U. S. DEPARTMENT OF AGRICULTURE
BUREAU OF SOILS
IN COOPERATION WITH THE
TEXAS AGRICULTURAL EXPERIMENT STATION

SOIL SURVEY OF HARRIS COUNTY TEXAS

BY

H. V. GEIB, IN CHARGE, AND T. M. BUSHNELL, TEXAS AGRICULTURAL EXPERIMENT STATION, AND A. H. BAUER,
U. S. DEPARTMENT OF AGRICULTURE

[Advance Sheets—Field Operations of the Bureau of Soils, 1922]

UNITED STATES
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WASHINGTON
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[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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SOIL SURVEY OF HARRIS COUNTY, TEXAS

By H. V. GEIB, in Charge, and T. M. BUSHNELL, Texas Agricultural Experiment Station, and A. H. BAUER, United States Department of Agriculture

COUNTY SURVEYED

Harris County is in the southeastern part of Texas. Houston, its county seat, is about 50 miles northwest of Galveston, the nearest Gulf port. It is irregular in shape, measuring approximately 35 by 50 miles, with an area of 1,765 square miles, or 1,129,600 acres.

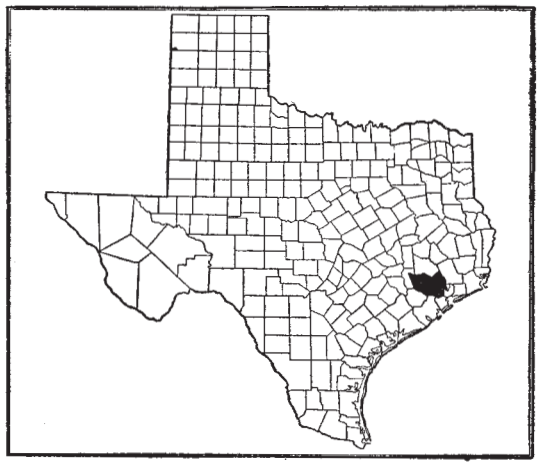

FIG. 56.—Sketch map showing location of Harris County, Texas

The county consists mainly of a broad, nearly level plain, the major portion of which is open, treeless prairie. Parts of it, however, are heavily forested, especially along the streams. In the northwestern part of the county the land is considerably higher and the surface rolling, and a narrow forested belt bordering the north county line is rolling or hilly. This forested belt is a part of the interior flatwoods subdivision of the coastal plain, whereas the remainder of the county is in the coastal prairie subdivision.

Harris County touches the coast line on the Gulf of Mexico at its extreme southeast corner. It is a part of the coastal plain. In this region the coastal plain is a smooth, almost featureless plain, rising gently from sea level at the coast line. The maximum rise is in a northwesterly direction almost perpendicular to the coast line. The highest part of the county is the northwestern corner, with an elevation of about 300 feet. The distance from the southeastern corner to the western corner is more than 60 miles, so that there is a slope of about 5 feet to 1 mile. In this whole distance there is practically no break in the regularity of the general slope other than that which has been produced by valley cutting and the rather rapid rise along the southerly edge of the belt of Katy and Hockley soils. It is apparent that the slope is constructional, owing to the gradual increase in the elevation inland from the coast line.

The plain has been dissected to a very slight extent by San Jacinto River and its tributaries. This stream crosses the eastern part of the county in an almost due southward course. The greater part of the county, therefore, is drained by the west-bank tributaries of this stream, the largest of which is Spring Creek, which forms the northern boundary of the county from the northwestern corner to within 20 miles of the eastern line of the county. From this point the county line runs northeastward, and the stream below this is included wholly within the county boundaries. It is evident that the eastern part of the county, therefore, is more thoroughly dissected than the western part. Large areas of the western part are still in practically the virgin condition, consisting of the almost unmodified constructional plain dotted with a very great number of small depressions varying in size from a few acres to a square mile or more. Practically all the western part of the county is an unmodified plain, with the exception of two or three narrow belts where drainage ways from San Jacinto River have worked themselves back into it. These have produced narrow belts of undulating topography along their valleys. The valleys rarely have a depth of more than 20 feet and the eroded belts on both sides of the valley are narrow. The northeastern part of the county, lying as it does close to San Jacinto River, or to the lower parts of its tributaries where they have attained their maximum size, is most thoroughly dissected. Its dissection has proceeded to a point where the surface of this part of the county may be designated as undulating. The southeastern part of the county, although crossed by San Jacinto River, lies at such a slight elevation above sea level that the streams are unable to cut more than a few feet beneath the level of the plain and are unable therefore to produce a belt of uneven surface bordering them more than a few hundred yards wide. Their work has been confined, therefore, practically to the erosion of their own narrow and very shallow valleys. This limitation on the amount of work that the streams have done is not only due to the very low elevation of the country over which they run, but is also probably due in part to the late elevation of this coastal belt as compared with that of the northeastern part of the county.

A large proportion of Harris County, particularly the flat coastal area, is treeless. Even the expansive undulating areas of the Hockley soils in the western and northwestern parts of the county are locally undulating and even gently rolling but are not forested. The more rolling better-drained areas in the northern part of the county are largely forested, and there are forested strips along many of the streams that extend across the coastal flats. Along these streams there is forest growth in the wet bottoms as well as along the better-drained strips adjacent to the bluffs. In many places the forest extends out to a considerable distance beyond the stream margin, covering perfectly flat lands that appear to be as poorly drained as any part of the county not actually constituting swamp. Acadia clay and Acadia clay loam, for example, although flat and as poorly drained as most of the coastal flat lands, are wholly forested with such trees as oak, ash, pine, and sweet gum. At many places through the county islandlike clumps of pine and oak occur at distances of one-fourth mile, one-half mile, or more than a mile away from large areas of forest on soils that show no differences from adjacent un-

forested soils in soil character, surface relief, or drainage. Many of these clumps of trees were not there when the county was settled. In other words the forest is invading the prairies in many places. The underlying causes of the treeless condition of large areas and the forested condition of other large areas having essentially the same conditions of soil and drainage are not very clear. Possibly poor drainage of the flats has retarded the development of forests over many of these areas; but this alone does not explain the situation satisfactorily.

Water for domestic use is usually plentiful and of excellent quality throughout the county. The wells, many of which are artesian, range from 50 to 1,000 feet in depth. Windmills and gasoline engines are used in raising the water from the deeper wells. (Pl. LI, fig. 1.) The county abounds in springs, especially the northern part along Spring Creek. Most of the shallow water of this region[1] comes from the formation known as the Lissie gravel which outcrops in the northwestern part of the county. Excellent water is also obtained in the Dewitt formation at depths not exceeding 1,200 feet. At Houston as many as eight water-bearing sands are tapped at depths between 137 and 1,197 feet, the upper ones in the Lissie gravel and the lower in the Dewitt formation. In the oil fields much of the water obtained at shallow depths is brackish. In the northwestern part of the county flowing wells are confined to the valleys and lowlands, flows being obtained at depths of from 65 to 400 feet. In other places flows have been obtained on both the lowlands and the uplands.

Harris, originally Harrisburg County,[2] was organized in 1836, and in 1839 was given its present name in honor of Mr. John R. Harris, who erected the first steam sawmill in Texas in 1829. At that time the county extended south to the Gulf of Mexico, including Galveston Island.

Various tribes of Indians originally inhabited this part of the State. The first white settlement was made in 1822 on the present site of Lynchburg. Harrisburg was laid out in 1826 and other settlements were made soon afterwards. In 1836 Texas gained her independence from Mexico after winning the battle of San Jacinto, fought in the eastern part of Harris County. Houston was then made the seat of the State government and remained so until 1839, when the capital was moved to Austin.

The population of Harris County in 1850 was 4,668. In 1910 this had increased to 115,693 and in 1920 to 186,667. Of this last number 22.9 per cent were negroes and 16,514 persons of foreign birth, representing a great number of nationalities. The rural population is fairly well distributed over the county with a density of 26.8 persons to the square mile, the greatest density being in the vicinity of Houston. Houston was incorporated as a city in 1837. Its population in 1910 was 78,800 and in 1920, 138,276. Many of the residents are descendants of the early settlers, but owing to the industrial activities centered around Houston, large numbers of people come there from all parts of the country. Practically every State of the Union is represented in the population of Harris County.

[1] Deussen, Alexander. Water-Supply Paper No. 335, U. S. G. S.
[2] Losseau, Adele B. Harris County, 1822 to 1845.

Houston is also an important manufacturing center, and since the completion of Houston Ship Channel (pl. LI, fig. 2) has become a very important seaport and distributing point for the Southwest. Cotton is the most important product shipped, and large cotton compresses are located on the ship channel. Great wharves and warehouses have been erected at the turning basin, and many oil, cement, and flour mills are located along the channel because of both water and railway shipping facilities. Houston is the only city in Harris County with a population of more than 10,000, but a large number of smaller towns, located along the railroads throughout the county, are important business centers and shipping points for agricultural products. Very few farms in the county are farther than 5 miles from a railroad town. Houston is a good market for the agricultural products of the county, but most of the livestock is shipped to outside points.

Harris County has a large mileage of surfaced roads, radiating in every direction from Houston and usually extending beyond the county lines. Earth roads, many of which are not graded and are in fairly good condition, except in rainy seasons, connect the main highways. The roads in the northern part of the county are sandy and are more easily traveled in wet weather than the roads in the southeastern part, where the soils, for the most part, are much heavier. Very little good road-building material is available within the county, and gravel, crushed rock, and other road materials are shipped in from outside.

Practically all of Harris County is served by rural mail delivery, and telephones are in general use. Churches and schools are located in most sections. Houston is the seat of Rice Institute.

CLIMATE

Harris County has a mild climate. The winters are short, but marked by occasional sudden changes of temperature caused by blizzards or cold waves from the north and west. They come in the form of north winds, locally called "northers," accompanied frequently by rain, sometimes changing to sleet. The summers are long and hot, and on account of the low altitude and proximity to the Gulf, a high humidity prevails, but a breeze from the Gulf during the night usually cools the atmosphere considerably.

The mean annual temperature at Houston is 68.9° F. The mean temperature for the winter is 54.1°, for the spring 69.1°, for the summer 82.5°, and for the fall 70.1°. The lowest recorded temperature is 6° above zero, and the highest 108°. The date of the latest recorded killing frost in the spring is March 27, and of the earliest in the fall October 25, but the average date of the last killing frost is February 20, and the first in the fall November 29. This gives an average frost-free season of 281 days.

Excessive precipitation occurs, also periods of drought, although prolonged, severe droughts are rare. During rainy seasons much of the land is too wet for the best growth of crops, and when heavy rains occur in the late spring, planting is often retarded to such an extent as to cause great loss in crop production. The annual pre-

cipitation at Houston averages 46.22 inches. The wettest year on record, 1900, had a rainfall of 72.86 inches, and the driest year, 1917, had 17.66 inches. The average annual rainfall is evenly distributed throughout the year, that for the winter being 10.47 inches; for the spring, 12.05 inches; for the summer, 12.54 inches; and for the fall, 11.16 inches.

High winds occasionally do considerable damage, but the most destructive of these, the tropical tornadoes, are very rare and are dangerous only in the narrow path which they traverse.

The following table gives the normal monthly, seasonal, and annual temperature and precipitation as recorded by the Weather Bureau station at Houston:

Normal monthly, seasonal, and annual temperature and precipitation at Houston

(Elevation, 138 feet)

Month	Temperature			Precipitation		
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1917)	Total amount for the wettest year (1900)
	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*
December	54.1	82	15	4.08	1.19	5.72
January	53.3	84	11	3.16	1.29	7.26
February	55.0	86	6	3.23	1.56	4.66
Winter	54.1	86	6	10.47	4.04	17.64
March	63.0	91	23	3.17	.65	4.22
April	69.4	92	34	3.83	2.30	6.57
May	75.0	98	45	5.05	2.21	3.07
Spring	69.1	98	23	12.05	5.16	13.86
June	81.2	103	55	4.45	.83	3.75
July	83.3	104	55	3.98	3.30	14.80
August	82.9	108	54	4.11	1.13	10.74
Summer	82.5	108	54	12.54	5.26	29.29
September	78.8	101	47	4.16	1.95	5.36
October	70.3	99	33	3.49	.32	1.75
November	61.2	87	23	3.51	.93	4.96
Fall	70.1	101	23	11.16	3.20	12.07
Year	68.9	108	6	46.22	17.66	72.86

AGRICULTURE

The first settlements in Harris County were made along Buffalo Bayou, in the east-central part of the county where water and timber were plentiful, and the near-by open prairies afforded excellent range for cattle. The first settlers grew small patches of corn, potatoes, and other vegetables, and raised cattle on the open range. As settlements increased, livestock raising combined with the growing of cotton and corn became the principal industry. The first cotton gin in this part of the State was built on Brazos River in 1825, but it was not until some time later that one was built in Harris County.

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Agriculture, at present second only to the oil industry in importance, consists of general farming combined with livestock raising and feeding.

In the western part of the county, where the land is not so well suited for cultivated crops, cattle raising is an important industry. Considerable rice is grown, and in the better-drained sections some general farming is carried on.

In the southern and eastern parts large areas of rice are grown and the better-drained areas used for cotton, corn, sorghum, and other farm crops. Livestock is also raised.

Dairying is of much importance, and promises to become more so as drainage conditions are improved and better grasses are developed. Small dairy farms are located in nearly every section, and several large modern dairies are in operation in the county. Houston affords a ready market for all dairy products, and large quantities of butter and cheese are shipped into the city.

In the northern and northeastern parts of the county along Cypress and Spring Creeks and north of San Jacinto River, as well as in other localities, lumbering is carried on. The forest growth consists mainly of loblolly pine, oak, sweet gum, and ash, with some sycamore, pecan, hackberry, live oak, elm, ironwood, magnolia, hickory, bay, and cypress. The chief timber now being cut for lumber is loblolly pine.

Only 36 per cent of the land in the county is in farms, with 57 per cent of this improved. This improved land represents 20.5 per cent of the total area. On the cultivated farms the principal crops grown are corn, cotton, rice, sweet potatoes, potatoes, peanuts, and hay. Grain sorghums are grown somewhat and also considerable sorgo (sweet sorghum) and sugar cane. A few varieties of fruit, the principal one being the fig, do well. Some blackberries and strawberries are grown and the county contains a few pecan groves.

On the virgin prairies there is usually a vigorous growth of grasses, including many species of little or no value. The little bluestem is the most important valuable grass because of its abundance, but carpet grass grows in many places, and its acreage could easily be increased. A scattering growth of small shrubs, such as wax myrtle, and also numerous species of coarse weeds occur. Areas once cultivated but allowed to revert to pasture land are soon carpeted with these native grasses and weeds, as well as Bermuda grass. Land that is frequently submerged is generally so densely covered by "coffee bean" as to exclude other vegetation. Ragweed, broomweed, blazing star, sneezeweed, goldenrod, croton weed, and Indian plantain represent the flora.

