

A considerable number of areas of this phase are scattered throughout the forested sections of the county, usually in close association with the typical soil. Some of the larger areas occur several miles north of Detroit in the northwestern part of the county. The surface is nearly level to very gently sloping, but the dome-shaped mounds give it a billowy appearance. Surface drainage is fairly good, though in many places water stands on the surface for some time in wet seasons.

The phase is forested with the same growth as the typical soil. Perhaps 50 per cent or more is in cultivation. Crops and yields are probably somewhat lower than on the typical soil, as the mounds are numerous and are less productive than the depressions.

Land values are approximately the same or a little lower than for the typical soil.

## SUSQUEHANNA CLAY.

The Susquehanna clay comprises areas where much of the original surface material of other Susquehanna soils has been washed away. The profile normally consists of a layer of gray silt loam or very fine sandy loam, 1 to 3 inches thick, resting on a layer of a heavy, stiff, or plastic, mottled red and gray clay, slightly mottled in places with yellow, and a lower subsoil layer of gray or bluish-gray stiff clay, only slightly mottled with red or yellow. In places the stiff clay is exposed at the surface.

The Susquehanna clay is of very small extent in the county. It occurs in a number of small, widely scattered areas throughout the forested regions of the county. One of the larger areas lies about 8 miles southeast of Clarksville, and others are situated in the southeastern part of the county. Some bodies, too small to show separately on the map, are included with other types.

The surface of the Susquehanna clay is usually sloping, most of it occupying steep to gentle slopes adjacent to the stream valleys. Surface drainage is good and in many places excessive, even in forested areas.

Most of the type is forested with red oak, post oak, hickory, and other trees, and only a very small part is in cultivation. It is not a very productive soil where the slopes are subject to erosion, but elsewhere it could be made productive by the use of barnyard manure and by growing and plowing under cowpeas and similar crops.

At present the type is probably best suited to forestry and to grass. The soil is well adapted to oats and in favorable spots will give fair yields of cotton and corn.

## LUFKIN VERY FINE SANDY LOAM.

The surface soil of the Lufkin very fine sandy loam consists of a gray or light-gray very fine sandy loam or loamy very fine sand 8 to 12 inches deep. The subsoil is a light-gray or ashy-gray silty clay loam or clay, in places slightly mottled with yellow, which passes at 20 to 30 inches into a heavy, tough, very compact, ashy-gray to dark-gray clay. In places the clay layer is dark bluish gray in color, with here and there a small amount of deep-red mottling in the upper part.

Small mounds of Lufkin or Norfolk very fine sand or a deep phase of the Lufkin or Susquehanna very fine sandy loam occur over the surface. The type as mapped also includes small bodies of Lufkin silty clay loam and of the typical Susquehanna very fine sandy loam.

The Lufkin very fine sandy loam is not an extensive type. It occurs in a number of small widely scattered areas in the northern and southern parts of the county. The areas are practically level and water stands on the surface for long periods during wet seasons.

The typical tree growth is largely willow oak, though there is some post oak, blackjack oak, hickory, and shortleaf pine. Little of this type, probably less than 10 per cent, is in cultivation, owing doubtless to the poor drainage, which makes the crops somewhat uncertain. The yields are fair in good seasons, and the soil becomes more productive after being used for a few years, doubtless because of better aeration and somewhat better drainage brought about by plowing and cultivation.

This soil would be fairly well suited to cotton and grass if drained or ditched in such a way as to carry off excess water promptly. The land is held at prices ranging from \$15 to \$25 an acre.

*Lufkin very fine sandy loam, mound phase.*—This phase differs from typical Lufkin very fine sandy loam in the greater number of mounds present. In the higher of these mounds the clay seldom lies within 3 feet of the surface, although in many a loamy very fine sand or very fine sandy loam is encountered at about 30 to 36 inches. Much of the higher mound soil is a brown or light-brown very fine sand or loamy very fine sand, passing at about 5 to 10 inches into yellow or brownish-yellow very fine sand. On the lower mounds deep Susquehanna very fine sandy loam is generally developed. The intermound soil consists predominantly of Lufkin very fine sandy loam. In places the mounds constitute 50 per cent of the surface. The phase occurs in a number of scattered small areas in the forested sections.

The soil has the same crop adaptations as the typical soil, though it is probably less productive, the mounds being less productive than the depressions. The forest growth is largely willow oak, with some red oak, post oak, pine, red haw, and elm. The phase is cultivated in small patches with associated soils. About the same crops are grown as on the Lufkin and Susquehanna very fine sandy loams, and yields are approximately the same. The phase requires ditching to provide adequate drainage. Land of this phase sells for about the same as the typical soil.

#### LUFKIN SILT LOAM.

The surface soil of the Lufkin silt loam is a gray silt loam 5 to 8 inches deep. This grades into a gray silty clay loam, which extends to a depth of about 12 inches, where it is underlain by a heavy gray or dark ashy gray clay, in places mottled with yellow.

At about 20 to 24 inches this becomes very tough. In places the surface layer of silt loam rests at 5 to 8 inches on heavy gray clay. The surface soil dries to a whitish color and becomes compact and hard. A few mounds are scattered over the type. These consist of Norfolk and Lufkin very fine sand and deep Lufkin, Caddo, and Susquehanna very fine sandy loam.

The Lufkin silt loam occupies several small areas in the extreme southeastern part of the county between Lydia and the Sulphur River. One fairly large area is situated in the extreme southwestern part of the county, 5 miles southwest of Bogata. The areas are practically level, and water stands on the surface a long time in wet seasons, the movement of water downward being retarded by the relatively impervious subsoil.

In the southeastern part of the county the forest growth consists principally of post oak and willow oak, with some blackjack oak and hickory. Here very little of the type is cultivated. Where it is farmed the same crops are grown and about the same yields are obtained as on the Lufkin silty clay loam. In the southwestern part of the county the type occupies a considerable part of Lipp Prairie and supports a growth of broom sedge, needle grass, and other grasses. Here the land is utilized largely for pasture, though some of it is devoted to cotton, corn, and oats. Cotton yields one-fifth to one-third bale, corn 15 to 20 bushels, and oats 20 to 40 bushels or more per acre.

This type seems best suited to small grains, cotton, and grass. The drainage could be considerably improved by ditching. The soil is difficult to till, but can be made much more tractable by incorporating organic matter. Land of this type sells for \$15 to \$35 an acre.

#### LUFKIN SILTY CLAY LOAM.

The surface soil of the Lufkin silty clay loam consists of 4 to 8 inches of brownish-gray silty clay loam or 2 or 3 inches of silt loam passing into silty clay loam. This is underlain by a gray or bluish-gray heavy clay which shows in many places some pale-yellow mottling, and which either continues to a depth of 36 inches or more, or grades into a stiff, very tough, dark-gray, ashy-gray, or bluish-gray clay. In places the immediate surface consists of mottled gray and yellow or brown silty clay loam. In some places very slight mottlings of red occur in the upper subsoil. The soil dries out to a light-gray or ashy-gray color and becomes rather hard. A few small mounds of Lufkin very fine sandy loam are scattered over the areas.

The Lufkin silty clay loam occurs in small and large areas in all parts of the forested sections of the county, but is somewhat more extensive in the southwestern part than elsewhere.

The Lufkin silty clay loam occupies level or slightly basinlike areas, locally known as "pin-oak flats" or "willow-oak flats." The surface drainage is poor, owing to the nearly level surface and to the heavy clay subsoil, which is almost impervious. Water stands on the surface for considerable periods after rains, if the land is not ditched.

The main forest growth is pin oak or willow oak, some post oak, and hickory. Probably not over 20 per cent of the type is farmed. The land is rather more productive than the silt loam and improves with cultivation. This is probably due to aeration of the soil. Cotton yields one-fourth to one-half bale per acre, and corn 15 to 20 bushels. The land produces good Bermuda grass and wheat and oats do well, the latter yielding as much as 40 to 50 bushels per acre under the most favorable conditions.

Uncleared land of this type sells for \$20 to \$25 an acre, and improved land for \$50 or \$75 an acre, or even more if near good roads.

The soil works up into a loose seed bed, if stirred when moisture conditions are right, though it is inclined to bake if allowed to dry out without cultivation. The crops suffer in dry weather some time before crops on the sandy type or on the Houston black clay show signs of injury. The type seems best suited to cotton, small grains, especially oats, and grass. For best results the land should be drained. This can be accomplished by ditching. The use of barnyard manure and the plowing under of organic matter are recommended. Growing cowpeas on the land and plowing under the vines would be beneficial.