The following table, giving the acreage and production of the leading crops, as reported by the Federal census, shows the trend of agriculture in the last 40 years:

Acreage and production of principal crops in 1879, 1889, 1899, 1909, and 1919

Crop	1879		1889		1899		1909		1919	
	Acres	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*
Corn	9,895	139,333	11,756	232,564	20,607	342,260	20,822	440,230	22,109	324,203
Oats	172	7,165	19	700	122	3,280	144	3,085	30	1,500
Peanuts				5	125	3,198	456	10,261	500	5,114
Potatoes		18,891	352	24,603	911	60,201	2,307	149,377	1,160	50,014
Sweet potatoes	905	67,832	684	63,507	1,475	122,477	1,335	91,323	1,269	53,192
Other vegetables					1,212		1,690		521	
		Bales		*Bales*		*Bales*		*Bales*		*Bales*
Cotton	4,440	1,892	7,313	2,521	13,537	6,666	8,688	2,255	10,387	1,801
						Pounds				*Bushels*
Rice					35	113,400			6,638	202,977
		Tons		*Tons*		*Tons*		*Tons*		*Tons*
Hay (all kinds)	820	770	5,153	5,427						
Tame hay					218	299	1,412	1,006	1,076	1,445
Wild hay					15,336	14,761	22,133	21,211	12,849	16,937
Coarse forage					624	1,619	173	443	623	1,006
Silage crops									375	1,524
		Gallons		*Gallons*		*Gallons*		*Gallons*		*Gallons*
Sugar cane	144	8,508	63	7,600	71	4,980	37	3,148	59	6,746
Sorgo cane		976	58	3,543	75	831	185	971	36	1,713
	Trees	*Pounds*	*Trees*	*Pounds*	*Trees*	*Pounds*	*Trees*	*Pounds*	*Trees*	*Pounds*
Figs					11,293	36,810	34,722	669,481	44,942	70,946
Nuts [1]							892	5,553	1,605	23,460
	Vines		*Vines*		*Vines*		*Vines*		*Vines*	
Grapes					15,423	43,843	764	1,925	1,949	5,742

[1] Principally pecans.

The most important crops, as indicated by these figures, are corn, rice, and cotton. Corn has been an important crop since the first census record was made. Rice is of recent importance and cotton was formerly of much more importance than at present. Other crops of considerable importance are sweet potatoes, potatoes, sugar cane, and figs; the less important ones include peanuts, oats, hay, and sorgo.

The agricultural census for 1925 compared with that of 1920 shows the recent trend of the more important crops. Corn during this period showed a slightly decreased acreage from 22,109 acres in 1919, to 21,503 acres in 1924 but the yield increased from 324,203 bushels to 351,359 bushels. Rice decreased in acreage from 6,638 acres in 1919 to 1,568 acres in 1924 and the yield from 202,977 bushels to 67,266 bushels.

The cotton acreage increased from 10,387 acres in 1919 to 29,736 acres in 1924, and the yield from 1,801 to 10,682 bales.

More land is devoted to corn than to any other cultivated crop. It is grown by nearly all farmers and on practically all the cultivated soils in the county. Several varieties of corn are grown, but those giving the best returns are Strawberry Dent and Thomas, the latter being a white, medium hard, dent variety. Land for corn is plowed either in the fall, winter, or early spring, fall or early winter plowing giving the best results. Many farmers break the land with a lister, planting the corn in the water furrow at the same operation, though sometimes the land is flat broken and later bedded up, or the corn planted on level ground. In general, planting on level ground or on low ridges is preferable to planting in water furrows, on account of the poor drainage. Corn should be planted if possible

by the first of April, since early planting results in larger yields. The most common hindrance to early planting is excessive rainfall and lack of good drainage.

Best results are usually obtained by planting the corn in rows about 3 feet apart, and spacing the hills 18 to 24 inches apart in the rows. Where the soil is fertile, closer planting is sometimes practicable, but on the more sandy lands wider spacing may be necessary. Some farmers plant corn in rows 6 feet apart and 12 inches apart in the rows. Although this method does not usually give such good yields as planting in rows from 3 to 3½ feet apart, it allows planting a row of cowpeas or peanuts between the corn rows. A better practice, however, seems to be to plant corn in rows 3 feet apart and at the time of the last cultivation to sow cowpeas broadcast, using 15 or 20 pounds to the acre. After the corn is harvested the cowpeas make a rapid growth, and may later be harvested for hay or plowed under as a green-manure crop. Plowing under cowpeas is recommended, especially on the sandy soils, which are very low in organic matter, and practically all the soils in the county would be benefited by this practice.

Corn is usually husked from the standing stalks, sometimes the blades being stripped from the stalks and stored for winter feed. However, the usual practice is to turn cattle into the fields after the grain is harvested. When it is to be used for silage, corn is usually cut with a binder.

Of the cultivated crops cotton ranks next to corn in acreage. Many varieties are grown, but Mebane seems best suited to the conditions in this region. Cotton is grown to some extent on nearly all the cultivated soils of the county. Cotton yields range from one-seventh to two-thirds bale an acre. The best yields are obtained on the heavier soils, but good yields are obtained from some fields of light soils.

Cotton is planted both on level and on bedded land, in the latter case on the "ridge." The most common practice is to plant in rows about 3 feet apart, and about 12 inches apart in the rows. Some farmers flat break the land, sow the seed close together in the rows; and when the plants are well up, harrow with a spike-tooth harrow to kill weeds and thin out the plants, making less chopping necessary. Planting is usually done in April. Early planting, especially on the lighter soils, is recommended, there being less danger from the boll weevil then. Commercial fertilizers are used by many farmers to give the crop a quick start.

Rice is an important crop in Harris County. The 1920 census reports an acreage of 6,638 in 1919 and a yield of 202,977 bushels of rough rice, equivalent to 5,657,984 pounds of cleaned rice. Rice is grown principally on Lake Charles clay and Katy fine sandy loam, both of these soils being underlain by a clay pan which tends to hold the irrigation water at the surface. Water for irrigating is plentiful and usually obtained at depths ranging from 100 to 600 feet or more. The land for rice is usually flat broken in the fall or late winter and thoroughly harrowed. Small levees from 1 to 2 feet high are built at intervals of 100 feet or more for the purpose of retaining irrigation water at the necessary depth over the surface. When the plants are between 4 and 6 inches high, water is turned on the field and

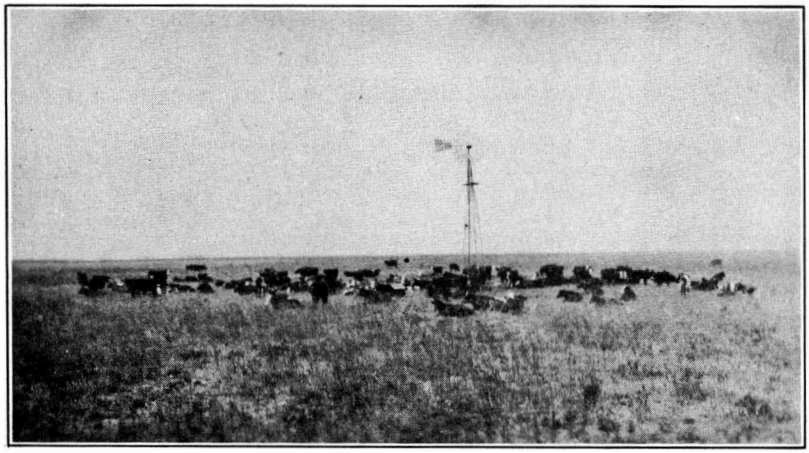

FIG. 1.—WINDMILL PUMP SUPPLYING WATER FOR LIVESTOCK ON PASTURE

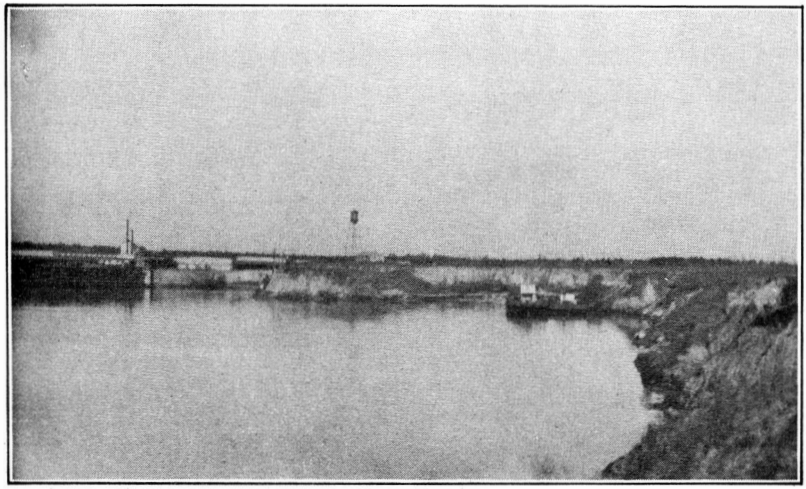

FIG. 2.—TURNING BASIN OF HOUSTON SHIP CHANNEL

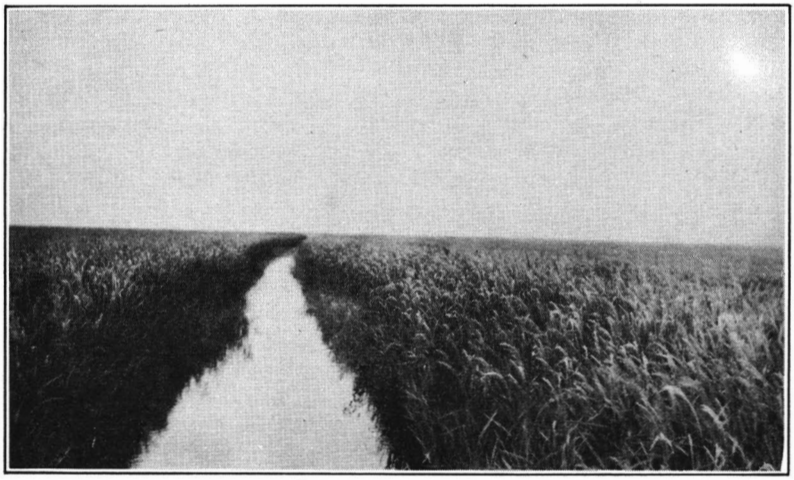

FIG. 1.—WATER ON RICE FIELD SOUTHEAST OF HOUSTON

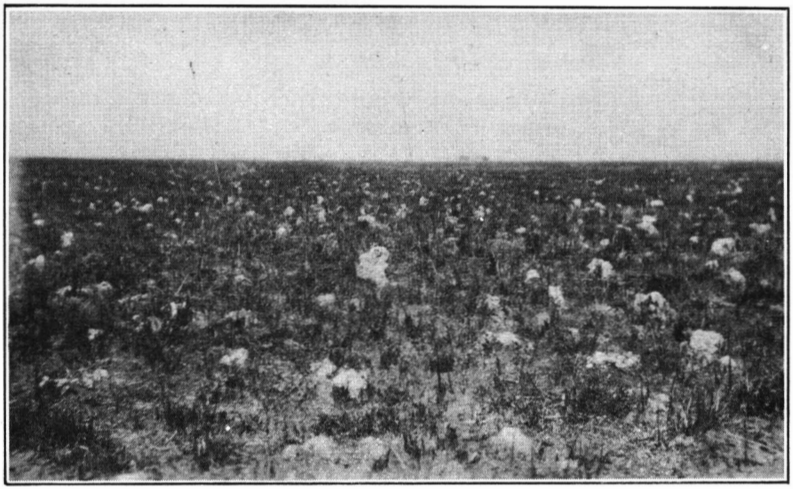

FIG. 2.—CRAWFISH HOLES ON AN ABANDONED RICE FIELD

The soil is Katy fine sandy loam

retained until harvest time, the depth being gradually increased to 6 or 8 inches. The height of the levee should be equal to the depth of water required and there should be a sufficient supply to run continually over the levees in a thin film and keep the water from becoming stagnant and injurious to the crop. (Pl. LII, fig. 1.)

Rice is usually grown on the same land two or three years in succession, and although flooding prevents the growth of many noxious weeds, red rice (wild rice), one of the worst pests of the rice fields, may be expected to make its appearance after the first year. Where rice is grown on the same land for more than two successive years this weed becomes so prevalent that it practically ruins the third crop. Other weed pests are "alligator-head" and "turtle-back." Crawfish are also injurious and sometimes become very troublesome. (Pl. LII, fig. 2.) Draining and cultivating for other crops is the best means of combating these pests. The rice root maggot is very destructive at times, and to combat this pest some growers turn off the water at intervals, believing this will diminish the damage done by the maggot.[3] Some farmers also claim that occasional turning off of the water encourages greater stooling.

Yields varying from 15 to 85 bushels of rough rice to the acre are obtained, the heavier yields coming from fresh land; that is, land that has been rested for a few years or used for rotated crops. Cowpeas, velvet beans, or lespedeza are introduced into the rotation with good results, and light applications of fertilizer are used by some growers.

Rice is usually planted in March or April, maturing in August or September. The grain is either seeded by hand or drilled in. When the crop is nearly ready to be cut the water is turned off, so that the land may become sufficiently dry for use of the harvesting machinery. The crop is cut with a grain binder.

Regarding the use of fertilizer with rice crops,[4] Chambliss says that the rice soils of the prairie are as a rule deficient in phosphorus, and that in most of them there is enough potassium. These plant-food elements can be added to the soil in the form of commercial fertilizers. A large part of the nitrogen and potassium of the rice plant occurs in the straw, so that this is saved if the straw is plowed under. The burning of straw piles and stubble, therefore, is wasteful, so far as nitrogen is concerned. The potassium is not completely lost, however, if the ashes of the burned straw are returned to the soil. The heavier soils probably contain sufficient potassium, but it is very likely that the more sandy soils of Harris County, such as Katy fine sandy loam, are deficient in this plant-food element and would be benefited by a moderate application of potash.

Oats are grown very little in Harris County. Sown in the fall they usually make good winter pasturage and are sometimes planted for this purpose.

Very little wheat is grown, and rye, buckwheat, and barley, sometimes planted as soil-improvement crops, are plowed under as green manure.

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[3] WEBB, J. L. HOW INSECTS AFFECT THE RICE CROP. Farmer's Bul. 1086, 11 pp., illus. 1920.

CHAMBLISS, CHARLES E. PRAIRIE RICE CULTURE IN THE UNITED STATES. Farmers' Bul. 1092, 26 pp., illus. 1920.

[4] See footnote 3.

Grain sorghums, such as milo and feterita, are grown to a very limited extent, as the crops do not seem to be adapted to the conditions in this part of the State. In 1919, 65 acres were reported, yielding 1,873 bushels.