A few small areas of Susquehanna silty clay loam of little importance, occurring mainly in the central part of the county, are included with the Lufkin. This soil consists of yellowish-brown to light-brown silty clay loam, 3 to 6 or 8 inches deep, grading into a mottled heavy red and gray clay subsoil, which in places shows slight mottling with yellow. This clay extends to depths of 36 inches or more without change of texture, but in most areas the gray color increases with depth and the red becomes less pronounced. In many places the lower subsoil is a heavy gray clay very slightly mottled with red or red and yellow. In places the surface soil is slightly mottled with gray. In forested areas the surface layer, an inch or two thick, is usually gray in color, being somewhat darkened by leaf mold or other decomposed organic matter.

The areas of this type are level to very gently sloping or undulating. The drainage, except on slopes, is imperfect. The soil is inclined to wash, if the slope is at all steep. The soil would respond

well to barnyard manure, and the supply of organic matter should be increased by plowing under green-manure crops.

The following table gives the results of mechanical analyses of samples of the soil, subsoil, and lower subsoil of the Lufkin silty clay loam:

*Mechanical analyses of Lufkin silty clay loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
445335.....	Soil.....	0.2	1.2	1.2	15.2	14.0	52.4	15.9
445336.....	Subsoil.....	1.2	1.6	.9	12.9	13.4	38.4	32.0
445337.....	Lower subsoil...	1.8	2.5	1.7	13.1	9.9	38.0	32.9

#### LUFKIN CLAY.

The typical Lufkin clay is a dark-gray or brownish-gray heavy clay, passing at 2 to 6 inches into light-gray or bluish-gray heavy clay, slightly mottled with pale yellow and sometimes reddish yellow. Some borings were made in which the mottled gray and yellow clay extends to a depth of 3 feet, but usually the lower layer of tough clay present in other types of the series occurs within the profile. This is so dense that boring is almost impossible, even when the material is somewhat moist. In a few places a rather dark gray or black subsoil occurs. Such areas are really the Wilson clay or an approach toward that type. Frequently at from 15 to 24 inches and commonly at some depth in the 3-foot section the subsoil grades into ashy-gray, dark-gray, or light bluish gray material of tough, impervious nature. In some included spots the subsoil color is mostly yellow, with some gray mottlings; if more extensive this condition would have been mapped as Tabor clay. When dry the surface soil of the Lufkin clay is decidedly ashy gray. The type is rather sticky when wet and hard and intractable when dry, though if cultivated under proper moisture conditions the immediate surface breaks down into a fairly fine seed bed.

The Lufkin clay, though not very extensive, is developed in a considerable number of areas a square mile or more in extent in all parts of the county. Many areas occur in the central part within a few miles of Clarksville. Good-sized bodies also lie a few miles south of Bogota, in the southwestern, and in the northeastern parts.

The surface of the Lufkin clay is nearly level to gently sloping. In the main forest regions of the county the type occurs as flatwoods or nearly level areas. Adjacent to the Wilson clay in the central part of the county the type occupies long, narrow strips following branches and comprising gentle slopes leading down from higher areas of the former type. The surface drainage is fairly good where

the land is sloping, but poor on the nearly level areas. Owing to the compact subsoil, underdrainage is deficient in all the areas.

Where it borders the prairie soils the Lufkin clay is forested with post oak, some hickory, and red oak. In these areas more than 50 per cent of the type is in cultivation. In the main forested sections, where the type is more nearly level, the timber growth consists of post oak, willow oak, blackjack oak, and some hickory. In these sections the proportion of the type cultivated is much smaller. Improved land of this type in the central part of the county, usually adjacent to Wilson clay, sells for a little more than \$100 an acre. In other parts of the county the price is much lower.

The farmed area of the Lufkin clay is utilized principally for the production of cotton, though it is said that the staple is not quite so long on this soil as on the heavy black prairie soils. The yield is ordinarily one-third to one-half bale per acre. Little corn is grown, and the opinion prevails that the soil is not well adapted to this crop. Yields range from 15 to 20 bushels per acre. Bermuda grass grows well and supplies good pasturage and hay. Little small grain is grown and only small amounts of sorghum.

The soil would be greatly improved by the addition of barnyard manure and by plowing under other forms of organic matter. It is locally called "gray land." Crops are said to suffer from drought much sooner on this soil than on the Houston black clay.

#### CROWLEY SILT LOAM.

The surface soil of the Crowley silt loam consists of a gray, grayish-brown, or light-brown silt loam 6 to 10 inches deep. The upper subsoil consists of a heavy mottled red or brownish-red and bluish-gray clay. The lower subsoil, from 18 or 24 inches to 3 feet, is a dull-brown or yellowish heavy clay, with very faint bluish-gray mottlings. Small black concretions are present in places on the surface and throughout the soil and subsoil.

The Crowley silt loam covers in all about 4,000 acres. It occurs in a number of small prairies in the southeastern part of the county, southeast of Boxelder and a few miles southwest of Lydia. The surface is gently undulating to nearly level, and drainage is fairly good over much of the type, though the slopes for the most part are so gentle that the run-off is slow.

The Crowley silt loam supports a growth of prairie grasses, including a kind of blue stem and considerable poverty or needle grass. In the larger prairies perhaps 25 per cent of the land is in cultivation. It has been considered of little value for the production of crops, but some farmers have produced one-fourth to one-third bale of cotton per acre, 15 to 20 bushels of corn, 2 tons of Bermuda-grass hay, 30

bushels of oats, and 8 to 18 bushels of wheat per acre. Good yields of saccharine sorghum have also been obtained. The type is held at \$20 to \$40 an acre. The soil is probably best suited to grass and small grains. It would be improved by the use of manure and the plowing under of green-manure crops.

#### WILSON SILT LOAM.

The surface soil of the Wilson silt loam consists of a dark-gray, grayish-brown, or light-brown silt loam, 4 to 8 inches deep. This commonly rests on a subsoil of dark bluish gray or mottled dark bluish gray and brown clay. In places the surface soil grades into a layer of dark-gray or light-brown silty clay loam before the clay subsoil is reached.

In some places the lower subsoil is quite compact, and near the forest soils some red mottling occurs here and there in the lower subsoil. Occasionally small mounds of Susquehanna very fine sandy loam are present near the margins of the areas adjoining forest lands.

This type is developed in several areas in the southwestern part of the county. Some of these are more than a square mile in extent, the largest areas lying just west and southwest of Bogota and around Halesboro, but the total extent of this soil is small, only a little more than 4,000 acres.

The surface of the Wilson silt loam is nearly level to very gently sloping. In many places the surface drainage is slow, but on the whole the drainage is sufficient to allow cultivation.

This is a prairie soil, though it supports a few trees near its boundaries with forest areas. Practically all of the type is in cultivation. It is utilized principally for the production of cotton, corn, and oats. A small amount of wheat is grown on some of the farms. The land is productive, yielding one-third to one-half bale of cotton, 15 to 25 bushels of corn, and 30 to 60 bushels of oats per acre. Wheat yields 6 to 15 bushels per acre. Small patches of sorghum are grown for forage. The type does not appear to be well suited to vegetables or tree fruits, though berries do well. Vegetables and fruit probably could be grown more successfully after the land has been under cultivation longer and the content of organic matter increased. The soil bakes after rains and must be cultivated when moisture conditions are proper to give a friable surface.

It responds well to barnyard manure. Growing cowpeas and turning under vegetable matter would increase the productiveness and render the physical condition of the soil more favorable for tillage. The length of staple of cotton grown on this soil is about the same as that on the other Wilson soils, ordinarily about 1 inch. Land of this type sells for \$75 to \$150 an acre.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Wilson silt loam:

*Mechanical analyses of Wilson silt loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
445360.....	Soil.....	0.0	1.0	0.6	3.2	13.6	62.8	18.7
445361.....	Subsoil.....	.0	1.5	2.2	8.6	9.1	51.4	27.4

WILSON SILTY CLAY LOAM.

The surface soil of the Wilson silty clay loam is a dark grayish brown to brown silty clay loam 4 to 8 inches deep. The subsoil is typically a dark bluish gray clay slightly mottled with brown. In a few spots the lower subsoil is mottled with yellow and gray, and here a few lime concretions occur in the material at a depth of 36 inches. In places on level or low areas the surface soil for 2 or 3 inches is a light-brown silt loam, and on some slopes that have been eroded it consists of only 3 or 4 inches of silty clay loam.

This type occurs in some good-sized and a number of small areas in the western part of the county, several miles south of Detroit, and northwest and west of Bogata. The surface for the most part is gently rolling to undulating. The surface drainage is good. Some of the slopes are rather steep and in places erosion has thinned the surface soil and considerably depressed crop yields. The more nearly level areas are the most productive.

This type is a prairie soil, and practically all of it is cultivated to cotton, corn, and oats. A small acreage is devoted to wheat on a few of the farms. Where the land is cropped exhaustively the yields are low, but where care is taken to change the crops occasionally, where methods of cultivation that tend to control erosion are used, and where the soil is kept supplied with organic matter, the crop yields are good. Ordinarily cotton yields one-third to one-half bale per acre, corn 15 to 25 bushels, oats 30 to 60 bushels, and wheat 12 to 20 bushels per acre. The soil responds well to applications of barn-yard manure and to any practice that maintains or increases the supply of organic matter in the soil. Land of this type of soil sells for \$100 to \$200 an acre.

The Wilson silty clay loam is well suited to the production of cotton, grass, and oats. It is not so good a soil for growing corn, fruits, and vegetables, though these crops may be grown by using care in preparing the seed bed and by adding well-rotted barnyard manure and other organic matter to the soil.

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

*Mechanical analyses of Wilson silty clay loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
445355.....	Soil.....	0.0	0.3	0.3	5.4	18.2	53.9	22.0
445356.....	Subsoil.....	.2	.2	.4	5.9	9.9	50.7	33.0

WILSON CLAY.

The surface soil of the Wilson clay is a dark-brown to black clay 6 to 12 inches deep. The subsoil is a dark-bluish, bluish-gray, dark-gray, or ashy-gray clay, showing faint mottlings of yellowish brown, rusty brown, yellow, or reddish brown. The subsoil gradually becomes lighter in color with depth. In ditches the substratum, at depths of 4 to 6 feet, shows a gray or mottled gray and yellow brittle heavy clay. In places the type consists of black clay, which shows but little change within the 3-foot section, except the development of a grayish cast in the lower part and some yellowish-brown mottling below 20 inches. The surface in places has a slight sprinkling of small waterworn quartz and quartzite gravel.

The Wilson clay is known locally as "black land." While the surface resembles the Houston black clay, the types differ considerably in agricultural value. On slopes where small spots of the subsoil are exposed the cultivation of the soil is very difficult, satisfactory plowing being almost impossible. These spots are called "gumbo" land. When cultivated under proper moisture conditions, however, the typical soil works into a friable tilth. Neither the soil nor the subsoil effervesces with hydrochloric acid.

The Wilson clay occupies prairie areas in the central and western parts of the county. A number of large areas lie a few miles south, southeast, and southwest of Clarksville. The largest area is in the southwestern part of the county, just north of Bogata, and another of importance is mapped just south of Detroit.

The Wilson clay occurs as broad, flat, or undulating areas sloping gently down to small streams. The surface drainage is very good, though with considerable rain the more nearly level areas become soggy. On some relatively steep slopes erosion is somewhat active.

The Wilson clay is a very desirable soil. It was originally prairie land, requiring no clearing, and is now practically all in cultivation. The soil is especially esteemed for cotton. It sells for \$150 to \$225 an acre, and some farms have brought more than \$300 an acre. The soil

is said to produce cotton of a rather long staple, although not so long as that produced on the Houston black clay.

The leading varieties are Lone Star, Mebane, Rowden, and Acala. Snowflake, a long-staple cotton, has been grown successfully. It is said that this soil gives better yields of cotton than the Houston black clay. Ordinarily the yields range from one-third to three-fifths bale per acre, though 1 bale per acre is sometimes obtained. Cotton blight apparently does not affect cotton on this soil. Oats and wheat are grown to a small extent, with indifferent results. Some corn is grown, the yields commonly ranging from 15 to 25 bushels per acre. Bermuda grass is grown in a small way for pasturage and for hay. It is usually cut twice a year and yields 4 to 5 tons of hay per acre per season. Some saccharine sorghum is grown for forage, and it yields well.

The soil, though naturally productive, responds to the application of well-rotted barnyard manure. In one instance a field of this type well manured produced about 1 bale of cotton per acre, while unmanured land of the same kind near by produced one-third bale the same season. Undoubtedly the soil is becoming deficient in humus with continued cropping to cotton. A rotation, including a legume crop, would aid in restoring the proper balance between the mineral and organic soil constituents.

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

*Mechanical analyses of Wilson clay.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
445312.....	Soil.....	0.7	5.6	4.6	14.0	6.4	35.2	34.0
445313.....	Subsoil.....	.5	7.0	4.8	17.0	7.6	26.6	36.5

HOUSTON BLACK CLAY.

The typical Houston black clay consists of a black, heavy clay, very sticky when wet and waxy when moderately moist, but slaking to a crumbly mass upon drying. On slopes and ridges the surface soil is 8 to 18 inches deep; on flat or low areas the black clay often continues to a depth of 3 feet, though the lower part of the 3-foot section may be a very dark bluish gray. The areas in which the black clay forms the soil have commonly a subsoil of gray clay or silty clay. In places the material may be a brown clay, becoming yellow with depth, or a yellow or greenish-yellow clay throughout. Lime concretions are present in the subsoil, and in many places white soft chalk is found in the lower subsoil. Beds of white and blue

chalk lie several feet beneath the surface, and in a few small areas the beds come within the 3-foot profile. On some slopes, as for example one-half mile north of Clarksville, the subsoil in spots is a mottled yellowish-brown, reddish and pale-yellow, sticky, noncalcareous clay, resembling the subsoil of the Oktibbeha. In places freshly plowed fields have a spotted black and brown appearance; some of these spots resemble Sumter clay.

Both the soil and subsoil of this type are calcareous, but on the more nearly level areas, where the dark surface material is deep and the chalk beds farther from the surface, the soil effervesces only faintly with hydrochloric acid, indicating a relatively low content of free lime carbonate.

The Houston black clay is a moderately extensive and very important soil, occupying large prairie areas in the central part of the county, around Clarksville. The topography is gently rolling to undulating, the surface rising from the numerous small streams in long, gentle slopes to the crests of broad ridgelike divides. The drainage in general is good, but some low, swalelike areas remain wet for a considerable time in periods of wet weather. Such areas would doubtless be improved by laying tile drains. Numerous small streams of intermittent flow traverse the main body of the type.

The Houston black clay is prairie land and originally supported a vegetation consisting mainly of grasses, with occasional clumps of red haw and a few post oak, bois d'arc, and other trees on the slopes adjacent to the streams. Practically all the type is now in cultivation. It is considered one of the most desirable soils in the county and farms composed of it sell for \$125 to more than \$200 an acre.

This soil is used principally for the production of cotton and corn, with cotton occupying much the larger acreage. Oats are grown on many farms and there is a very small acreage of wheat. Many small areas, especially the lower lying parts of the type, are kept in Bermuda grass for pasture and for hay. Some saccharine sorghum is grown for forage.

Cotton on the Houston black clay yields from one-third to 1 bale per acre, depending on the season, with the average yield nearly one-half bale per acre. Corn ordinarily yields 25 to 60 bushels per acre, though dry weather in June and July frequently impairs the crop. On one farm, where the land is well prepared and the crop properly cultivated, the estimated average yield for 10 years is 40 bushels per acre. Ordinarily, however, the corn is neglected and effort concentrated on the cotton crop. Bermuda grass affords excellent pasturage on this soil, and yields 3 to 5 tons of hay per acre per season. Oats yield 30 to 75 bushels, and wheat 12 to 20 bushels. Little attention is given to crop rotation, and the land is frequently planted to cotton year after year.

In preparing the land for cotton or corn it is commonly bedded in the spring, after the stalks have been raked up and burned. No commercial fertilizers are used, though a few farmers use some barnyard manure. The soil, as a rule, responds well to applications of well-rotted barnyard manure. This soil is naturally very productive, but it is the opinion that much of it is deteriorating slightly from year to year. The addition of well-rotted barnyard manure and rotted straw or other vegetation is believed to be advisable. The practice will not only add plant foods, but will improve the physical condition of the soil, making it more retentive of moisture in dry seasons.

The practice of running the rows up and down the slopes tends to increase the washing away of the soil and thus to lessen its productiveness. Placing the rows in this way appears to be considered necessary by many to accelerate drainage in the spring and hasten the conditioning of the fields for planting. Probably terraces should be constructed along the slopes to check erosion. Crop rotations that include a small grain, corn, cotton, and cowpeas, or alfalfa would increase the productiveness of the land. Rotations tend to eliminate the cotton blight which affects the crop in some fields.

*Houston black clay, shallow phase.*—The surface soil of the Houston black clay, shallow phase, is a black, brown, or grayish-brown clay to silty clay loam 6 to 15 inches deep. The subsoil is a gray, mottled gray and yellow, or yellow clay to silty clay. At depths of 15 to 24 inches the subsoil rests upon gray or yellowish, rather hard chalk. The soil material varies in color with the depth to the chalk beds. Where the bed lies within 12 or 15 inches of the surface the soil is usually gray and the subsoil yellow or mottled yellow and gray, and where the chalk lies 24 inches or more below the surface the soil is usually dark brown to black and the subsoil yellow or yellowish brown. The color averages thus lighter than that of the typical Houston black clay.

This phase occurs in a number of very small areas scattered through large bodies of the Houston black clay. Many of these areas are too small to show on the map, but the larger ones are shown. These occur principally in the central part of the county.