The growing of peanuts is increasing in popularity, especially on the sandy soils of the northern and western parts of the county. In 1919, 500 acres were grown, producing 5,114 bushels. Peanuts are grown for the nuts, sometimes harvested for hay, and often are planted for hog feed, the hogs being turned into the fields when the crop matures and allowed to forage. Peanuts are planted in rows 3 feet apart (pl. LIII, fig. 1) and from 6 to 18 inches apart in the rows, best results usually being obtained when the space in the row is from 6 to 10 inches. Yields range from 20 to 75 bushels of peanuts to the acre, or from 1½ to 2 or more tons of hay. The varieties grown with the best success are the Virginia Bunch, the improved Virginia Runner, and the Spanish peanut. The latter is the most common and possibly the best suited for general farm use. The Virginia Bunch is a good variety for hay, as its growth is more erect. The hay and the peanuts mature at about the same time. The improved Virginia Runner has a larger top than the Virginia Bunch and will yield more hay to the acre, but slightly less seed. The Spanish peanut must be cut early for hay, for when the seed is mature the hay is overripe.

Cowpeas are grown to a very limited extent, and are usually harvested for hay. In some parts of the county, especially in the northwestern part, they are sometimes planted with corn, either in alternate rows, or sown broadcast in the corn, just before the tasseling stage. Good results have been obtained from both methods. The crop is sometimes plowed under as a soil improver, and is known as one of the best crops for this purpose.

Hay is a rather important crop. In 1919, approximately 18,500 tons were cut in Harris County, of which about 17,000 tons was wild or prairie hay; 1,400 tons tame or cultivated grasses, and the remainder grains cut green for hay, and legumes, mainly cowpeas and alfalfa. The prairie grasses are mostly coarse, native grasses, but the quality of hay improves with cutting, as cutting purifies the stand by reducing the number of species of weeds and worthless grasses. They are cut at least twice and yield from one-half to 2 tons of hay an acre in a season. Bermuda grass is the principal tame-hay crop, yielding from 1 to 1½ tons an acre of better quality hay than the native prairie grasses, and also affording excellent pasturage. Lespedeza is grown to some extent and yields fairly well on light soils but is best suited to heavier soils.

Alfalfa is successfully grown in some localities, especially on well-drained areas of calcareous soils, such as Lake Charles clay loam, shallow phase. It gives a large yield of hay and is an excellent soil builder. If the soil is acid, an application of 1,000 to 2,000 pounds of ground limestone an acre will be beneficial to land on which alfalfa is to be grown.

Crabgrass is a troublesome weed in cultivated fields, especially on sandy soils, but it grows in many pastures and meadows and makes a good quality hay when cut early.

Very little Sudan grass is grown in Harris County, but where grown it makes a very good quality hay and yields well. It is usu-

ally planted with a drill in rows from 18 to 36 inches apart. Land for this crop should be harrowed thoroughly before planting in order to kill as many weeds as possible, and after planting, the crop may be benefited by cultivation between the rows or by cross harrowing. Sudan grass should be sown early, using from 12 to 18 pounds of seed to the acre if sowed in 18-inch rows and 30 or 35 pounds if sown broadcast. The crop should be cut for hay when about one-third of the heads show. If the crop is desired for seed the first growth should be cut early for hay, and the second growth left to mature seed. Two or three cuttings of hay may be made in a good season, the yields ranging from 2½ to 3½ tons an acre. This is a good crop to introduce into a rotation as it will grow on nearly every kind of soil and is a good soil builder when plowed under as green manure.

Rhodes grass is almost unknown in the county, but could probably be grown to advantage on the better-drained soils if a good quality hay is desired.

Sorgo (sweet sorghum) is grown to some extent, the greater portion being cut early for hay. Some, however, is allowed to mature for winter roughage for feeding livestock; some is cut for silage; and some is used for making sirup. Sorgo does well on most of the soils of the county, but gives the best returns on medium heavy soil where drainage conditions are good.

The greater part of the sirup produced in Harris County is made from sugar cane. In 1909 there were 37 acres of cane which yielded 3,148 gallons of sirup, and in 1919, 59 acres produced 6,746 gallons. This crop gives the largest yield on heavy rich soils, but on sandy soils very good yields are obtained and a better quality of sirup produced. The principal variety grown is Japanese ribbon cane. If the crop is to be continued on the same ground for more than one year, the 2-line row method should be used and the rows planted 6 or 7 feet apart; but if the crop is to be grown for one year only the 3-line row will give better yields.

Potatoes and sweet potatoes are grown extensively, especially on the lighter-textured soils, and both vegetables yield fairly well. Other vegetables are grown to considerable extent. Nearly every farm has a small garden for home use, and many, especially those close to Houston, produce large quantities of vegetables for the city market. In 1919 a total of 521 acres in miscellaneous vegetables was reported. The principal vegetables grown for market are cabbage, lettuce, tomatoes, radishes, asparagus, okra, beets, onions, carrots, turnips, and parsley. Plate LIII, Figure 2, shows a field of excellent cabbage.

Strawberries, blackberries, and dewberries are cultivated to some extent; blackberries and dewberries also grow wild, especially along streams, and produce an abundance of fruit of good quality in seasons of plentiful rainfall.

Fig growing has become an important industry. The crop was first reported in 1899, when 36,810 pounds of fruit were gathered from 11,293 trees. By 1909 the number of trees had increased to 34,722, and by 1919 to 44,942. Figs do very well on medium heavy soil that is well drained. There are several fine young orchards in the county and others are being set out. Pears rank next in importance, followed in order by plums, peaches, and apples. These

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larger fruits do not usually thrive after the first few years. Grapes do well in most localities, 1,949 vines being reported in 1919 with a yield of 5,742 pounds.

Watermelons are grown extensively in nearly all parts of the county but more especially on the sandy soils in the northern part, where large yields of good quality are produced. Most of the crop is marketed locally, but some melons are shipped to distant points. When the crop is overabundant and the price low, large quantities are used as hog feed. A few Satsuma oranges are grown, but so far they have not been very successful.

Small pecan groves are numerous in the county. Along many of the streams the trees grow wild and produce small nuts of fairly good quality, but it is necessary to bud improved varieties onto native stock in order to obtain a first-class product. In 1919 there were 1,605 nut trees (chiefly pecans) reported, which yielded 23,460 pounds of nuts, a large increase, both in number of trees and in yield of nuts over 1909. Pecans are not likely to succeed except where there is good subsoil drainage.

Livestock raising and dairying are important in Harris County. Ranches range in size from several hundred acres to 10,000 or 12,000 acres, and on most of these some land is devoted to crops, especially feed crops to supplement the pasturage during winter. In 1909 there were 5,807 calves sold or slaughtered and 14,140 other cattle. Most of the cattle raised in the county are shipped to other parts of the State or to other States for fattening, as the grasses here are such that cattle feeding on them do not attain a finished condition unless supplemented by large quantities of concentrates. Some farmers raise corn and feed this, together with cottonseed meal, to put their livestock in marketable condition. During the early spring, when rainfall is plentiful and the grass fresh and tender, the cattle do very well, but during the remainder of the year, except in a few more favorable locations, the grass becomes dry and woody and of very little nutritive value. According to the 1920 census, 56.9 per cent of the farms of the county reported $723,794 expended for feed, or an average cost of $441.34 to the farm.

Is is usually necessary to dip the cattle frequently during the year in order to kill the tick which carries and transmits the Texas-fever germ. Dipping vats have been established in practically every community. A good many Brahman sires or grade Brahmans have been brought into the county, as these cattle are tick resistant and not subject to the Texas fever. This trait is inherent, and where Brahman sires are crossed with native stock the progeny are immune to the disease for several generations. They are very large animals, and when crossed with Herefords or Shorthorns the offspring is usually greatly increased in size. The peculiar hump on the shoulders of the Brahmans is not present in the hybrids to any great extent. One breeder at Pierce, Wharton County, has a large herd of purebred Brahmans, having imported the original stock from India.

Numerous dairy farms throughout the county produced, exclusive of milk and cream for home use, $242,183 worth of dairy products in 1909, and in 1919 the dairy products had a value of $978,519. Large quantities of butter and cheese are shipped into Houston from outside sources; but it would seem that an excellent opportunity

exists in Harris County for a much greater development of the dairying industry.

Hogs are raised to considerable extent and marketed chiefly in Houston. In 1909, 6,749 hogs were sold or slaughtered, and in 1919 a considerably greater number.

Goats seem to do better than sheep, though large numbers of each are raised. In 1909, 2,041 sheep and goats were sold or slaughtered, and the income from wool, mohair, and goat hair sold amounted to $3,987, and in 1919 to nearly three times this amount.

Poultry, including a few turkeys, geese, and ducks, is kept on practically every farm, more attention being given to chickens. Several large poultry farms are located in the county, and as the climate is almost ideal for chicken raising and an excellent market is within the county, this industry bids fair to grow rapidly. In 1909 the value of poultry and eggs produced amounted to $143,672, and in 1919 to $331,908.

Many farmers keep a few hives of bees, and some have rather large apiaries. The honey produced is of excellent quality.

It is a common practice to burn over the pastures during winter so that the new grass will get a better start in the spring, but this practice tends to rob the soil of organic matter and encourages the growth of weeds and inferior grasses at the expense of the more valuable pasture grasses. If the growth on the pastures were cut close with a mower in early winter, the same result would be obtained as by burning, and the cut grass would add organic matter to the soil.

Some barnyard manure is used with good results, but the supply is inadequate for the needs of the county, and large quantities of commercial fertilizers are used which give good results. In 1919, 21.4 per cent of the farms of the county reported the expenditure of $35,203 for commercial fertilizers, or an average of $57.15 to the farm. Ordinarily the sandy soils are lacking in nitrogen, phosphorus, and potash, and would be benefited by the addition of a fertilizer containing these plant foods. On the other hand the heavy soils are deficient in phosphorus and nitrogen, but have sufficient potash.

Farm improvements are good in many parts of the county, especially where the owners live on farms. Up-to-date machinery is in use, and many farmers use large plows drawn by four or more horses, or by tractors.

The number of farm laborers is usually adequate, negroes being commonly employed. Much of the work is done by the farmer and his family. Hired laborers are paid $25 to $30 a month and board, but when hired by the day receive from $1.50 to $2 a day for chopping or hoeing cotton and from $2 to $3 a day during harvest. Cotton pickers receive from $1 to $1.50 for each hundred pounds of seed cotton. According to the 1920 census, 27.6 per cent of the farms reported an expenditure of $362,170 for labor, or an average of $454.42 a farm.

In 1909, 37.8 per cent of the land in the county was in farms, averaging 157.5 acres each, and 37 per cent, or 58.3 acres, of this was improved. In 1919, a slight decrease was shown in the amount of land in farms, and the average size of farms had decreased to 131.7

acres, of which 57.2 per cent, or 75.3 acres, was improved. There were 2,543 farms in the county in 1909, and 2,880 in 1919, ranging in size from less than 50 acres to several hundred acres, some ranches comprising as many as 12,000 acres.

The farms in the county operated by owners decreased from 78.1 per cent in 1899 to 64.2 per cent in 1919. There is a gradual tendency toward farms operated by tenants, but this is not advisable from the standpoint of soil improvement and permanent agriculture. Some farms are leased for cash, but the majority are leased on the share basis, the owner usually receiving one-fourth of the cotton and one-third of all other crops, where the tenant furnishes his own equipment.

Land prices vary in Harris County according to the kind of soil, location with regard to good roads and towns, condition of buildings and fences, amount of land in cultivation, and drainage conditions. Land made up of heavier soils sold in 1921 from $50 to $150 an acre, whereas land in the sandy sections of the county could be bought for $40 to $75 an acre, and some of the more level, poorly drained areas for less than $20 an acre.

One of the Texas agricultural experiment stations, Substation No. 3, is located at Angleton, in Brazoria County, which borders Harris County on the south. Soils in that county are principally of the Lake Charles series, and the results obtained from experiments at that station are applicable to a large part of Harris County. Farmers would be greatly benefited by keeping in touch with this experiment station, as a great deal of work is carried on looking to the improvement of the present varieties of crops, to the introduction of new and better varieties, and to improved methods of crop rotation, tillage, and other farm practices and problems.

SOILS

The soil map of Harris County shows in a broad way four regions, each characterized by a different group of soils. One of these is the coastal belt which extends across the southern part of the county, the northern boundary line of which runs through Houston. Another comprises an east-west belt extending across the central part of the western half of the county. A third belt occurs in a similar way in the northern part of the western half of the county. These three areas are rather well-defined belts. The fourth region includes a central area in the northeastern part of the county and three tongues radiating from it, one running southwestward to Houston and thence westward, gradually disappearing by progressive narrowing, a second running westward from Humble, and a third running along the northern boundary of the county.

In these four areas the soils have dominant characteristics which have been determined largely by drainage. The first or coastal belt, being the lowest, has the most poorly drained soils. (Pl. LIV, fig. 1.) Here the soils have developed under a grass cover. Whether the treeless character of this coastal belt is the result of poor drainage or some other factor does not concern us at this moment. However, the one important characteristic of the soils determined by the grass cover under which they have developed, is their dark color. The soil

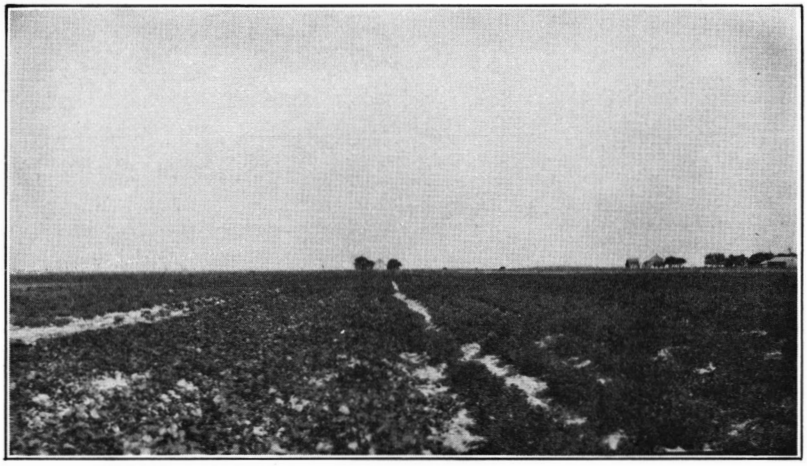

FIG. 1.—PEANUTS AND SWEET POTATOES ON KATY FINE SANDY LOAM

FIG. 2.—CABBAGE ON ACADIA CLAY LOAM, WITHOUT FERTILIZATION

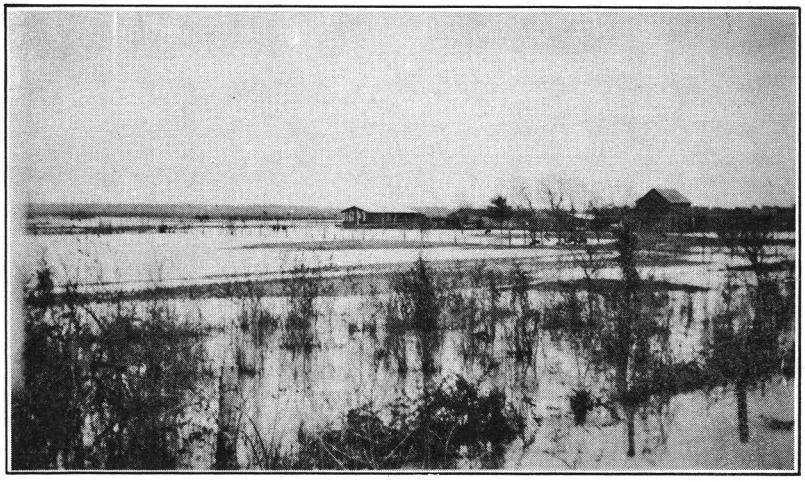

FIG. 1.—WATER STANDING ON LAKE CHARLES CLAY, TWO DAYS AFTER A HEAVY RAIN

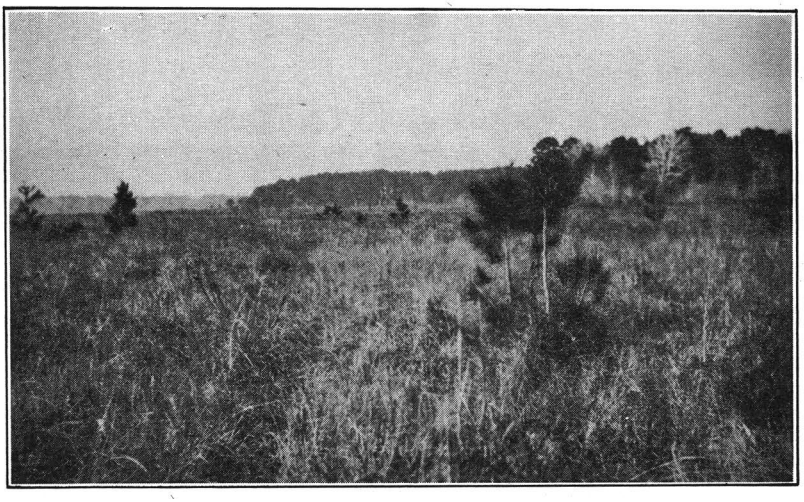

FIG. 2.—SHOWING HOW PINES START THEIR INVASION OF THE PRAIRIE

The soil is Lake Charles clay loam. The forested soils in the background are Acadia clay loam and Acadia very fine sandy loam