The surface of the Houston clay, shallow phase, is usually gently sloping. As a result the drainage is good to excessive, and there is some washing where the soil is unprotected. It is this tendency to erode that has produced the shallow phase by removing the surface soil and bringing the underlying chalk nearer the surface.

The phase is not so productive as the typical Houston black clay, and it is said that its productiveness is proportionate to the depth to the chalk beds. This soil should be protected to prevent erosion.

Terracing probably could be effectively employed. The soil could be made more productive by the addition of barnyard manure and other forms of organic matter. The phase is said to be better suited to oats and other small grains than to cotton or corn.

OKTIBBEHA CLAY LOAM.

The Oktibbeha clay loam consists of a brown or reddish-brown clay loam or silty clay loam, 2 to 5 inches deep, underlain either by (1) red heavy clay which grades into mottled red, gray, and yellow heavy clay and then into yellow or mottled yellow and gray plastic, sticky clay; or by (2) mottled red and gray plastic heavy clay passing downward into mottled red, yellow, and gray sticky, plastic clay, and then into yellow to mottled yellow or greenish-yellow and gray sticky, plastic clay. This lower yellowish subsoil may or may not be reached within the 3-foot section, but it appears within 3 to 6 feet of the surface, as seen in exposures. In places it is calcareous, containing white lime nodules or concretions, and it is nearly everywhere calcareous at a depth of 4 feet. The type resembles the Susquehanna silty clay loam, the main difference being the calcareous substratum. In some small prairie areas the surface soil is a black or dark-brown silty clay loam several inches deep.

The Oktibbeha clay loam is not extensive in this county. It is developed in a number of small, narrow areas along the northern border of the prairie land north, northeast, and northwest of Clarks-ville. A number of smaller areas are scattered through the central part of the county.

The Oktibbeha clay loam usually occupies sloping areas lying, in this county, between the areas of Houston soils and of Susquehanna soils. The drainage is good. In many places the run-off has been active enough to expose the clay subsoil by erosion.

The Oktibbeha clay loam is cultivated rather extensively. Originally it was forested mainly with post oak, blackjack oak, and hickory. It is utilized principally in the production of cotton, for which it is considered a fairly good soil, the yield averaging around one-third bale per acre. The staple is about as long as on the Houston black clay. The soil is not so well suited to corn, but produces 15 to 25 bushels per acre. Sorghum and Bermuda grass yield well. The land is subject to erosion and farm practices should be planned to guard against this. The soil could be greatly improved by the addition of barnyard manure and other organic matter. The land is generally sold with other soils. It is valued at \$50 to \$100 an acre.

OKTIBBEHA CLAY.

The surface soil of the Oktibbeha clay is a brown, yellowish-brown, or mottled red and gray clay 4 to 8 inches deep. The subsoil is a

mottled gray or bluish-gray and red heavy noncalcareous clay, extending to 3 feet or more. In some places at depths of 18 inches or more, and commonly at depths less than 4 feet, the subsoil or substratum consists of yellow or mottled yellow and gray or greenish-brown clay. The layer is calcareous and contains lime concretions. The subsoil in places also carries small black or rusty-brown concretions. In many places the soil and subsoil contain little if any lime carbonate to a depth of 3 feet or more. In other places the yellow calcareous subsoil comes near the surface and is overlain by a shallow brownish clay, which may also be high in lime. The type here is the Sumter clay, but occurring only in patches it was not mapped. There are some included dark spots where the soil resembles the Houston black clay, but the subsoil of these commonly shows some red mottling. Such areas represent either Wilson or Crockett clay.

The Oktibbeha clay is a type of small extent in the county. It occurs in a number of small areas a few miles north and northeast of Clarksville on the northern border of the prairies of Houston black clay. Here it lies in long irregular strips, bordered on the north by areas of Susquehanna and Lufkin soils. A few small bodies of the type are located in the west-central part of the county, one about 2 miles southwest of Detroit.

The Oktibbeha clay generally occupies slopes that lead downward from higher areas of Houston soils. The slopes range from gentle to rather steep, and surface drainage is good to excessive. In places the soil has been washed away, leaving the subsoil exposed.

The Oktibbeha clay originally supported a growth consisting mainly of post oak, with some blackjack oak and hickory. Probably more than 75 per cent of the type is now in cultivation. The land is farmed in conjunction with larger areas of the Houston black clay and other soils. It is held, along with other soils in farms, at \$75 to \$100 or more an acre.

The same crops are grown as on the Houston black clay, giving somewhat lighter yields. Cotton yields one-third bale and corn 15 to 25 bushels per acre. The soil produces cotton of good staple, approximating that on the Houston black clay. Oats and wheat give fair yields, and grass attains good growth.

This soil should be protected from erosion by terracing and contour cultivation. The soil would respond to the addition of barnyard manure and of organic matter in other forms.

#### KALMIA VERY FINE SAND.

The Kalmia very fine sand consists of a light-brown or grayish very fine sand, grading a few inches below the surface into yellow

or pale-yellow very fine sand, which continues to a depth of 36 inches or more. The soil resembles the Norfolk very fine sand.

The type is rather unimportant in the county, owing to its small extent. It occupies a number of small areas along the outer margins of the bottoms of Cuthand Creek and Sulphur River. It occurs as small benches or terraces somewhat lower than the general surface of the upland and a little higher than the present flood plains of the streams. The surface is gently undulating, and drainage is good. The type is marked by mounds similar to those appearing in the upland soils.

The Kalmia very fine sand supports a forest growth mainly of pine, post oak, blackjack oak, hickory, and red oak. Probably 75 per cent of it is cultivated. It is a rather light soil, well suited to vegetables and berries and probably to peaches. It is utilized mainly in growing cotton and corn. The yields are below the average, approximately the same as on the Norfolk very fine sand, from one-fifth to one-fourth bale of cotton and 10 to 15 bushels of corn per acre.

#### MYATT VERY FINE SANDY LOAM.

The surface soil of the Myatt very fine sandy loam consists of a rather compact gray very fine sandy loam, about 10 inches deep. The subsoil is a gray or light-gray rather heavy clay, which becomes heavier, compact, and very tough in the lower part. In places throughout the subsoil there are layers of white silt loam that are practically dry even where water has been standing on the surface for a long time. In places the subsoil is mottled with yellow. Mounds of Kalmia very fine sand are numerous over the surface, and near these the subsoil color is in many places predominantly yellow. This type resembles the Lufkin very fine sand, but is a terrace soil of more recent origin.

Only a small area of the Myatt very fine sandy loam is developed in Red River County. It occurs along Cuthand Creek in the southern part and along Red River in the northern part of the county. The areas occupy rather low terraces lying above overflow, reaching from the upland down to the bottoms along the streams. The surface is flat to very gently sloping. The boundary between these terraces and the uplands is distinct, the latter rising rather abruptly 20 to 50 feet above the terrace surface. On the stream-bottom side there is no sharp line of separation, the terrace sloping gradually into the bottoms. The surface drainage is poor in many places, and the soil remains wet for long periods.

Small areas of the type are in cultivation, the rest supporting a growth of willow oak, post oak, hickory, and some palmetto. Cotton, the main crop, yields one-fourth to one-third bale per acre, and corn yields 10 to 25 bushels per acre. Bermuda grass does well.

The drainage would be greatly improved by ditching. Possibly rice would grow well on this soil.

A small area included with this type along Cuthand Creek just north of Cuthand has a loose brown sandy soil with a friable mottled gray and yellow subsoil. Drainage here is fairly good. Medium yields of corn and cotton are obtained, and a peach orchard shows fairly good growth.

MYATT SILTY CLAY LOAM.

The surface soil of the Myatt silty clay loam consists of a gray or dark-gray heavy silty clay loam about 10 inches deep. The subsoil is a heavy gray clay, the upper part being mottled in places with orange or yellow.

The type is developed in a few small areas in the northern part of the county. It occupies a terrace lying a few feet above overflow at the edge of the bottom lands. The surface is flat, but there are some inequalities due to "hog wallows," which consist of numerous small depressions and elevations. There are occasional sand mounds consisting of *Kalmia* very fine sand. Drainage is very poor, and water stands on the surface for weeks in rainy seasons or during the winter.

Willow oak is the most abundant and characteristic tree growth, with some post oak, pine, and other trees. The land in its undrained condition is not cultivated and is considered of little agricultural value. With drainage it would produce fair yields of cotton and good yields of grass. The type would possibly give success with rice.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Myatt silty clay loam:

*Mechanical analyses of Myatt silty clay loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
445390.....	Soil.....	0.0	0.0	1.2	5.6	12.0	50.2	31.1
445391.....	Subsoil.....	.0	.0	.5	5.9	17.4	38.1	38.2

LEAF VERY FINE SANDY LOAM.

The Leaf very fine sandy loam is a light-brown to grayish-brown very fine sandy loam or loamy very fine sand, underlain at 6 or 8 inches by yellow or mottled yellow and gray very fine sandy loam, which becomes heavier with increase in depth, and passes at about 15 to 24 inches into mottled red and gray or red, yellow, and gray plastic heavy clay. Numerous large mounds are present in the areas, the soil, consisting mainly of *Kalmia* very fine sand or a deep

phase of the Leaf very fine sandy loam. Patches of Myatt very fine sandy loam, Myatt silt loam, and Leaf silt loam also occur throughout the type. These are not mapped separately, owing to their small size.

The Leaf very fine sandy loam occurs in a number of small areas on terraces lying above overflow along the Red River bottoms. The surface is nearly flat to gently undulating. Drainage is poor in many places, though sufficient to allow the use of the land for farming. Little of the type has been cleared and brought under cultivation as yet. Most of the type is forested with post oak, red oak, willow oak, shortleaf pine, and hickory. Cotton and corn are grown, cotton yielding about one-third bale and corn 20 to 30 bushels per acre. The soil is well suited to Bermuda grass. Ditching the land would greatly increase its value for the cultivated crops.

#### BREWER CLAY.

The surface soil of the Brewer clay is a black heavy clay about 12 inches deep. The subsoil to 36 inches or deeper is a dark-gray, black, or bluish-gray heavy clay. In low, poorly drained places the lower subsoil is mottled with bluish gray and brown. Here and there the subsoil consists of yellow clay mottled with brown. When dry the immediate surface has a grayish color. When wet the surface soil is very sticky, but on drying it becomes crumbly and friable.

The Brewer clay is not an extensive type in Red River County. It occurs in one large area and several smaller ones just south of Davenport, in the northwestern part. These areas lie on a terrace at the outer margin of and 10 or 15 feet above the Red River bottoms. The surface is nearly level and the drainage imperfect. In wet weather water stands on the surface for a considerable time.

About 50 per cent of the type is cultivated, the rest being forested with bois d'arc, willow oak, water oak, post oak, and pecan. The land is used for cotton and corn. Cotton yields one-fourth to one-half bale and corn 20 to 40 bushels per acre. The type is well suited to Bermuda grass and forage crops, and probably to alfalfa where well drained. It is held at \$50 to \$75 an acre. Ditching would improve the drainage materially.

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

*Mechanical analyses of Brewer clay.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
445374.....	Soil.....	0.0	1.7	2.8	21.4	12.4	40.4	21.3
445375.....	Subsoil.....	.0	1.7	2.9	22.5	14.9	34.4	23.6

## CAHABA VERY FINE SANDY LOAM.

The Cahaba very fine sandy loam consists of a reddish-gray very fine sand, about 15 inches deep, underlain to a depth of 36 inches or more by a yellowish-red or reddish-yellow friable fine sandy clay. This soil as mapped is uniform in color, but the texture of the subsoil ranges from fine sandy clay to very fine sandy loam. There are numerous small, well-rounded mounds over the surface which consist of very fine sand to a depth of 3 feet or more. Included with the type as mapped are small areas of Cahaba fine sandy loam, consisting of reddish-gray fine sandy loam, 10 or 15 inches deep, underlain by reddish-yellow friable fine sandy clay.

The Cahaba very fine sandy loam is not extensive in this county. Several small areas lie in the northwestern part of the county in the vicinity of Scrap and Halls Store. These areas occupy gently undulating benches or old terraces at the outer border of the Red River bottoms, above overflow but somewhat lower than the adjacent upland. The drainage is good.

About 75 per cent of the type is in cultivation, most of it being devoted to cotton, with a little in corn. The forested areas support a growth of post oak, red oak, some walnut, and other trees. Cotton yields one-third to three-fourths bale per acre and corn 20 to 40 bushels per acre.

The type sells for \$25 to \$50 an acre. It is well suited to cotton, Bermuda grass, and forage crops. Its fertility can be maintained by applying barnyard manure and by plowing under green manuring crops.

## TELLER VERY FINE SAND.

The surface soil of the Teller very fine sand is a grayish-brown very fine sand about 18 inches deep. The subsoil is a yellowish-red very fine sandy clay, or in places a very fine sandy loam. This soil contains considerable organic matter and is very retentive of moisture in dry weather.

This type, which is of small extent, occurs principally in one narrow strip extending for about 5 miles along the outer margin of the Red River bottoms near Davenport. Two small areas lie about a mile east of Halls Store. The Teller very fine sand occupies a level to very gently undulating terrace, 10 or 15 feet above overflow. The drainage is good.

Practically all the type is in cultivation, most of it being utilized in growing cotton and a little for corn. Cotton yields one-third to three-fourths bale and corn 15 to 40 bushels per acre. This type has been in cultivation approximately 65 years without any marked decrease in yields, but it would be benefited by growing legumes and by plowing under green manuring crops. The soil is well suited to the

production of cotton, vegetables, fruits, berries, Bermuda grass, and forage crops. The land is held at \$85 to \$100 an acre.

Below are given the results of mechanical analyses of samples of the soil and subsoil of the Teller very fine sand:

*Mechanical analyses of Teller very fine sand.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
445376.....	Soil.....	0.0	0.0	0.1	21.0	65.3	9.9	3.7
445377.....	Subsoil.....	.0	.0	.0	15.0	67.8	13.6	3.8

#### BASTROP CLAY.

The surface soil of the Bastrop clay consists of chocolate-brown to reddish-brown clay, about 8 to 12 inches deep. The subsoil is a brownish-red or dark brownish red clay. Both the soil and subsoil are typically calcareous, though in places only very slightly so.

This type appears in a few very small areas 8 or 10 miles northeast of Clarksville, a few miles north of White Rock, and in several other widely separated bodies.

The Bastrop clay usually occupies gentle slopes near stream valleys. The drainage is good. Unprotected areas are subject to erosion.

The type supports a forest growth consisting principally of post oak. Little of it is cultivated. It is a very productive soil and should give good yields of cotton, corn, oats, wheat, sorghum, and other crops. Alfalfa and clover probably will succeed.

#### TRINITY CLAY.

The surface soil of the Trinity clay is a black or very dark brown clay or silty clay, prevailingly 8 to 15 inches deep, though in places a black clay may extend to depths of 3 feet. The subsoil, to a depth of 36 inches or more, is a dark gray or bluish gray slightly mottled with yellow and rusty brown. The soil is heavy and sticky when wet, but on drying is crumbly, and works into a friable seed bed. Typically, the Trinity clay effervesces with hydrochloric acid, but there are areas, especially along the interior creeks of the county, where the content of lime carbonate is not sufficient to show this reaction. Where the larger stream bottoms come together the Ochlockonee soils merge gradually into the Trinity clay.

The Trinity clay is an extensive alluvial soil. It occupies a considerable area in the southern part of the county and constitutes the only type in the Sulphur River bottoms. It also comprises considerable areas of bottom lands along Scatter, Mustang, and Cuthand

Creeks in the southern part, Pecan Bayou in the northeastern part, and a number of small streams in the central part of the county.

The surface of these areas is flat and the run-off is slow. Ordinarily, however, these lands have sufficient drainage to allow successful cultivation. Overflows occur rather frequently, but seldom cause a complete loss of crops. Sometimes crops are destroyed even after maturing and before gathering, but more frequently they are damaged to some extent by earlier overflow. Some of the type is now protected by levees, and additional large areas will be protected in the same manner in the near future.

Large areas, especially along the Sulphur River, remain heavily forested with hackberry, elm, ash, pecan, willow oak, hickory, sweet gum, some white oak, bur oak, bois d'arc, and other trees. In the Sulphur River bottom probably less than 10 per cent of the type is in cultivation, but along the creeks 75 per cent or more of its area is cropped. The land in forest is utilized for grazing cattle and hogs. The leading crops are cotton and corn. The soil is strong and productive, yielding one-half to 1 bale of cotton and 30 to 60 bushels of corn per acre. Forage crops yield abundantly and Bermuda grass does well. The soil is well suited to cotton, corn, grass, and forage crops, and, where well drained, to alfalfa.

Land in cultivation sells for about \$75 to \$100 an acre, and uncleared land for \$20 to \$50 an acre.

#### OCHLOCKONEE VERY FINE SANDY LOAM.

The surface soil of the Ochlockonee very fine sandy loam is a grayish-brown, dark-gray, brown, or yellowish-brown loamy very fine sand to very fine sandy loam. The same material may continue to a depth of 36 inches, but normally at 15 to 18 inches there is a change to a subsoil consisting of a grayish loam or clay loam, slightly mottled with yellow or brown. In places a gray or mottled gray and yellow very fine sand is encountered below 36 inches. As is commonly the case in soils of alluvial origin, the texture of the type is not uniform. The material does not effervesce with acid, which indicates a low content of lime carbonate.