profiles are imperfectly developed, mainly for two reasons: (1) The soil-forming materials are heavy in texture, and consequently the soils even under favorable conditions would develop slowly; and, (2) because of the fact that they have developed on the lowest and most recently uplifted part of the land area of the county. The materials from which they have developed are calcareous clays, which contain small percentages of fine sand and silt, so that the soils of the greater part of this belt are clays, and the soil profile shows very little difference in texture.

The predominant soils of the first belt are members of the Lake Charles series. Inasmuch as the northern part of this belt is a little higher than the southern part and is somewhat better drained, the soils here have developed profiles that are somewhat better defined than those of the soils of the southern part of the county. The northern part of this belt is indicated on the map by areas of a shallow phase of Lake Charles clay loam. The material usually effervesces when treated with hydrochloric acid.

The soil of the second belt, which extends across the central part of the western half of the county, is classed as Katy fine sandy loam. This soil has developed under a grass cover, and the region is still treeless. The soils are not black, however, like those of the Lake Charles series. On account of the heavy rainfall of the region and the longer time during which this belt of soil materials has been exposed to the effects of this rainfall, as compared with the southern belt, leaching has proceeded further. In addition to their being more leached, the soils of this belt have developed somewhat abnormal profiles. The topsoil has developed a fine sandy loam texture, but at a depth of less than 2 feet occurs a layer of heavy clay. The clay layer, retarding the percolation of water, tends to cause the surface soils to be extremely wet during wet weather and dry during dry weather.

The soils are subjected, therefore, to the extremes of wetness and dryness. It is well known that when soils are subjected to these extremes for a considerable length of time they tend to become lighter in color than soils which develop under conditions of good drainage or conditions of continuously excessive moisture. Although these soils, therefore, without much doubt, were at one time as dark in color as the members of the Lake Charles series, they have become brown rather than black. They are still rather dark brown, but not dark enough to be designated as black soils. They have been derived from material that is very similar to that which underlies the Lake Charles soils, except that the former material has been leached of its lime carbonate to a much greater depth. It is possible that the soil materials of this belt were originally somewhat more sandy than the material giving rise to the Lake Charles soils, and they have more gravel in the deep subsoil.

The third belt of soils, occurring as an east-west area in the northwestern part of the county, comprises Hockley fine sandy loam. This soil is similar to Katy fine sandy loam, but differs from it in a similar way that the Katy soils differ from the Lake Charles soils. Hockley fine sandy loam is less dark in color than the Katy soils, just as the Katy soils are less dark in color than the Lake Charles soils. It is brown in color, although it is still covered by grass.

The development of a heavy subsoil seems not to have advanced much, as compared with the Katy soils. It is apparent that the soil-forming forces, whatever they may have been, which caused the development of the heavy layer in the Katy soils reached their maximum degree of activity at the time when the Hockley soils were in the same stage of development as the Katy soils. Since then their activity has been such as to produce a lighter-colored topsoil without greatly changing the character of the subsoil material.

The predominant soils in the northeastern part of the county, included in the fourth belt, are members of the Acadia series. They range in texture from fine sandy loam to clay. In general the fine sandy loam and very fine sandy loam of this series occur either on the banks along the streams or they lie only a short distance back from the streams. The areas of clay loam and clay, on the other hand, lie at a greater distance from the streams and in positions where the drainage is not so good as in the areas of fine sandy loam and very fine sandy loam. This distribution is very well shown in a large area a few miles east of Houston. The area is crossed by Greens Bayou. Along the immediate banks of the streams are belts mainly of fine sandy loam. Farther back from the streams is an almost continuous belt of Acadia clay with patches of Lake Charles clay scattered through it. It is apparent that Acadia clay closely resembles Lake Charles clay, both in position and presumably, also in character. Like all of the other soils, the Acadia soils have developed from calcareous parent material, but the carbonate has been leached from the topsoil and the upper part of the subsoil. They have attained a more advanced stage of development than any of the other soils in the county. Apparently the Hockley and Katy soils are abnormal, to the extent that their heavy clay layers are not the result of normal development but the result of the presence in these soils of certain salts which are known to produce such layers in regions where such salts are present.

In the northern part of the county, immediately south of Spring Creek valley in an area which has been more thoroughly dissected than any other part of the county, occurs a number of soil types, predominant ones being the Norfolk, Orangeburg, Caddo, and Susquehanna soils. The Orangeburg soils, occurring in the most rolling areas, have developed under the best drainage conditions of any of the soils in the county, so that they have developed normal profiles; that is, each have developed a light-textured surface layer and a heavier-textured layer beneath it. The surface layer is gray to brown and the heavier layer is deep red in color. Associated with the Orangeburg soils, principally Orangeburg fine sandy loam, is Norfolk fine sand, the only type of Norfolk soil which has developed in the county. It consists essentially of sand from the surface to a considerable depth. It is gray on the surface and yellow in the subsoil. The Susquehanna soil, the fine sandy loam member of the series, is sandy in a shallow surface layer, which is underlain by heavy unweathered clay. This clay represents essentially the parent soil material of the region, giving the soil an incompletely developed profile, in that a normal B horizon, or true subsoil, has not developed beneath the surface layer. The topsoil, or A horizon, lies on the clay which represents the parent material. The Caddo soils are similar

to the Norfolk soils, with the exception of a rather indurated layer at a depth of about 2 feet.

Within the coastal belt the types of soil occur in large unbroken areas. Lake Charles clay extends for miles without interruption by any other type of soil. North of the belt of Lake Charles clay and south of the belt of Katy soils the distribution is entirely different. Though as a whole Lake Charles clay loam occurs in large areas, each of them (the areas) contains a great number of small basinlike areas which are not so well drained as the main areas of Lake Charles clay loam. This same characteristic is true of the area comprising the Katy soils, except that the small areas of poorly drained soil are more numerous than in the areas of Lake Charles clay loam. Within the belt of Katy soils these small shallow, depressed areas contain Edna very fine sandy loam, which is a light-colored fine sandy loam underlain by heavy clay. In the same way, the third belt, including the Hockley soils, contains fully as many small areas of other soils as the second belt in which occur the Katy soils. In the case of the fourth belt, however, though some of the soils in the depressed areas consist of Edna very fine sandy loam, many of them contain Katy fine sandy loam. In other words, Hockley fine sandy loam, taken as a whole, is a better drained soil than Katy fine sandy loam, although within the belt of Hockley soils there are a great number of small depressed areas, a few feet in depth, in which the drainage has been sufficient to allow the development of soils equivalent to the Katy soils, but which have not reached the stage of development attained by Hockley fine sandy loam.

For the purpose of mapping, the soils are separated into series on the basis of common origin and similarity of color, topography, and drainage; and each series comprises a number of soil types differentiated on the basis of texture. Twenty-nine soil types, including several phases, are mapped in Harris County. These soil types represent 15 soil series. In addition two miscellaneous classes, tidal marsh and made land, are mapped. The soils of the coastal prairie region are classed in the Lake Charles, Edna, Morse, Acadia, Harris, Katy, and Hockley series. Those of the interior flatwoods region are grouped in the Norfolk, Orangeburg, Susquehanna, Ochlockonee, Trinity, Lufkin, Caddo, and Kalmia series.

A brief description of the several soil series in the county follows:

Lake Charles soils are very dark brown or black in the heavy types, and dark brown or nearly black in the sandy members of the series. The subsoil ranges from dark brown to black and the lower subsoil from yellowish brown or yellow to ashy gray or dark ashy gray. No lime is present in Lake Charles topsoils or subsoils, but the substratum, at depths ranging from 3 to 6 feet, is light colored and contains lime concretions. In places where limy clay is reached at less than 3 feet the soil is mapped as a shallow phase. The Lake Charles series is represented in this county by three types and a phase of a fourth type, Lake Charles clay, with a shallow phase, Lake Charles clay loam, with a shallow phase, Lake Charles very fine sandy loam, and a shallow phase of Lake Charles fine sandy loam.

Acadia soils are forested, and have grayish-brown or ashy-gray surface soils and lighter colored, stiff, heavy subsoils of light ashy

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gray or mottled ashy gray and pale yellow. Ferruginous concretions are present in the subsoil in some areas, and lime concretions in the substratum, below depths ranging from 3½ to 6 feet causing it to closely resemble the substratum of Lake Charles soils. Acadia soils occur in broad areas and in narrow strips, usually following drainage lines. The land is commonly flat and water stands on the surface after rains. These soils are derived from marine sediments. They rather closely resemble the Lufkin soils of the interior flatwoods of the coastal plains region but average somewhat darker in color and have a calcareous substratum or a substratum containing lime concretions, whereas the Lufkin soils do not have lime concretions so near the surface. This series is represented by four members, the fine sandy loam, very fine sandy loam, clay loam, and clay.

Morse soils occur in the eastern part of the coastal prairie subdivision of the coastal plains. These are brown soils with mottled brownish-red and yellow subsoils, and have fine dark bluish-gray mottlings in the surface soils and light bluish-gray mottlings in the subsoils. The subsoils are heavy in texture and rather impervious to water. As mapped in Harris County the Morse soils are forested. This land is level or gently sloping and the natural drainage varies from poor to fairly good. Iron concretions are present in places in the subsoil and although the surface and subsoil are nearly always noncalcareous, lime concretions occur in many places in the substratum below depths of 5 to 10 feet. The organic-matter content of the virgin soil is moderately high. The Morse series is represented in the county by three members, the fine sandy loam, very fine sandy loam, and clay.

Edna soils occur in poorly drained flats and depressions of the coastal prairies. They are light colored and low in lime, but the substratum in many places contains lime concretions at a depth of 4 or 5 feet. The soils are light gray, here and there faintly mottled with grayish brown or dark gray, and the subsoils are light gray or almost white, with some pale-yellow or grayish-yellow mottlings. Crawfish chimneys are numerous over the surface, and except during dry spells, both soil and subsoil are saturated, water standing on the surface for long periods after heavy rains. During long dry spells the surface dries out to a whitish color. The parent material of this soil consists of marine deposits. The series is represented in Harris County by one soil type, Edna very fine sandy loam.

Lufkin soils occur in the forested flatwoods of the coastal plain. The surface soils are ashy gray or gray and the subsoil and substratum are light ashy gray or light gray with some pale-yellow or yellow mottling. The lime content is very low until a depth of 6 or 8 feet is reached and the parent material consists of sedimentary strata. Surface drainage is poor in the flat areas and the subsoil, being impervious to water, is dry in places, when water is standing on the surface. When dry the soil is very hard and shows little tendency to crumble. Lufkin soils differ from Edna soils in that the substratum does not contain lime concretions, the subsoil is more tough and compact, and the surface material more ashy gray, especially in the heavier types. They are lighter colored than the Acadia soils. The Lufkin series in this county is represented by one soil type, Lufkin clay loam.

Harris soils represent little more than semideveloped soils, and are more or less marshy, lying on the higher marginal areas of the tidal marshes where drainage is better than on tidal-marsh areas. They are subject to overflow by salt water from the Gulf in times of high-wind tides. The soils are dark brown finely mottled with dark bluish gray and rust brown, showing little change throughout the topsoil and subsoil. The content of organic matter is high and the lime content low. Drainage is poor. The series is represented by Harris clay and Harris fine sand.

Susquehanna soils have brownish-gray or brown surface soils, somewhat reddish in the case of heavy types, and light brownish gray in sandy types. The subsoil begins abruptly at varying depths and consists of a heavy plastic clay, mottled with red and yellow, or red, yellow, and gray. It commonly occurs having a light-red or brick-red color changing abruptly into highly mottled yellow and bluish-gray clay, the mottling increasing with depth. Little organic matter is present in the surface soil, especially in the sandy members, and no lime in either the subsoil or deep substratum. These forested soils are derived from water-laid strata of heavy clays, and belong to the interior flatwoods subdivision of the coastal plain region. The Susquehanna series is represented in Harris County by two members, clay loam and fine sandy loam.

Katy soils occur on the coastal prairies of the coastal plains. They have light-brown or brown surface soils with light-gray subsurface layers, usually mottled with light brown, yellow, yellowish brown, or pale yellow. The subsoil is essentially a clay pan, consisting of a heavy clay, in places containing some fine sand in the upper part. The subsoil is mottled gray and yellow in color on the more poorly drained areas, and usually yellowish brown, dark brown, and yellow, or ashy gray in the better-drained positions. The subsoil shows more red mottling in the better-drained places. Reddish-brown and yellowish-brown concretions are of common occurrence in the lower subsoil and are usually abundant in the substratum, but no indication of lime appears down to a depth of 40 or 50 inches. In the absence of lime concretions the Katy soils are distinctly different in their lower strata from the Morse soils, which they resemble in some other respects. The surface soil of members of the Katy series is much more brownish than that of the Susquehanna soils and the gray subsurface section of the Katy soils is lacking in the Susquehanna. These soils occur in the vicinity of the town of Katy, and are derived from marine sediments belonging to the Lissie gravel formation. The series is represented in the county by Katy fine sandy loam, with a poorly drained phase.