The Ochlockonee very fine sandy loam is widely distributed in narrow strips along the streams throughout all parts of the county, except in the prairie areas, in the Red and Sulphur River bottoms, and in the southwestern part of the county. Ordinarily the areas are several miles long and from 100 yards to a little more than one-fourth mile wide. One of the widest bottoms of this type is along White Oak Creek, in the southern part of the county. Some areas of the type were too narrow to show on the map.

The surface of the Ochlockonee very fine sandy loam is flat or almost level. The areas lie a few feet above the beds of the streams and 10 to 30 feet or more below the level of the surrounding uplands. Drainage is poor, and after rains or overflows water stands for several days in the lower situations. Overflows are common, though none may occur for periods of several months. The water soon passes off after the floods subside over much of the type, and the drainage is not so imperfect as to prevent cultivation.

Originally all the type was forested, and much of it is at present. The principal trees are hackberry, sweet gum, water oak, elm, and some white oak. Probably more than 50 per cent of the type is in cultivation. The main crops are cotton, corn, Bermuda grass for hay and pasture, and sorghum. Sometimes the crops are damaged by overflows, but they are rarely destroyed. The soil is considered a good cotton soil, and it is said to produce a staple somewhat longer than that on the upland soils. Cotton yields one-fourth to one-half bale per acre and in favorable seasons more. Corn yields 15 to 25 bushels per acre, and with good tillage should produce more. Bermuda grass supplies excellent pasturage, and yields 2 to 4 tons of hay per acre. Saccharine sorghum and ribbon cane are grown in small patches, and both yield a fine grade of sirup. The soil could probably be improved by ditching to facilitate surface drainage.

#### OCHLOCKONEE SILTY CLAY LOAM.

The surface soil of the Ochlockonee silty clay loam is a brown, dark-gray or grayish-brown silty clay loam 8 to 15 inches deep. The subsoil is a mottled gray and yellow, or gray, yellow, and brown silty clay loam to silty clay, the latter texture appearing at depths of 24 to 36 inches. Gray predominates in the subsoil colors, but shows considerable range in hue. It may be a light gray or dark bluish gray. The color of the soil and subsoil is modified more or less by the varying drainage conditions. Small bodies of Ochlockonee silt loam, loam, and fine or very fine sandy loam have been included with the type. In some places the lower subsoil is somewhat sandy. The lighter textured variations occur as a rule adjacent to or near the beds of streams. The material does not effervesce with acid. This shows a low content of lime carbonate.

The Ochlockonee silty clay loam is a type of considerable extent in the county though no individual areas are large. The type is found as long narrow bodies, some a mile wide, constituting the first bottoms of streams. These areas occur in all parts of the county except the central prairie part, along the larger creeks and branches that drain the main areas of forested upland.

The surface of the type is flat, and slight depressions occur in some parts. Drainage is slow, and in places water stands a long

time. Occasional overflows occur which flood the land for several hours, but usually crops are not destroyed by these, although they may be somewhat damaged.

The Ochlockonee silty clay loam was originally heavily forested with a mixed growth, largely willow oak, water oak, elm, ash, hackberry, white oak, and pecan. Probably 50 or 60 per cent has been cleared and placed in cultivation. The land is very productive. It is utilized in growing cotton, which yields one-half to three-fourths bale per acre; corn, which yields 20 to 50 bushels per acre; and Bermuda grass, which yields 3 to 6 tons of hay per acre. The soil is rich in organic matter and produces good yields, despite some damage from overflows. The land sells, where cleared and in cultivation, for \$50 to \$75 an acre. Cotton grown on this soil has a staple of a good length and quality.

#### CATALPA SILTY CLAY LOAM.

The surface soil of the Catalpa silty clay loam is a brown to light-brown silty clay loam 6 to 10 inches deep. The subsoil, to 36, inches or more, is a yellowish-brown to mottled gray and yellow silty clay. In places both the soil and subsoil effervesce with hydrochloric acid.

This is not a very extensive soil type. It occurs as bottom land in the western and central parts of the county along the upper reaches of Cuthand and Scatter Creeks, Pecan Bayou, and some smaller streams. The streams flow from or through areas of the black-land prairies, and the soils of these creek bottoms are derived in part by the deposition of soil particles washed from these prairies.

The surface of the Catalpa silty clay loam is flat to very gently sloping. The run-off is slow, and during wet seasons drainage is very poor. However, drainage is usually sufficient in the spring and summer to allow the growing of crops. Overflows occur occasionally and in some years there may be several. Crops, as a rule, are not destroyed by these overflows, though sometimes they may suffer considerable damage.

Probably 90 per cent of the type is cleared and in cultivation. The land is very productive, and is valued at \$100 or more an acre.

The same crops are grown and approximately the same yields obtained as on the Ochlockonee silty clay loam. Uncleared areas support a forest of bur oak, white oak, willow oak, hackberry, and other trees. The type closely resembles the Ochlockonee silty clay loam, differing chiefly in containing more lime carbonate. This soil is well suited to cotton, corn, grass, sorghum, and other forage crops. Doubtless alfalfa would do well if better drainage could be supplied.

## YAHOLA VERY FINE SANDY LOAM.

The surface soil of the Yahola very fine sandy loam consists of a light brownish red to chocolate-brown or reddish-brown very fine sandy loam or, in some places, loamy very fine sand. It ranges in depth from 6 to 15 inches. The subsoil to 36 inches characteristically consists of a brownish-red or reddish-yellow or buff very fine sand, though in many interior areas adjacent to heavier types it is a brownish-red silty clay or silty clay loam, which at 20 to 30 inches is underlain by reddish very fine sand. Small areas of Yahola loam and Miller very fine sandy loam were included with the type as mapped, owing to their small extent.

The Yahola very fine sandy loam is a river-bottom soil occupying large areas along the Red River in the northern part of the county. The surface is nearly level to gently sloping. In places the type occupies low situations in the bottoms; in others it occupies benches or flat areas several feet above surrounding soils. Some areas lie 30 feet above the river bed; others only 10 to 15 feet above the river. The type has good natural drainage for the most part, and the porous condition of the subsoil admits ready drainage downward. Overflows from the Red River occasionally damage crops considerably.

The Yahola very fine sandy loam is the most extensive soil type in the Red River bottom, and, owing to its better drainage, it is more largely cultivated than the other soils in this bottom. Probably 90 per cent of the type is in tilled crops or is used for pasturage and hay production. The timber growth consists principally of hackberry, elm, sycamore, ash, pecan, and cottonwood.

The soil is utilized principally for the production of cotton, corn, and Bermuda grass. On the lighter areas of the type the yields of crops, especially corn, are not so high as where the subsoil is rather heavy, even though the lower subsoil is composed of very fine sand. The layer of silty clay or silty clay loam retains moisture better than does the subsoil that is all very fine sand. In ordinary seasons cotton yields one-third to two-thirds bale per acre, corn 20 to 40 bushels, and Bermuda grass 3 to 5 tons of hay per acre. Bermuda grass is a very important crop, affording excellent pasturage and hay of high quality. The crop is grown only in individual fields of a few acres. Common varieties of cotton grown on this soil have a rather long staple and on the heavier areas of the type long-staple cotton may be grown successfully and is grown at present to some extent. This type is held at \$25 to \$75 or more an acre, though little of it is for sale.

A very large proportion of this type is farmed by tenants under the supervision of the owner or a farm manager.

On the areas with lighter textured subsoil the growing of legumes, such as cowpeas, and the plowing under of green-manure crops would improve the soil, especially for corn. The type is well suited to the growing of vegetables and small fruits, though it is utilized very little for such products. Alfalfa grows well in small patches, and it would seem that the acreage could be increased advantageously.

YAHOLA CLAY.

The Yahola clay consists of a brownish-red silty clay, 8 to 24 inches deep, underlain by a very fine sand or very fine sandy loam subsoil of the same color. Both soil and subsoil are calcareous.

This type occurs in a number of small widely separated areas in the Red River bottoms in the northern part of the county. It usually occupies narrow, somewhat low basins representing old river channels that have been filled with soil material. Drainage is rather poor, though usually the soil is dry enough in the spring and summer months to grow crops. In places these areas hold water for some time after heavy rains and are lakes in wet seasons.

Probably 50 per cent of the type is in cultivation, the rest being covered with a growth of cottonwood, hackberry, willow, and some ash and elm. This is a very productive soil. It is utilized principally in growing cotton, which yields one-half to 1 bale per acre, and corn, which yields 20 to 50 bushels per acre. The soil is well suited to Bermuda grass and alfalfa. Yahola clay has approximately the same value as the adjoining Yahola very fine sandy loam. The type is subject to more frequent overflows than the higher Yahola very fine sandy loam areas.

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

*Mechanical analyses of Yahola clay.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
445366.....	Soil.....	0.2	0.5	1.2	5.9	1.6	44.7	46.1
445367.....	Subsoil.....	.0	.0	.0	.6	45.0	45.3	9.2

MILLER CLAY.