Hockley soils are derived from the same character of material as Katy soils, with which they are closely associated. They are coastal prairie soils on fairly well drained flat or undulating surfaces. They have brown surface soils, yellowish-brown or light-brown subsurface soils, and yellow lower subsurface sections, with mottled yellow and gray or ashy-gray heavy clay subsoils. No lime is present in the substratum to depths of several feet. This series is represented by two soil types, Hockley fine sandy loam, with a rolling phase, and Hockley fine sand.

Trinity soils are dark-brown or black first-bottom alluvial soils, usually rich in lime, occurring along the streams in the coastal plains region. The subsoils are usually lighter colored than the surface soils. The material of these soils which have good drainage between periods of overflow, is washed, in part at least, from limy upland soils such as Houston and Sumter. The soil crumbles when dry, but is very sticky when wet. Virgin Trinity soils are usually heavily forested. The series is represented in this county by a single soil type, Trinity clay.

Orangeburg soils have gray or grayish-brown surface soils and red friable subsoils. The sandy members of the series tend toward gray or grayish brown in the surface, and the heavier members toward brown. The surface is flat or rolling and the drainage always good. No evidence of lime carbonate exists, though quartz and chert gravel are present in places. These are forested soils of the interior coastal plains region, and are derived from water-laid sandy deposits. The organic-matter content is usually rather low in the more sandy soils and only fairly good in the heavier soils. In Harris County this series is represented by one type of soil, Orangeburg fine sandy loam.

Norfolk soils are derived from sandy strata of the coastal plains region. They are lighter colored than Orangeburg soils, and have yellow friable subsoils and pale-yellow lower subsoils in case of the deep sandy members. They are very low in lime content, and drainage is good or excessive. The organic-matter content is low and the virgin soils are forested. In Harris County this series is represented by one soil type, Norfolk fine sand.

Kalmia soils superficially resemble Norfolk soils in that they have grayish soils and friable yellow subsoils; but they occur on stream terraces where the material was deposited by overflow water before the streams had cut their channels to the present levels. The water table is usually nearer the surface than in the Norfolk soils of the uplands and in many places there is some gray mottling in the lower subsoil. This series is represented by two soil types, Kalmia fine sandy loam, and Kalmia sand.

Ochlockonee soils are brown first-bottom soils of the coastal plains, having light-brown or yellowish-brown subsoils, in many places mottled with gray and rusty brown. The material has been washed from the noncalcareous upland coastal plains (from areas of Norfolk, Orangeburg, and Ruston soils), and the drainage is fairly good between periods of overflow. The content of organic matter is good, except in the very sandy members which are lighter in color. Little lime is present, either in the soil or subsoil. Four members represent this series in Harris County, Ochlockonee clay, fine sandy loam, fine sand, and sand.

The Caddo soils resemble Norfolk soils in general appearance, in origin, in color, and character of the surface and subsurface sections. They are derived from sandy strata of the coastal plains. They are brownish gray or gray at the surface with a grayish-yellow or pale-yellow friable subsurface and a pale-yellow subsoil which in the lower part is usually mottled with gray and yellow. They are low in lime content, both in the subsoil and in the lower

substratum. The organic-matter content is only fair in the virgin soils and the drainage is moderately well developed. One member of this series is mapped in Harris County, Caddo fine sandy loam.

Areas of tidal marsh represent soils in the process of development, hence they include the lowest-lying and youngest soils in the county. These areas lie at sea level and are subject to tidal overflow, being more frequently inundated than the Harris soils which lie at slightly higher level. Here the soil consists chiefly of sediments of silt and clay of a dark bluish-gray color, washed from the uplands and deposited along the edges of sounds, bays, and the mouths of streams. These soils contain much salt and are rich in organic matter.

Made land, as its name signifies, includes land areas which man has made. Its character is determined chiefly by the location and the depth from which the filling material has been obtained. It usually consists of a mixture of surface soil, subsoil, and in many places of substrata material, such as that dredged from the ship channel.

In the following pages the soils of Harris County are described in detail, and their relation to the agriculture of the county discussed; the accompanying map shows their location and distribution throughout the county; and the following table gives the name and the extent of each soil type mapped.

Acreage and proportionate extent of each type of soil in Harris County

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Lake Charles clay	270,912	24.6	Edna very fine sandy loam	36,608	3.2
Shallow phase	6,784		Orangeburg fine sandy loam	2,048	.2
Lake Charles clay loam	100,352	16.8	Norfolk fine sand	7,104	.6
Shallow phase	89,536		Caddo fine sandy loam	7,488	.7
Lake Charles very fine sandy loam	19,776	1.7	Kalmia sand	8,128	.7
Lake Charles fine sandy loam, shallow phase	6,080	.5	Kalmia fine sandy loam	6,464	.6
Katy fine sandy loam	111,872	11.0	Susquehanna fine sandy loam	9,216	.8
Poorly drained phase	12,416		Susquehanna clay loam	3,072	.3
Hockley fine sandy loam	85,504	10.2	Lufkin clay loam	1,024	.1
Rolling phase	30,656		Trinity clay	2,624	.2
Hockley fine sand	1,984	.2	Ochlockonee sand	3,264	.3
Acadia fine sandy loam	30,144	2.6	Ochlockonee fine sand	576	.1
Acadia very fine sandy loam	83,584	7.4	Ochlockonee fine sandy loam	5,376	.5
Acadia clay loam	81,472	7.2	Ochlockonee clay	13,184	1.2
Acadia clay	58,432	5.2	Harris fine sand	2,112	.2
Morse fine sandy loam	2,368	.2	Harris clay	3,072	.3
Morse very fine sandy loam	13,056	1.2	Tidal marsh	4,800	.4
Morse clay	5,568	.5	Made land	2,944	.3
			Total	1,129,600	

LAKE CHARLES CLAY

The surface soil of Lake Charles clay consists of dark ashy-gray or black clay, in many places showing some very faint rust-brown mottling, changing at depths from 18 to 26 inches into ashy-gray, bluish-gray, or dark-gray heavy clay, with brown or yellowish-brown mottlings. The lower subsoil is light ashy-gray or light bluish-gray clay, mottled or streaked with some brownish yellow. Although the dark color of the surface usually penetrates to a depth of about 2 feet, there are places where ashy-gray clay occurs at depths from 12 to 18 inches. In a very few places the dark

color of the surface continues to a depth of 3 or more feet. The subsoil in some places tends toward a yellowish-brown color, because of yellow and brown mottling, whereas in borings taken only a few rods distant, the brownish and yellowish mottlings are absent. In rare instances a faint-reddish mottling is encountered at a depth of about 3 feet. Dark-brown iron concretions are present in the subsoil, usually below 24 inches, a few occurring in places close to the surface. Occasional lime concretions are present in the lower subsoil, and the underlying substratum contains lime concretions in quantities varying from scattered concretions to abundant beds. This substratum is encountered at depths varying from 42 inches to 8 or more feet.

The soil is very sticky when wet, but when dry that from cultivated fields crumbles like the black limy soils of the State, whereas that from uncultivated areas does not crumble but cracks deeply on drying. The wet subsoil is very plastic.

Mapped areas of this soil include small patches of Lake Charles clay, shallow phase, and of Lake Charles clay loam, which are too small to indicate on the map.

Although this is a prairie soil, some forest growth is present on it where it is adjacent to other forested soils. Trees seem to be advancing steadily out upon the prairies in nearly all parts of the county. (Pl. LIV, fig. 2.)

Lake Charles clay is the most extensive and most important soil, and it occurs particularly in the southeastern half of the county.

Areas of the Lake Charles clay are nearly flat, the virgin areas having a slightly hummocky surface. A few small bare alkali or slick spots occur in areas of this soil, but they are less common than on the lighter-textured soils. Drainage is poor.

Probably over half of this soil is under cultivation and the remainder is utilized as pasture. These pastures in the original unbroken condition are heavily covered with carpet grass, broom sedge, and other wild prairie grasses. Bushes and clumps of wax myrtle are present and are abundant in some places. Where cultivated land has been allowed to revert to pasture, many weeds have appeared, thereby greatly decreasing the grazing value of the land. The most common weeds are ragweed, broomweed, goatweed, bitterweed, and crab grass.

The principal crops grown on Lake Charles clay are corn, cotton, and rice. Considerable hay is cut from the pastures, and small quantities of other crops, such as sweet potatoes, potatoes, and garden vegetables are grown for home use and markets. A little fruit is grown, but it seems to do better on lighter soils. Pears and plums succeed fairly well where the land is sloping and has good drainage. Blackberries and dewberries give good returns. Corn yields from 15 to 45 bushels an acre, cotton from one-fifth to three-fourths bale, and rice from 20 to 85 bushels, depending on the season, tillage, and control of weeds. Both sorgo and sugar cane are grown to some extent. Bermuda grass has been introduced into some of the pastures to advantage, but some farmers object to it because of the difficulty of keeping it out of cultivated fields. Sudan grass does very well. Legumes, such as cowpeas, grown in rotation with other crops, with a green crop occasionally plowed under would increase the

FIG. 1.—A WELL CONSTRUCTED DRAINAGE DITCH ABOUT 17 MILES NORTHEAST OF HOUSTON

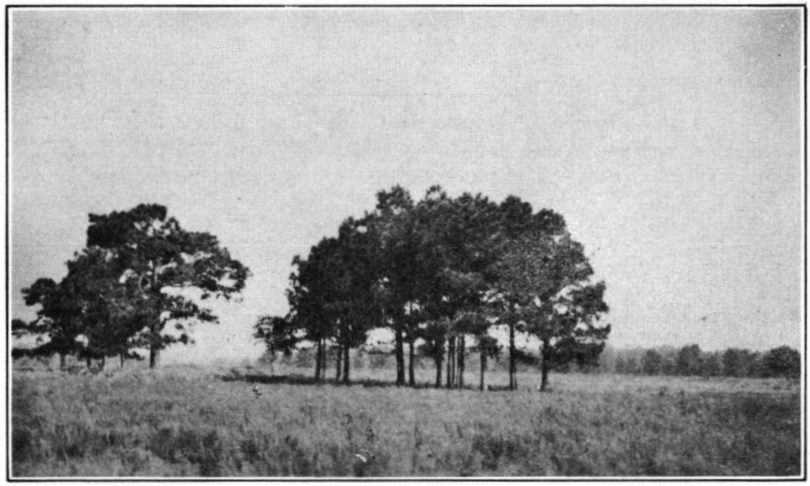

FIG. 2.—SMALL GROVE OF TREES ON THE PRAIRIE

supply of organic matter in the soil, making it easier to work and giving it a greater drought-resisting capacity.

Less fertilizer is used on this soil than on the more sandy soils. Phosphate is needed mainly on the heavy soils, and a light application of nitrogen fertilizer proves beneficial in many places.

Owing to the poor drainage conditions on much of this land, planting is sometimes retarded by excessive rains during the spring, the heavy clay soil warming more slowly than the more sandy soils. Good drainage would improve Lake Charles clay. (Pl. LV, fig. 1.) This land sells for $30 to $100 an acre, depending on the acreage in cultivation, drainage, closeness to roads and towns, and improvements.

Lake Charles clay, shallow phase.—The surface soil of the shallow phase of Lake Charles clay consists of black, dark-gray, or dark brownish-gray clay 8 or 10 inches deep overlying brownish-gray clay, slightly lighter in color than the surface soil and usually more plastic. Below a depth of 20 inches the subsoil becomes light gray and contains a quantity of lime particles and concretions, and at a depth of about 3 feet the material is light-gray or grayish-yellow clay, containing many whitish lime particles and concretions. The surface soil in many places is calcareous, and lime in considerable quantities is usually encountered at a depth of about 24 inches. However, there are spots where neither the surface soil nor the subsoil react to tests for lime.

This shallow soil closely resembles Lake Charles clay, differing chiefly in the lighter color and more calcareous nature of the subsoil. In some included patches the soils are light gray in color, and in places lime concretions are plentiful on the surface, notably on the small hummocks where yellow clay subsoil comes near the surface. The subsoil is rarely mottled like Lake Charles clay. The soil is sticky and plastic when wet but has a tendency to crumble when dry.

A few small areas of Lake Charles clay loam and some patches of fine sand, too small to map separately, have been included with this phase as mapped. A few slick spots occur. At Lynchburg, on a slight ridge above the area of Harris clay, there is a very dark-brown or black calcareous clay soil which has yellow or greenish-yellow calcareous clay below the surface. Oyster shells occur over the surface of this ridge, undoubtedly scattered by man. This phase is of small extent, occurring chiefly in the southern part of the county, in small areas usually surrounded by Lake Charles clay. It is a prairie soil and in its original state is heavily covered with carpet grass, sedge grass, and other grasses common to the Lake Charles soils. Some wax myrtle and partridge pea grow on the soil.

Less than half of this land is cultivated. With the exception of rice, which is rarely grown, the same crops are grown as on the Lake Charles clay, and the same farming practices followed. On account of its nature, this soil is suited to the growing of legumes, especially cowpeas. Alfalfa probably could not be grown except in some sloping areas along streams where drainage is good. This soil would be greatly benefited by improved drainage, and the heavy surface soil would be made more friable by plowing under vegetable matter.

Land values range from $55 to $85 an acre.

LAKE CHARLES CLAY LOAM

The surface soil of Lake Charles clay loam is black noneffervescing fine sandy clay loam merging, at a depth of 10 or 15 inches, into dark-gray or gray clay or fine sandy clay. This in turn changes abruptly into light-gray clay or pale-yellow stiff clay with yellow or gray mottling. In some areas the yellow mottlings are so conspicuous as to give the subsoil a yellowish cast. Some lime concretions are present in the lower subsoil, and at depths ranging from 3½ feet to 8 or more feet, a substratum occurs similar to that underlying the Lake Charles clay. This substratum is highly calcareous and contains numerous lime concretions and in places it is composed almost entirely of these. Slick spots are common. In these spots the soil is brown very fine sandy loam or mixed brown clay, and whitish very fine sandy loam underlain at depths of 1 to 8 inches by light-brown or yellowish-brown stiff clay which is very tough when dry. Here and there some whitish fine sandy material is present in the clay of the upper subsoil, but the middle and lower subsoil usually consist of yellowish-brown or brownish-yellow noneffervescing tough clay containing some lime concretions. At the immediate surface a film from one-sixteenth to one-fourth inch thick of very fine sand, which dries out to a conspicuous whitish color, commonly occurs. These spots are either bare of vegetation or support a scant vegetation of short grasses, including a variety of salt grass. Slick spots of this character occur about some of the broken ant holes and in places similar whitish soil is noticed in streaks paralleling some roads. These slick spots may be due to alkali accumulation.

The soil type as mapped includes some patches of Lake Charles clay, Lake Charles clay loam, shallow phase, and Lake Charles very fine sandy loam, which are too small to be indicated on the map. Scattered over this soil are numerous, low, small mounds, usually from 10 to 30 feet in diameter, rising from 6 or 8 inches to 1 or 2 feet above the general level of the surrounding land. These mounds may be composed of brown very fine sandy loam, fine sandy loam material, or very fine sand, grading downward into lighter-brown or yellowish-brown loam 10 or 12 inches deep and underlain at a depth of 3 or 4 feet by material like that composing the typical subsoil of the surrounding type of soil.

Alkali or slick spots are more common on this soil than on Lake Charles clay, but are not sufficiently numerous to affect the soil to any great extent.

Lake Charles clay loam is not extensive in Harris County. It occurs in small areas associated with Lake Charles clay in the southeastern half of the county. A few small areas, somewhat lighter, both in color and texture, are mapped in the northern and central-western parts of the county.

The surface is flat, although in places it has a little more relief than areas of Lake Charles clay. Pitted or "hog-wallow" land [5] is not so common here, although it obtains to some extent. The drainage is poor in practically all this soil, though some narrow strips

[5] Hog wallow is a local term applied to a peculiar pitted land surface appearing in many places on the Gulf coast and in the West. Its cause is not positively known, but it is believed to be due to cracking and shrinking of heavy soils.

along streams have sufficient slope to give fairly good natural drainage.

About half of this soil is cultivated. It is a prairie soil with a few scattered trees near the border of the forest. The virgin prairie supports a heavy growth of grasses similar to those on Lake Charles clay. Here clumps of wax myrtle are more common than on the clay soils, and partridge pea is rather abundant.

The main cultivated crops are corn and cotton. Corn yields from 15 to 35 bushels, and cotton from one-sixth to one-half bale an acre. Considerable hay is cut from the prairies. Both potatoes and sweet potatoes are grown with more success than on the clay soils and garden vegetables also give better yields. Sorgo is grown for forage and sirup. Little rice is grown on this soil except where patches occur in larger areas of Lake Charles clay. The soil is easier to work than the heavier soils and warms up earlier in the spring. A few plums, pears, and figs are grown in the better-drained localities. Blackberries do well, and grapes are also successfully raised where drainage conditions are good. All the soil would be greatly benefited by drainage. A rotation including a legume such as cowpeas, grown every two or three years, would prove of practical benefit. A green crop plowed under occasionally would undoubtedly help in maintaining good yields.

Lake Charles clay loam, shallow phase.—Lake Charles clay loam, shallow phase, consists of dark-gray, dark brownish-gray, or nearly black friable clay loam, about 8 inches deep, underlain by gray clay loam material slightly heavier in texture than the surface soil, and grading at a depth of about 20 inches into light-gray, ashy-gray, or pale yellowish-gray heavy clay loam or very light-colored clay which carries an abundance of whitish lime particles and concretions. The surface soil is usually calcareous, but in some areas it does not react to the acid test above a depth of 18 or 20 inches.

This soil differs from typical Lake Charles clay loam mainly in texture and in the slightly lighter color of the subsoil, which seldom shows any mottling. In places the surface soil is rather light in texture, consisting of a brown loam or fine sandy loam, and the heavy lime-bearing subsoil is not encountered above a depth of 24 or 30 inches. Both the surface soil and subsoil are mellow and friable, probably on account of the high percentage of lime. Because of their small extent some patches of Lake Charles fine sandy loam, shallow phase, and Lake Charles clay loam are included in mapped areas of this soil.

Alkali or slick spots are probably more common on this shallow soil than on any other soil in the county. These spots are usually from 8 to 15 feet in diameter, but in places occur as long, narrow strips.

The surface of areas of Lake Charles clay loam, shallow phase, is usually flat, but where this soil occurs adjacent to streams the surface is gently sloping. In a very few places low, sandy mounds occur, and in other localities the surface is slightly depressed, as is characteristic of practically all the prairie soils of the county.

The shallow soil of Lake Charles clay loam occurs chiefly in the southeastern half of the county, but there are some areas in the north-central and west-central parts. It is a prairie soil, forested only in very narrow strips bordering other forested lands, except

where small groves of trees occur at some distance from the forested land. (Pl. LV, fig. 2.) The soil in these small groves consists of Lake Charles clay loam, shallow phase, in some areas, but in other localities it is light in color, resembling Acadia clay loam.

Virgin areas of Lake Charles clay loam, shallow phase, support a heavy growth of grasses similar to that on the typical Lake Charles soils. Clumps of wax myrtle are very numerous, and partridge pea is common. About half of this soil is under cultivation. The crops grown are similar and the yields are about the same as on typical Lake Charles clay loam, but this seems a slightly more productive soil, especially in the better-drained locations. Corn is the main crop, and yields from 12 to 40 bushels an acre, depending on the season and drainage conditions. Cotton yields from one-fifth to one-third bale to the acre. Sorgo does well, and some sugar cane is grown. Garden vegetables succeed where the drainage is good, and berries and orchard fruits give fairly good returns. Alfalfa is grown in some parts of the county and yields very well on those areas of this soil phase that have good drainage, such as slopes bordering streams. Cowpeas yield well and should be grown to a greater extent to supply organic matter to the soil.

By draining and proper handling Lake Charles clay loam, shallow phase, could be made one of the best, if not the best soil in the county. It seems to be almost ideal for the production of figs. Just south of Houston there is an excellent fig orchard on this kind of soil. Near Beaumont, figs do better on this kind of land than on any other.

The selling price of Lake Charles clay loam, shallow phase, ranges from $35 to $75 an acre, as a general rule, but where special crops, such as figs, are raised, the price is much higher, reaching $500 or more.

LAKE CHARLES VERY FINE SANDY LOAM

Lake Charles very fine sandy loam is a dark-brown loamy very fine sand or very fine sandy loam, underlain at depths ranging from 12 to 30 inches by brown sandy clay loam material which grades downward abruptly into brown or mottled brown and yellowish-brown tough clay, the yellow color increasing with depth, and usually predominating in the lower subsoil, where some gray mottling occasionally is present. On high mounds the brown sandy material is deeper, and in the depressions the color of the soil is darker, and clay is ordinarily reached nearer the surface. Some depressions contain black very fine sandy loam, fine sandy loam, and fine sandy clay loam overlying dark-brown, mottled dark-brown, or yellowish-brown clay with some red mottling. Other depressions include material of the same texture, but not so dark in color.

Neither the surface soil nor subsoil are calcareous, and if there is a deep lime-bearing stratum below this soil it lies at depths below 8 or 10 feet.

Sandy mounds, similar to those on areas of Lake Charles clay loam but more numerous, and ranging in height from about 6 to 18 inches, and in diameter from 15 to 25 feet, are common on this land. A few alkali or slick spots occur.

Mapped areas of this soil include patches of Edna soils, and some soils that are darker brown at the surface and resemble Hockley fine sandy loam. In a few places the texture of the first 3 or 4 inches of surface soil approaches fine sandy loam, fine sand, or very fine sand. The subsoil in some localities is clay loam material of brownish or yellowish-brown color, and in these areas clay occurs at a depth of 42 inches. In other localities the lower subsoil is gray or yellow with mottlings of brown, dark bluish gray, and some red. Some iron concretions occur, particularly in the lower subsoil.

Lake Charles very fine sandy loam occurs as level areas or as the numerous small mounds and water-holding depressions of the Lake Charles prairies. The drainage is usually poor, except on slopes which border streams.

This type of soil is small in extent and of minor importance from an agricultural point of view. It is a prairie soil, occurring chiefly in the north-central part of the county, and the virgin areas support a fairly good growth of native grasses. Most of it is utilized for pasture and hay land, with perhaps 25 per cent of it in cultivation at the present time. Where once cultivated and then allowed to lie idle, a dense growth of weeds spreads over the land, greatly reducing its value as pasture land. Corn is the principal crop, yielding from 8 to 20 bushels an acre. A little cotton is grown but the yield is light. Considerable sorgo is grown on this land, and potatoes, peanuts, and truck crops do well when fertilized. In a few localities where drainage conditions are better than the average, strawberries, blackberries, and raspberries are grown successfully. This land ranges in price from $10 to $35 an acre.

Most of the Lake Charles very fine sandy loam would be benefited by drainage. Its greatest need is organic matter, which may be added in the form of barnyard manure or by growing and occasionally turning under a green-manure crop, such as cowpeas. Sudan grass could probably be grown successfully on this soil. Bermuda grass is grown to some extent and increases the value of the pasture, and also produces hay of good quality.

LAKE CHARLES FINE SANDY LOAM, SHALLOW PHASE

The surface layer of Lake Charles fine sandy loam, shallow phase, consists of gray or dark brownish-gray mellow friable fine sandy loam about 6 inches deep. At depths varying from 6 to 15 inches the subsurface is light-gray or light brownish-gray loam or clay loam, and below a depth of 15 inches the subsoil consists of an ashy-gray mellow friable clay loam material underlain at a depth of 20 or 24 inches by an ash-gray or whitish-gray friable clay which contains an abundance of lime particles and concretions. This lower subsoil is characteristic of the Lake Charles soils. The first 6 inches of surface soil is usually noncalcareous, but the subsurface 15 or 24 inches deep, reacts to acid tests, and the subsoil is usually highly calcareous.

Variations occur in which the surface soil in places is nearly black to a depth of 2 feet. The surface soil is a very fine sandy loam over some areas and a light loam over others. Small patches of Lake Charles very fine sandy loam and Edna very fine sandy loam are included in mapped areas of this soil. Numerous low sandy mounds

and slight depressions where water stands for some time after hard rains are present. Neither surface soil nor subsoil of the sandy mounds is calcareous, and the lower subsoil is usually mottled like Lake Charles very fine sandy loam. Alkali spots are numerous in this soil.

Areas of Lake Charles fine sandy loam, shallow phase, are similar to those of the other prairie soils, being billowy. The drainage is usually poor except near streams where the surface is gently sloping. Underdrainage is better than in typical Lake Charles soils, inasmuch as the character of the subsoil allows the water to pass downward with much greater ease than in the soils which are underlain by a clay pan.

This soil is not extensive in Harris County. It is a prairie soil and occurs chiefly in the central and north-central parts in small areas associated with other Lake Charles soils. The vegetative growth is similar to that on the shallow phase of the Lake Charles clay loam, but is usually not so luxuriant. About 25 per cent of the soil is under cultivation. The main crops are corn, cotton, and sorgo, with some potatoes and other vegetables. Yields average about the same as on Lake Charles very fine sandy loam, and farm practices and methods of improvement indicated for that soil apply also to this soil. Cowpeas and peanuts are grown to some extent with fairly good success, and Lespedeza would probably do well on this soil phase. The prairies are utilized as pasture and hay land.

No farms in Harris County are composed entirely of Lake Charles fine sandy loam, shallow phase, and the price of such land is usually governed by the value of surrounding soils. The selling price should correspond closely to that of Lake Charles very fine sandy loam.

KATY FINE SANDY LOAM

Katy fine sandy loam is a rich-brown fine sandy loam grading downward into yellowish-brown or pale-yellow and gray fine sandy loam, and underlain at depths ranging from 18 to 30 inches by mottled bluish-gray and yellow plastic clay with reddish-yellow or red mottling in the lower part, the latter occurring principally in the substratum. On some areas this soil consists of 8 or 12 inches of light-brown fine sandy loam over mottled gray and pale-yellow compact fine sandy loam, which, in turn, grades downward into mottled yellow and gray hard clay at depths ranging from 20 to 30 inches. This is underlain by mottled red or reddish-yellow, yellow, and gray extremely hard clay.

Reddish-brown, rusty-colored, and ocher-colored iron concretions are present in the subsoil, in places so abundant as to make difficult boring with a soil auger. In gully exposures some quartz gravel commonly occurs in the substratum. The soil of such areas consists of brown fine sandy loam grading at about 12 inches into lighter-brown, merging into yellowish-brown fine sandy loam and this into yellow fine sandy clay faintly mottled with pale yellow and gray. This in turn changes to stiff clay mottled with yellow, reddish yellow, red, and gray, in the lower part of the subsoil. Katy fine sandy loam includes many variations from the typical soil.

About 2 miles southeast of Waller this soil is a brown fine sandy loam about 12 inches deep, grading into light-brown fine sandy loam

with some grayish mottling and becoming yellowish with depth. At a depth of about 20 inches the soil varies to light-brown or brownish-yellow fine sandy clay, this in turn grades downward into tough, mottled gray, yellow, and reddish-yellow clay, with a little red mottling, and containing dark ferruginous concretions.

One and one-half miles southeast of Waller this soil is brown fine sandy loam, 10 or 12 inches deep, with pale-yellow and gray mottling, underlain by yellowish-brown fine sandy loam which, at a depth of 18 or 20 inches, passes into brownish-yellow clay becoming mottled with yellow and reddish-yellow as the lower subsoil is approached. The subsoil contains an abundance of concretions at a depth of 24 inches, where the clay is yellow with some blue and red mottling in the lower part. This lower layer in places constitutes a hardpan which is extremely compact and almost impenetrable in dry weather.

In the high country northwest of Kohrville, the soil is brown fine sandy loam, grading at a depth of about 15 inches into lighter-brown or yellowish-brown fine sandy loam, and underlain at a depth of 20 or 24 inches by mottled bluish-gray, pale-yellow, and yellow clay containing some sand and an abundance of ocherous-yellow, yellowish-red and red concretions. Red splotches appear in the lower subsoil.

An area 1 mile south of Tomball represents a hardpan phase, and consists of a rich-brown fine sandy loam 18 inches deep, underlain to about 24 inches by a brown or brownish-yellow friable fine sandy clay, which is in turn underlain by a hardpan of ferruginous gravel, red, reddish-brown, and ocherous-yellow in color, with yellow clay in the interstices and reaching a depth of about 30 inches. This grades into yellow clay with pale-yellow and reddish-yellow mottling, and contains fewer concretions than the overlying hardpan layer.

In some localities the surface soil is grayish brown or almost ash-gray, and in other areas where the texture of the surface soil approaches loam, the color is dark brown or dark grayish brown with mottlings of light gray, brown, and yellow. In a very few places the gray subsurface layer is not present.

About 2 miles east of the town of Katy the brown surface soil is underlain at a depth of about 8 inches by a yellowish-brown or yellow fine sandy loam mottled with gray or gray and yellow, and at 12 or 15 inches by a mottled gray and yellow heavy fine sandy loam or light fine sandy clay. This is underlain at a depth of about 18 inches by mottled yellow and gray tough fine sandy clay which is mottled yellow and reddish-yellow, or red and gray fine sandy clay. In certain places no yellow appears in the subsoil, and the mottlings are chiefly brown and light gray.

In many locations, especially where the drainage is poor, the surface soil is faintly mottled with gray, brown, and sometimes yellowish-brown, but over the better drained areas little evidence of mottling is present in the first 6 or 8 inches of the surface. In a few situations the surface is a very fine sandy loam or loamy very fine sand and in most of the area the surface soil shows considerable very fine sand.

When dry the subsurface becomes hard and the subsoil extremely hard, but when wet the soil and subsoil are soggy and, in many places,

miry. The organic matter in the soil is fairly abundant in the virgin prairie condition, but becomes depleted rapidly under cultivation.