The Miller clay consists of a brownish-red clay or silty clay to a depth of 3 feet or more, the surface 8 to 10 inches in most places being slightly darker than the material below. At depths of several feet this clay rests on brownish-red very fine sand or very fine sandy loam. The type is very similar in surface appearance to the Yahola

clay, and differs chiefly in not having the light sandy substratum within the 3-foot section. Both soil and subsoil are calcareous.

The Miller clay occurs in a number of relatively small areas in the Red River bottoms in the northern part of the county. It usually occupies low, nearly level, or basinlike areas. During wet seasons water stands in some places, forming intermittent lakes, but most of the type is drained sufficiently well to allow cultivation. The type is occasionally overflowed. Probably 80 per cent of the Miller clay is in cultivation, the rest being forested with willow, cottonwood, bois d'arc, ash, elm, hackberry, and other less important trees.

The soil is very strong and productive and is utilized for cotton, corn, and Bermuda grass for hay and pasture. Cotton yields one-half to 1 bale, corn 25 to 60 bushels, and Bermuda grass 3 to 5 tons of hay per acre. Alfalfa is grown in a small way by a few farmers. It seems well suited to this soil and yields several tons per acre. Land of this type sells for \$25 to \$75 an acre.

This soil, like the other stream-bottom soils, will produce long-staple cotton to good advantage, though little is grown. The ordinary varieties of cotton produce a longer staple than on the upland soils.

#### PORTLAND VERY FINE SANDY LOAM.

The surface soil of the Portland very fine sandy loam consists either of a brown or chocolate-brown very fine sandy loam, 10 to 16 inches deep, or of an upper layer of chocolate-brown and a lower one of reddish-yellow color. The subsoil is usually a brownish-red or chocolate-brown very fine sandy clay or silty clay loam grading into clay at 15 to 26 inches, which in some places grades into silty clay loam or very fine sandy loam at 24 to 36 inches.

The Portland very fine sandy loam is of small extent in the county. It occurs in several small areas in the Red River bottoms in the northern part of the county, most of them lying in the vicinity of Kiomatia.

The forest growth consists of red oak, hackberry, cottonwood, white oak, and pecan. Probably 95 per cent of the type is in cultivation. It lies rather high in the river bottoms, has good drainage, and is overflowed only by unusually high floods. It is farmed in conjunction with the Yahola very fine sandy loam. The same crops are grown, but the yields are somewhat higher than on the latter type. The soil is well suited to cotton, corn, grass, and alfalfa.

#### PORTLAND CLAY.

The surface soil of the Portland clay consists of a chocolate-brown or dark chocolate brown clay, 6 to 12 inches deep. The subsoil is a chocolate-brown, brownish-red, or dark brownish red clay. Where the drainage is rather poor the subsoil is a dark bluish gray clay,

slightly mottled with chocolate brown, or a chocolate-brown clay mottled with bluish gray. Included with this type are areas in which both the soil and subsoil consist of a very dark bluish gray clay mottled with brownish red.

Low dome-shaped sand mounds, in places constituting 10 to 40 per cent of the surface, occur in the type. These mounds consist of brown to chocolate-brown very fine sandy loam, 10 to 15 inches deep, grading into yellow or buff very fine sandy loam, which at 30 to 36 inches passes into yellow fine sandy clay. In places the surface soil of the intermound areas is a chocolate-brown clay or silty clay loam, underlain at 6 to 15 inches by yellow silty clay loam or very fine sandy loam.

The Portland clay occurs in several large areas and in some small ones in the Red River bottoms in the northeastern part of the county. The largest area is developed where Pecan Bayou extends into the Red River bottoms.

The surface of the type is nearly level, though most areas occupy shallow basinlike areas. The run-off is slow, water often standing on the surface for a considerable time after heavy rains or overflows, which occasionally result from back waters from the Red River and Pecan Bayou or from floods in smaller streams entering the Red River.

Probably not more than 10 per cent of the type in this county is in cultivation. This small proportion under the plow is due in part to the poor drainage of included areas. The type supports a heavy growth of hackberry, hickory, white oak, ash, elm, box elder, willow oak, and other trees. The cultivated area is used in growing cotton, corn, and grass. It is a strong and very productive soil, but needs artificial drainage for best results. This can be provided by ditching. Cotton yields  $\frac{1}{2}$  to 1 bale per acre and corn 20 to 50 bushels. Bermuda grass makes excellent pasture and yields in addition 2 to 5 tons of hay per acre. This type is held at about \$25 to \$50 an acre where improved.

#### PLEDGER CLAY.

The surface soil of the Pledger clay is a dark-brown to black silty clay, 10 to 18 inches deep. The subsoil is a chocolate-brown or brownish-red silty clay. The surface soil is heavy and sticky when wet, but flocculates and crumbles on drying. In poorly drained areas the surface soil is a bluish-black to mottled bluish-gray and brown silty clay, grading at 8 to 15 inches into bluish-gray silty clay mottled with chocolate brown and yellow, which at 30 to 40 inches is underlain by brownish-red or chocolate-brown silty clay. In places the material effervesces with acid.

The Pledger clay is found only in the Red River bottoms in a few small areas in the northwestern part of the county just east of

Kiomatia, and in two or three small areas about 2 miles northwest of Blakeney. It occupies rather flat or depressed areas, usually near or along creeks entering the Red River bottoms. Surface drainage is slow, and crops are occasionally damaged by overflows.

Practically none of the Pledger clay in this county is cultivated, owing to its poor drainage and to overflow. The type supports a heavy growth of water oak, willow oak, pecan, hackberry, some hickory, bois d'arc, and other trees. If well drained and protected from overflow, this soil would produce good yields of cotton, corn alfalfa, and grass.

#### CHALK (HOUSTON MATERIAL).

The surface soil of Chalk (Houston material) consists of 4 to 8 inches of a whitish, whitish-gray, or gray silt loam, silty clay loam, or silty clay. The subsoil is a white or mottled white and yellow silty clay containing soft white chalky material. At depths ranging from 6 to 24 inches, but usually at 12 to 18 inches, the subsoil rests on solid beds of white and blue chalk. In very small areas, usually not over an acre in extent, the white chalk is exposed on the surface, the surface soil having been washed off.

The total area of Chalk is small. It occurs in scattered bodies in areas of the Houston black clay. The largest body lies about 6 miles northeast of Clarksville, in the vicinity of White Rock and Madras. Here it occurs as an irregular narrow strip several miles long on the upper slopes of the Pecan Bayou Valley and along the upper reaches of the small tributaries draining into this valley. A number of other spots are mapped in the large areas of the Houston black clay east of Clarksville, and many very small areas, too small to show on the map, exist throughout the main areas of the Houston black clay.

The Chalk has a gently rolling to steeply sloping topography. The surface drainage is everywhere good, but the underdrainage is poor on account of the more or less impervious rock beds that underlie the soil. The type owes its origin to the erosion of soils of the Houston series, and the consequent exposure of partly weathered chalky material.

The Chalk is a prairie soil, though some areas near the margins of the main prairies have a scattering growth of bois d'arc (osage orange) trees and near the streams a few post-oak or other trees. The native grass is short and includes some needle or poverty grass. Where the type occurs in good sized areas it is utilized for pasture. Small areas surrounded by the Houston black clay are farmed with the latter type. Small areas having a relatively deep layer of soil material over the chalk beds are sometimes farmed. With plenty of rain light yields of cotton, sorghum, and oats are

obtained. It is said that the soil is better suited to oats or other grains than to other crops. This type is sold with adjoining types, and its presence, if considerable, tends to lower the selling price. Probably \$30 to \$50 an acre would be considered a fair price for this land in separate bodies. Its value depends chiefly on its use for pasture.

By growing sweet clover eroded Chalk land of this kind in the prairie belt of Alabama and Mississippi has been greatly improved, the soil gradually becoming deeper, darker, and much more productive. Possibly the same treatment could be employed with good results in Red River County.

#### RIVERWASH.

Riverwash comprises low-lying areas of recently deposited alluvial material along the Red River. The soil material consists chiefly of a mixture of very fine sand, silty very fine sand, very fine sandy loam, and clay (usually of the Yahola series). These areas lie adjacent to the river bed and but a few feet above the normal level of the river. They are frequently inundated and occasionally cut into by the stream and washed away. Much of this land is bare of vegetation; some of the higher areas support a growth of willow and cottonwood. Riverwash has no agricultural value.

#### SUMMARY.

Red River County is situated in northeastern Texas. The Red River forms the northern boundary and the Sulphur River the southern. The county consists of a broad, gently rolling to undulating ridge extending east and west through the central part bordered by belts of flat upland country and these by the river bottoms along the northern and southern borders of the county. The upland elevation ranges from about 230 to 500 feet above sea level.

The Red River receives the drainage from the northern half of the county, and the Sulphur River from the southern half.

In 1920 Red River County had a population of 35,829, of which 90 per cent was classed as rural. Clarksville, the largest town and county seat, is in the central part of the county and has a population of 3,386.