Mapped areas of Katy fine sandy loam include small scattered patches of Edna very fine sandy loam, Katy fine sandy loam, poorly drained phase, and Hockley fine sandy loam. In some places these soils occur so closely associated and intermingled that areas are mapped according to the predominating type of soil. Alkali spots occur in a few places and the small sandy mounds common to the prairie soils are very numerous.

Katy fine sandy loam is rather extensive in Harris County, occurring chiefly in the western and northwestern parts where it comprises large areas, and in small areas intermingled with other soil types.

In surface features this land is similar to areas of Edna soils. The larger areas are flat or billowy and many of the smaller areas occur in the form of small depressions, the soils in such positions being similar to the Edna soils in color and structure. The drainage is poor after hard rains as water remains on the surface for long periods. Probably not over 10 per cent of this soil is under cultivation. It is a prairie soil and virgin areas support a fair growth of native grasses. These grasses are coarse and not so succulent as those on the better-drained soils of the county, but they furnish fairly good pasturage during favorable seasons. Areas that have been cultivated and allowed to revert to pasture become foul with weeds, and consequently their pasture value is much decreased. Weeds are also abundant on some of the virgin prairies in the more poorly drained positions. The most common weeds are goatweed, ragweed, bitterweed, goldenrod, broomweed, and smartweed. On the virgin areas some wax myrtle grows in the better-drained locations, and in the more poorly drained places bulrushes are very common, as are also niggerhead (black-eyed Susan), shining niggerhead, wooly headed croton, bear grass, and saw grass.

Corn and cotton as well as considerable rice are grown on the cultivated areas. Corn yields from 12 to 24 bushels and cotton from one-seventh to one-third bale an acre. Rice does well on virgin land or on land that has been rested or rotated with other crops for a few years. The first crop on such land sometimes yields as high as 60 or 75 bushels to the acre, but with each successive year the yield decreases, until by the third or fourth year the crop is practically a failure. Red or wild rice becomes a serious pest after the first year, and alligator-head and turtle-back weeds are troublesome. Crawfish infest the fields in great numbers and sometimes injure the crop.

Both potatoes and sweet potatoes are grown in some of the better-drained areas, and other garden vegetables do fairly well. Lespedeza and bur clover are grown to some extent and give fair yields. Some peanuts are raised, and cowpeas do fairly well and should be grown to a much greater extent. Considerable sorghum is grown with fair success on the better-drained areas. Large quantities of hay are harvested from the virgin areas, and when cut early and properly cured is of moderately good quality. Most of the hay is baled in the field and either stored under shelter for local use or hauled immediately to market. Bermuda and crab grasses commonly grow on these areas and make good hay as well as good

pasturage. It is probable that giant Bermuda grass would do well on this soil.

Barnyard manure, where available, is the best fertilizer for this soil, but considerable commercial fertilizer is used with fairly good results. Corn produces from 25 to 40 bushels an acre in favorable seasons when fertilized with 100 pounds of a mixture of acid phosphate and cottonseed meal. Some farmers report from one-half to three-fourths bale of cotton to the acre where manure has been applied. Cotton does not suffer so severely from the boll weevil on this soil because of earlier planting.

Crop rotations, including cowpeas, should be used, and a green crop, as well as other crop residues, plowed under at intervals. Practically all this soil would be greatly benefited by drainage.

Land values range from $6 to $8 an acre for the poorly drained areas and from $50 to $75 an acre for the better-drained areas close to towns and good roads.

Katy fine sandy loam, poorly drained phase.—Katy fine sandy loam, poorly drained phase, occurs on low, flat areas and small kettle-hole depressions. It consists of brown or mottled light brownish-gray and yellow loamy fine sand or fine sandy loam about 10 inches deep, overlying dry and compact gray loamy fine sand or fine sandy loam, and underlain at a depth of about 20 inches by stiff clay or clay pan mottled yellowish brown, dark ash gray, and red. In places, as near Stockdick School, the subsurface is a light-gray or almost white loamy fine sand or fine sandy loam, compact when dry, and underlain at a depth of 18 or 20 inches by mottled pale-yellow and gray fine sandy loam material. At a depth varying from 24 to 32 inches the material is heavy plastic clay mottled with red, yellow, and ashy gray or bluish gray. Some patches of clay loam are included in mapped areas of this soil. Iron concretions are present in many places in the subsoil and also occur on the surface in some places.

The surface of this land is flat and the drainage is very poor. Mounds and alkali spots are uncommon. This soil is of small extent, and probably less than 5 per cent of it is under cultivation. The small areas usually occur as small kettle-hole depressions in association with Katy fine sandy loam and Hockley fine sandy loam. The vegetation on the virgin areas is the same as that on typical Katy fine sandy loam and the cultivated crops are similar, with slightly lower yields in wet seasons. The same methods for improvement should be practiced on this soil.

HOCKLEY FINE SANDY LOAM

The surface soil of Hockley fine sandy loam, to a depth of 10 inches, is light-brown, brown, or dark-brown fine sandy loam underlain by light-brown or yellowish-brown fine sandy loam, which becomes heavier with depth. At a depth of 12 or 16 inches a yellow heavy fine sandy loam appears, and at a depth of about 20 inches yellow fine sandy clay loam material. Below this, at depths of 20, 24, or even 30 inches, is stiff pale-yellow clay, which contains reddish-brown ferruginous concretions and some chert and quartz gravel. This subsoil is usually highly mottled with pale yellow, yellow, and

yellowish brown and occasionally with bluish gray and a little red. Iron concretions are usually present and in many places abundant from the surface down, and are consistently present in the substratum. When dry the subsoil, and in many places the subsurface soil, is extremely hard.

Variations occur in which the surface soil is brownish gray and contains considerable very fine sand. The subsoil also varies considerably, being a dark bluish-gray stiff plastic clay with yellow, red, and brown mottling, and in other locations a light sandy clay, brown or yellowish brown in color, with gray and yellow mottlings.

Hockley fine sandy loam is derived from the same kind of sediments as is Katy fine sandy loam, with which type of soil it is closely associated. As these soils have many characteristics in common, in places they are difficult to differentiate. Hockley soil differs in being slightly better drained, darker brown at the surface, without the well developed gray subsurface layer, more sandy in the subsoil, especially the upper subsoil, and in having more yellow and less red in the subsoil than Katy fine sandy loam. Evidences show that no lime is present in the topsoil or subsoil, but in wells drilled near Hockley, limerock was encountered in places at a depth of about 20 feet, and in other locations it does not occur above a depth of about 300 feet. Some quartz and chert gravel occur in the substratum and, in many places, in the subsoil.

Mapped areas of Hockley fine sandy loam include patches of Katy fine sandy loam, Edna fine sandy loam, Lake Charles fine sandy loam, and Hockley fine sandy loam, rolling phase. Sandy mounds are fairly common though not so numerous as on areas of Katy soils. Alkali spots occur in a few places.

Hockley fine sandy loam is of considerable extent in Harris County. It is a prairie soil in the northwestern half of the county, occurring principally in the region from Hockley and Waller to Cypress and Tomball, both in large areas and also in small bodies intermingled with areas of other soils.

The soil surface is flat or gently undulating, and as a rule the soil occurs at slightly higher elevations than the Katy soils. Drainage is usually deficient, although in the more undulating situations it is fairly good.

Less than 20 per cent of this soil is under cultivation. The virgin prairies support a good growth of native grasses similar to those which grow on Katy fine sandy loam, but on the more poorly drained areas weeds are so abundant that the pasture value is low. The crops grown and the agricultural practices followed are about the same as on Katy fine sandy loam, except that rice is seldom grown on the Hockley soils. Yields on the better-drained areas are slightly higher, and in a few places some fruit is successfully grown. Blackberries do fairly well, also strawberries and garden vegetables. The same methods of improvement suggested for the soils of the Katy series apply to this type of soil. Land values are practically the same.

Hockley fine sandy loam, rolling phase.—The surface soil of Hockley fine sandy loam, rolling phase, is brown fine sandy loam, grading at depths of from 8 to 12 inches into a yellowish-brown fine sandy loam subsoil. At a depth of about 20 inches the material is yellow and

heavy fine sandy loam in texture. At a depth of about 24 inches the subsoil is underlain by yellow or brownish-yellow sandy clay loam material, and at 26 or 28 inches by mottled yellow, pale-yellow, and gray clay or sandy clay. An abundance of reddish-brown ferruginous concretions are present in the subsoil and are in some places numerous on or near the surface. In some places the surface is a loamy fine sand, whereas in other places it approaches a loam. The color of the surface soil in some areas is light brown or grayish brown, but where the texture is heavier it is usually brown or dark brown. The subsurface in places is grayish brown mottled with pale yellow and brown, and the sandy clay subsoil may be encountered at a depth of 18 or 20 inches. There is no free carbonate of lime in the soil, subsoil, and substratum.

The soil is somewhat similar to typical Hockley fine sandy loam, the main differences being that the rolling phase has a more sloping surface and is therefore better drained; that it usually has a slightly darker-colored surface soil; and that the subsoil is more yellow and has more distinct mottlings than in the typical soil. More concretions also are present in the subsoil than in typical Hockley fine sandy loam. In the lower and more poorly drained areas, the surface soil may be light brown or grayish brown with faint mottlings of gray and pale yellow.

As mapped, areas of this soil include patches of typical Hockley fine sandy loam, Hockley fine sand, and Lake Charles fine sandy loam, which are too small to be indicated. No alkali spots occur on this type of soil, and the low sandy mounds common to most of the coastal prairie soils are absent. This phase is not so extensive as typical Hockley fine sandy loam. It occurs in the northern part of the county, on the undulating or rolling prairie country bordering Spring Creek.

This is a prairie soil, the virgin areas supporting a good growth of native grasses, commonly of better quality than those on the typical Hockley soils. About 10 per cent of the soil is under cultivation, the principal crops being corn, which yields from 15 to 40 bushels an acre; cotton, yielding from one-fifth to one-half bale, and sorgo which produces from 1 to 2 tons of forage an acre. From three-fourths to 1½ tons to the acre of fairly good hay is cut. Peanuts are raised with fair success, and a small acreage of cowpeas is grown with corn and produces a good crop. Potatoes yield from 30 to 100 bushels or more an acre and sweet potatoes from 50 to more than 200 bushels. Considerable sugar cane is grown and yields well, giving a high grade of sirup. Watermelons and cantaloupes are raised in large quantities. Berries and other garden truck are grown with good success, and considerable orchard fruit, such as plums, pears, peaches, and a few apples, are raised.

Farmers who practice crop rotation, growing cowpeas with the corn or alone, find that they can greatly increase their yields in this way. The virgin soil is fairly high in organic matter, but unless care is exercised in cropping this supply depreciates rapidly. An excellent practice is to plow under a crop of cowpeas or some other green-manure crop at least once in every rotation or once in every four or five years.

Land of Hockley fine sandy loam, rolling phase, sells for $14 to $75 an acre, depending on the location, acreage in cultivation, and improvements.

The greatest need of this soil seems to be organic matter. This may be supplied by plowing under vegetable matter, such as cotton stalks, cornstalks, grass, or cowpeas, or by applications of barnyard manure. Commercial fertilizers containing nitrogen, phosphorus, and potassium are used extensively, usually giving increased crop yields. Acid phosphate is better used in combination with cottonseed meal or barnyard manure.

HOCKLEY FINE SAND

Hockley fine sand to a depth of from 6 to 12 inches is a light-brown or grayish-brown loamy fine sand underlain by brownish-yellow fine sand, merging at 20 or 26 inches into pale-yellow fine sand. The substratum, which begins at depths ranging from 30 to 50 inches, is a mottled yellow and gray tough clay containing reddish-brown ferruginous concretions. The topsoil, subsoil, and substratum to depths of 8 or 10 feet are noncalcareous where examined in ditches and road cuts. No alkali spots appear on this soil.

Hockley fine sand is of small extent in Harris County. It is mapped in the northwestern part where it is associated with Hockley fine sandy loam, rolling phase.

Areas of this soil vary from gently undulating to rolling and include numerous small rounded hills. The drainage is good or even excessive.

It is a prairie soil, the virgin areas supporting a fair growth of native grasses and weeds similar to those on Hockley fine sandy loam. Less than 5 per cent of the soil is cultivated and crops similar to those grown on the fine sandy loam type are grown but the yields are light.

Land values range from $5 to $30 an acre.

The greatest need of this type of soil is organic matter which should be supplied in the form of barnyard manure or by plowing under green crops such as cowpeas, peanuts, oats, or rye.

ACADIA FINE SANDY LOAM

Acadia fine sandy loam consists of brown loamy fine sand about 6 inches deep, underlain by light-brown or pale yellowish-brown loamy fine sand or fine sandy loam, showing some faint rust-brown or yellowish-brown mottlings, and changing at a depth of about 18 inches into a stiff gritty clay mottled with gray, yellow, bluish-gray, and yellow. In places the surface soil is a brown loamy fine sand grading downward into lighter-brown loamy fine sand, and underlain at depths varying from 18 to 30 inches by mottled yellowish-brown, gray, and yellow clay. On flat areas the topsoil is a grayish-brown loamy fine sand 6 or 8 inches deep, underlain by grayish-brown loamy fine sand, and abruptly at a depth of 12 or 14 inches, by mottled yellow or yellowish-brown and gray clay. Both topsoil and subsoil are noncalcareous, and no lime concretions are present. A few ferruginous concretions may be present in the lower part of the subsoil.

Small areas of Acadia very fine sandy loam and Edna very fine sandy loam are included with Acadia fine sandy loam as mapped in Harris County. Sandy mounds occur in places but are not so abundant as on areas of Acadia very fine sandy loam.

The surface of areas of Acadia fine sandy loam is flat or very gently undulating. Drainage is usually deficient except where the land slopes gently toward streams.

This is a forested soil, and practically none of it is under cultivation. It occurs chiefly in the northeastern and east-central parts of the county, and is of rather small extent and minor importance. The forest growth consists of shortleaf pine, sweet gum, post oak, willow oak, ash, and other trees. In the more open places blackberry briers, French mulberry, and yaupon are abundant.

The value of such land depends largely on the forest growth, varying from $8 or $10 an acre to $50 or $75 an acre where there is a good growth of virgin timber. Over most of the area the best timber has been cut off, but in places, especially in the northeastern part of the county, considerable high-grade timber is still standing. Extensive areas of cut-over land sometimes support sufficient grass to afford fair pasturage.

ACADIA VERY FINE SANDY LOAM

The surface soil of Acadia very fine sandy loam to a depth of 6 or 8 inches is a light-gray or light brownish-gray loamy very fine sand or very fine sandy loam with some mottlings of pale yellow. This is underlain by very light-gray or pale yellowish-gray very fine sandy loam which may be faintly mottled with brown and pale yellow. The subsoil, beginning at depths varying from 15 to 22 inches, is a mottled yellow and light-gray compact impervious clay, or may be yellowish-brown tough clay containing some whitish material. The upper portion of the subsoil in many places contains sufficient fine sand to render it fairly friable. Sandy mounds are common over areas of this soil, in places very abundant. Both topsoil and subsoil are noncalcareous, though a few lime concretions as well as some iron concretions occur in the lower subsoil. In a few locations a little red mottling appears below a depth of 3 feet.