The Texas & Pacific Railway and the Paris & Mount Pleasant Railroad provide means of transportation to outside markets in the central and southwestern sections, but much of the county lies 15 to 20 miles from a railroad.

The climate is mild; the winters are short with only occasional freezes, and the summers are long and warm. The mean annual

temperature is 65.2° F., and the mean annual precipitation is 51.28 inches. The average growing season is 236 days.

The agriculture of the county centers around the production of cotton, with corn second in importance. About 51.6 per cent of the improved land is devoted to cotton and about 26 per cent to corn. Among the other crops grown are hay, oats, sorghum, peanuts, and cowpeas. Sweet potatoes and some other vegetables are being grown in a small way for market. Small quantities of berries and peaches are shipped from the county.

The animal industries are relatively unimportant. Hogs and dairy cattle are raised on many farms in sufficient numbers to furnish meat and dairy products for local use. Small numbers of beef cattle are grazed in the forested uplands and bottoms.

Red River County lies within the Coastal Plain region. The upland soils have been derived from unconsolidated beds of noncalcareous sand, sandy clay, and heavy clay, and from calcareous clays and chalk. The alluvial soils, which represent sediments washed from the various upland soils, are of two kinds—first-bottom soils representing recent alluvium and second-bottom or terrace soils, representing old alluvium.

The Bowie series is represented by a small area of the fine sandy loam and a fairly large area of the very fine sandy loam. These soils are used in growing the general farm crops, particularly cotton and corn. They are also well suited to the production of vegetables, tree fruits, berries, and grass.

The Ruston very fine sandy loam, the only type of this series in the county, is utilized for the general farm crops. It is well adapted to growing certain fruits and vegetables.

Only one type of the Norfolk series, the Norfolk very fine sand, is mapped. This type is used mainly for cotton and corn. It is well suited to the production of vegetables and small fruits.

The Susquehanna series is represented by the fine sandy loam, very fine sandy loam, and clay. The very fine sandy loam is an important soil, utilized largely for the production of the general farm crops. The fine sandy loam and clay are unimportant on account of their small extent.

Four types of the Lufkin series occur in the county. These soils are in general poorly drained, though some areas of the clay have fair drainage. Only a small proportion of the land is in cultivation. A considerable area of the clay type in the vicinity of the black prairies is cultivated and produces well. These soils are all naturally productive but need drainage.

The Crowley silt loam is a prairie soil of small extent. It is well adapted to the production of grasses and small grain. Some areas of it are used in growing the general farm crops.

The Wilson silt loam and silty clay loam are types of small extent. They are good soils for growing cotton, corn, oats, and grass. The clay covers large areas in the prairies. It is a strong soil used for cotton, corn, and grass.

The Houston soils are prairie soils. The Houston black clay is an important and very productive soil. It is utilized for cotton, corn, and grass. The other Houston soils are inextensive.

The Oktibbeha clay loam and clay are good general farming soils. They are used for the staple crops of the region, but are of relatively little importance owing to their small area.

The Kalmia very fine sand is a light sandy terrace soil. It is of slight extent and little cultivated. It is best adapted to the production of vegetables and small fruits.

The Myatt very fine sandy loam is a poorly drained second-bottom soil of slight extent. Little of it is cultivated. The Myatt silty clay loam is poorly drained and not in cultivation.

The Leaf very fine sandy loam is a second-bottom soil of small extent. A little of it is utilized for growing corn, cotton, and hay.

The Brewer clay is a dark-colored poorly drained second-bottom soil near the Red River. It occurs in only a few small bodies in the county. About half of it is cultivated, cotton and corn being the chief crops.

The Cahaba very fine sandy loam is a second-bottom type of small extent along the Red River. This soil is largely in cultivation, being used in growing corn and cotton.

The Teller very fine sand is a soil of small extent, occurring on a terrace near the Red River. The soil is highly productive and is practically all utilized in growing cotton and corn.

The Bastrop clay covers a very small area. It is a strong soil suited to growing corn, cotton, grasses, and small grains.

The Trinity clay is an extensive, dark-colored, first-bottom soil composed largely of soil materials washed from the black prairie lands. On the creeks it is utilized mainly in growing cotton and corn. It is a strong soil, but crops are sometimes damaged by overflows. Large areas occur along Sulphur River and Cuthand Creek. Little of the type in the Sulphur River bottoms is cultivated. Levees are under construction that will largely protect this land from floods.

The Ochlockonee very fine sandy loam and silty clay loam are productive first-bottom soils. Though subject to overflow they are largely in cultivation. Corn, cotton, and grass are the leading crops.

The Catalpa silty clay loam is an alluvial soil developed along some of the creeks. It resembles the Ochlockonee silty clay loam, but is more calcareous, being composed in part of materials washed from the Houston soils. It is largely cultivated, cotton and corn being the main crops.

The Yahola series is represented by the very fine sandy loam and clay. The clay is of small extent, but the very fine sandy loam is the most extensive type in the Red River bottoms. These soils are utilized in growing cotton, corn, grass, and forage crops. Alfalfa succeeds. Overflows occur occasionally, but not every year.

The Miller clay is another type of the Red River bottoms. It is of small extent, but is very productive, and much of it is cleared and used in growing cotton and corn.

The Portland series is represented by the very fine sandy loam and the clay. These types lie in the Red River bottoms. The very fine sandy loam is inextensive. The clay is a very productive soil, and some of it is utilized for the production of cotton, corn, and grass. Much of it is poorly drained and uncleared.

The Pledger clay is a dark soil of small extent in the Red River bottoms. It is naturally a productive soil, but is poorly drained and not in cultivation.

Riverwash represents very fine sand mixed with various other soil textures along the Red River. It has no agricultural value.

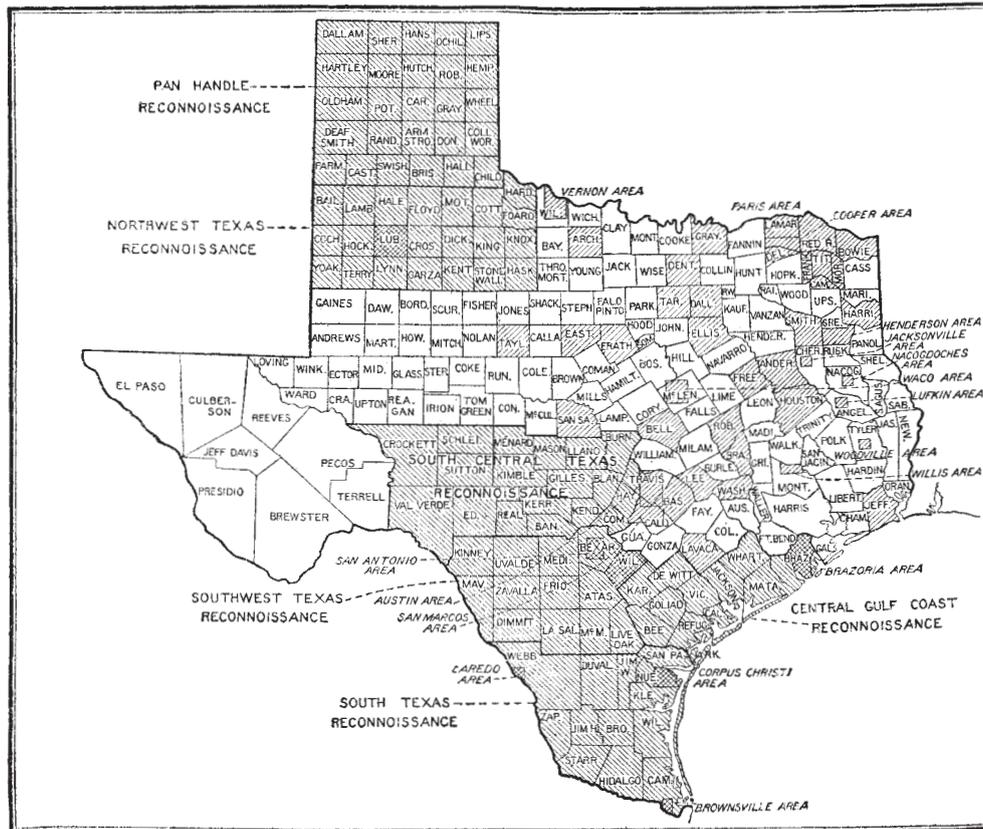
The soils growing cotton of the best staple are the Trinity, Ochlockonee, Catalpa, Portland, Yahola, and Miller series of the bottoms and the Houston black clay and the Wilson<sup>6</sup> clay of the uplands. The better types of the Susquehanna, Lufkin, Bowie, and Ruston series, also upland series, produce a good staple where the land is maintained in a productive condition.

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<sup>6</sup> The Wilson clay on Blossom Prairie in the southwestern part of the county is an exception.







Areas surveyed in Texas, shown by shading.

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