Mapped areas of this soil include patches of Acadia clay loam, Acadia fine sandy loam, and Edna very fine sandy loam. Where the forest trees have advanced over small areas of adjacent prairie soils such areas are usually included with the Acadia soil.

The surface of this soil is flat, gently undulating, or even gently sloping along streams. Drainage is fairly good on the sloping areas, but is deficient on the more level portions. After hard rains water often stands for some time in the shallow depressions.

In the extreme northeastern part of the county are large areas which closely resemble Lufkin fine sandy loam or Lufkin very fine sandy loam, and in these locations it is difficult to differentiate between the soils, only the presence of iron concretions in the subsoil determining the grouping of these soils in the Acadia series.

Only a few small areas of this forested soil have been cleared and put into cultivation. The soil type is of considerable extent in the county, occurring usually in the general vicinity of natural drainage systems. The forest growth consists principally of shortleaf pine,

willow oak, sweet gum, post oak, and water oak, with blackberry briers, French mulberry, carpet grass, and wire grass in the clearings.

Land prices range from $6 or $8 to $40 or $50 or more an acre, depending largely on the quantity and quality of timber on the land.

ACADIA CLAY LOAM

The surface layer of Acadia clay loam consists of slightly dark gray clay loam or shallow very fine sandy loam with some yellow mottling in the subsurface material. At depths varying from 2 to 6 inches this grades downward either into gray fine sandy clay loam, usually faintly mottled with yellow, or into gray or dark-gray clay, mottled with light gray. This in turn is underlain by tough gray or light-gray clay, in many places showing yellow mottling and here and there some red mottling in the upper part of the subsoil. In some areas the lower subsoil is an ashy-gray tough clay resembling the subsoil of the Lufkin soils which occur in the flatwoods division north of the coastal prairie belt, and in other areas the sandy surface layer is deeper and the subsoil is light gray with pale-yellow mottling. Mounds usually consist of gray or light brownish-gray very fine sand or loamy very fine sand, changing at a depth of 20 or 30 inches into gray clay loam or clay mottled with yellow or red.

Both topsoil and subsoil are noncalcareous, although a few scattered lime concretions may be present in the lower subsoil, together with occasional small brownish iron concretions. The surface soil may vary in texture from clay to fine sandy loam, the surface being uneven and pitted, so that water stands in the shallow depressions for some time after heavy rains. Small sandy mounds are rather abundant, on which the soil is usually a gray or light brownish-gray very fine sand or loamy very fine sand underlain at depths ranging from 20 to 30 inches by gray clay loam or clay, mottled with yellow and in places with red.

When dry, the topsoil of Acadia clay loam becomes hard and the subsoil exceedingly hard; but when wet, the surface soil is sticky and the subsoil plastic and tenacious.

Patches of Acadia fine sandy loam, Acadia very fine sandy loam, and Edna clay loam are included in mapped areas of this type of soil. Where this soil is bordered by a prairie soil, such as Lake Charles clay or Lake Charles clay loam, the forest has advanced for a short distance onto the prairie. Where the soil in these locations more nearly resembles the Acadia soils it is mapped as such, and where it resembles the prairie soil it is classed with the prairie type. Areas of Acadia clay loam also occur as openings or natural clearings where there is no forest growth. Where these areas are small they are included in mapped areas of the type of soil with which they are associated.

Acadia clay loam is fairly extensive in Harris County, and although it occurs in the coastal prairie region, it is all forested. It occurs usually in rather large areas in different parts of the county but the main areas are in the central and eastern parts, commonly following drainage lines. Narrow strips, only a fed rods in width, border many of the smaller creeks, the soil having the general appearance of a first-bottom soil. Such areas are often overflowed at

times of high water although there seems to be no appreciable deposition of material. On the other hand, the water seems rather to have eroded some of the surface material. On the more level and broad overflow areas along these streams, however, some alluvial deposits have been formed, and in such places the soil is mapped as first-bottom land.

Areas of Acadia clay loam are flat or gently undulating, except where numerous mounds give a billowy appearance. Drainage is deficient except on slopes which border streams.

The forest growth consists chiefly of willow oak, red oak, sweet gum, ash, some pine, live oak, and other oaks, with some yaupon and blackberry briers abundant in the undergrowth, and carpet grass, wire grass, and other grasses in the clearings.

Very little of this soil is under cultivation, although in a few places small areas have been cleared and planted to crops. The soil seems to be fairly productive, especially when it is first cropped. In the vicinity of Houston some truck crops like cabbage, lettuce, carrots, turnips, rutabagas, beets, and onions are raised on this soil. (Pl. LIII, fig. 2.) In other locations small acreages of corn, cotton, and sorgo are grown with fairly good success.

The value of Acadia clay loam ranges from $10 to $50 or more an acre, depending largely on the value of the forest growth, improvements, and nearness to markets.

ACADIA CLAY

The topsoil of Acadia clay is brownish-gray, ash-gray, or mottled clay about 6 inches deep. The subsoil is bluish-gray or light-gray stiff clay, showing some yellowish-brown mottling, usually reaching a depth of 3 feet. In other places the soil to a depth of a few inches is more brownish, and mottled with gray instead of bluish gray, and changes into bluish-gray clay with yellowish-brown mottling, or into light bluish-gray or light-gray clay mottled with varying proportions of pale yellow. In some areas the yellow mottling predominates. Areas of this soil are flat or depressed, and drainage is poor. The substratum usually shows lime concretions in varying quantities. About 12 miles east of Houston near the Liberty road is an area of Acadia clay which consists of mottled dark-gray or brown and bluish-gray clay which grades downward into bluish-gray clay with some pale-yellow mottling, the pale yellow predominating in places. The subsoil is very tough clay. In some localities the topsoil is slightly silty, and a shallow layer of very fine sandy loam overlies light-gray and yellow friable clay or clay loam, which in turn is underlain by tough noncalcareous clay mottled yellow or brownish yellow and bluish gray. Pine, willow oak, ash, and saw palmetto constitute the forest growth on this area.

Three miles east of Houston, Acadia clay consists of a topsoil of dark ashy-brown (grading into ash-gray) clay, and a subsoil of dark bluish-gray clay with faint yellow mottlings, the lower portion being a very tough bluish-gray clay with yellowish-brown mottling. Some dark-red mottling appears in the subsoil, but not nearly so much as is present in typical Acadia or Morse soils. This area slopes slightly toward a stream.

The Acadia soils rather closely resemble the Lufkin soils but differ in the presence of lime concretions in the substratum, beginning at a depth of 3 or 4 feet.

This soil is of rather small extent and of minor importance, occurring chiefly on flats somewhat lower than the surrounding country. It is a forested soil, none of it being under cultivation. The forest growth consists mainly of willow and other oaks, sweet gum, ash, and pine, with an undergrowth of yaupon, blackberry briers, and carpet grass in the clearings.

MORSE FINE SANDY LOAM

The topsoil of Morse fine sandy loam, 6 or 8 inches deep, is a brown or grayish-brown friable, mellow, loamy fine sand or fine sandy loam, underlain by light brownish-gray or pale-yellow loamy fine sand or fine sandy loam. At a depth of 15 or 18 inches the material grades into a gritty clay loam, which is mottled with gray, yellow, and some red. At a depth of about 24 inches occurs stiff plastic clay mottled with yellow, gray, and red, which continues below 42 inches. The surface soil in some places approaches fine sand in texture and in other places loam. The color of the surface soil may be almost gray, occasionally faintly mottled with bluish gray. In some locations the plastic clay occurs at a depth of 15 or 20 inches, but in other places it is not present above 3 feet. Frequently this clay subsoil carries considerable fine sand, which gives it a gritty feel. Mapped areas of this type of soil include patches of other Morse soils as well as some Acadia very fine sandy loam and Acadia fine sandy loam.

Morse fine sandy loam, like other soils of the Morse series, occurs mainly on gentle slopes which border streams. These slopes are usually somewhat less sloping than those on which occur the heavier types of Morse soils. The principal areas are in the northeastern part of the county along East Fork San Jacinto River.

This is a forested soil, and practically none of it is under cultivation. It supports a growth of shortleaf pine, oak, ash, and hickory.

Land values are about the same as for Morse very fine sandy loam.

MORSE VERY FINE SANDY LOAM

Morse very fine sandy loam consists of brown loamy very fine sand 8 or 10 inches deep, which grades downward, first, into light-brown loamy very fine sand and then into yellowish-brown, pale-yellow, or grayish-yellow loamy very fine sand, underlain at a depth of 18 or 22 inches by stiff, plastic clay mottled red and yellow, with some gray. A few iron concretions are present in the lower part of the subsoil, but no indication of lime is apparent in either the topsoil or subsoil.

This soil varies in different locations. The surface may be dark brown and contain considerable fine sand. In some locations the subsurface material is very fine sandy loam or loam and reaches depths of 20 or 24 or more inches before grading into the highly mottled clay subsoil. In a few places the subsoil is a brownish-gray clay with bluish-gray and yellow mottlings.

Some patches of Morse fine sandy loam, Morse clay loam, and Acadia very fine sandy loam and clay loam are included in mapped

areas of this type of soil, such patches being so small and so intermingled that it is impracticable to indicate them on the map.

Morse very fine sandy loam occurs principally in the eastern part of the county on the slopes and on some nearly flat areas near the streams. Along San Jacinto River it occurs mainly on the slopes between the first-bottom land and the upland, or between the terrace soils and the upland.

This type of soil is of small extent. Practically all of it is forested, and none is cultivated. The forest growth is similar to that on areas of Acadia very fine sandy loam. It is of minor importance, although it is the most extensive of the Morse soils and is equal in value to Acadia very fine sandy loam, usually ranging from $8 or $10 to $30 or $40 an acre, depending on the forest growth.

MORSE CLAY

Morse clay to a depth of 6 or 8 inches is a brown or dark-brown stiff clay, underlain to a depth of 24 inches by rich-brown sticky clay. The subsoil is a plastic clay varying in color from bluish gray with mottlings of pale yellow, grayish yellow, and some red, to yellow or yellow with gray mottlings. In a few places the surface soil is nearly black, especially on the more nearly level areas, though red and yellow mottlings occur here and there, and on some of the eroded slopes the surface is a red clay mottled with yellow and gray. Some red usually is present in the subsoil, and in some places the subsoil is predominantly red with yellow and bluish-gray mottlings. In places bluish-gray mottlings are also present in the surface soil. This soil is not calcareous, although a few scattered lime concretions occur below a depth of 3 feet, and in a few places the subsoil shows the presence of lime carbonate.

Mapped areas of this type of soil include small patches of Morse clay loam, Acadia clay, and Acadia clay loam. Some areas resemble the Susquehanna soils.

Morse clay is of very small extent in Harris County. It is a forested soil, occurring usually on slopes toward streams and especially on the steeper slopes where the surface soil has been washed away to some extent. This soil occurs principally in the eastern part of the county, the larger areas being along San Jacinto River and Buffalo Bayou. The areas are gently or steeply sloping and the drainage fair or excessive.

Practically none of this soil is tilled. The forest growth consists mainly of willow oak, white oak, pine, and sweet gum, and the undergrowth of carpet grass and other grasses, with blackberry briers abundant over some areas.

This soil, owing to its sloping character, is valued chiefly as pasture land. Some patches of Morse clay loam are included in mapped areas of Morse clay. The topsoil of Morse clay loam consists of brown or grayish-brown fairly friable clay loam, usually underlain at a depth of 6 or 7 inches by plastic sticky clay mottled red and yellow with some bluish gray or brown. At a depth of 16 or 18 inches the subsoil is a yellow plastic clay mottled with red, and continues to a depth greater than 3 feet. Some of the surface soil may show bluish-gray mottling and the texture approaches very fine sandy loam. In some

locations the mottled clay subsoil or subsurface material is not encountered above a depth of 18 or 24 inches, especially on the more level areas. Neither the topsoil nor subsoil shows any indication of the presence of lime carbonate, but some ferruginous concretions occur in the subsoil. Morse clay loam occurs on slopes along streams, principally in the eastern part of the county along San Jacinto River.

EDNA VERY FINE SANDY LOAM

The surface soil of Edna very fine sandy loam is brownish-gray or ashy-gray very fine sandy loam with faint mottlings of rust-brown and gray, underlain at a depth of 6 or 8 inches by gray very fine sandy loam with yellowish-brown or pale-yellow and bluish-gray mottlings, the gray color increasing with depth. The subsoil, consisting of rather tough bluish-gray fine sandy clay mottled in varying degrees with yellowish brown and containing some pockets of light-gray very fine sandy loam, occurs at about 20 inches. Some lime nodules are brought up by ants from the substratum, but other calcareous material is not present. The lower subsoil is usually stiff plastic clay ranging in color from light gray with brown mottlings to bluish gray with yellowish-brown and light-gray mottlings. The subsoil is noncalcareous, although an occasional lime concretion is present below a depth of 30 inches. Iron concretions occur in places in the lower part of the subsoil.

Drainage is imperfect and many crawfish holes have been formed. The areas are flat or billowy, similar to the areas of other prairie soils, and have numerous mounds and depressions. These depressions are from 6 inches to 2 feet below the general level of the surrounding plain and the soil in them is usually ashy gray at the surface and of clay loam texture. Many of these depressed areas are partially surrounded by low ridges of sandy material, probably of wind-blown origin, which range from 6 to 12 inches in height and from 10 to 20 feet in width.

On the larger level areas this type of soil includes patches of Lake Charles very fine sandy loam, Edna clay loam, and Edna fine sandy loam. In some places areas of this soil grade into areas of Katy and Hockley soils so gradually that it is difficult to differentiate between them. Small bodies of these soils have therefore been included in mapped areas of Edna very fine sandy loam. Here and there low sandy mounds are very numerous.

This type of soil, although rather extensive, is of little agricultural importance. The numerous small areas occur through the central part of the county. Practically none of the land is tilled. The grasses are coarse and of low nutritive value, though some hay is cut.

A few small areas of Edna very fine sandy loam occur in association with the forested Acadia soils, which have a scrubby scattered growth of cypress, elm, and other trees, and usually an abundance of wild coffee bean. Some areas where water stands for long periods are practically bare of vegetation. If drained, this soil might produce a good quality of hay if Bermuda and other grasses were introduced.

The current selling price of this land ranges from $5 to $12 an acre.

There are some patches of Edna clay loam where the topsoil consists of light ashy-gray clay loam, 6 or 8 inches deep, with faint mottlings of light gray or brownish gray. This ashy-gray clay loam may continue below 3 feet, but usually below a depth of 6 or 8 inches the material is light bluish-gray clay loam with whitish mottlings, which at a depth of about 24 inches grades into ashy-gray or light bluish-gray stiff impervious clay, mottled with brown and yellowish brown. The surface soil is brownish gray in some localities and approaches loam or very fine sandy loam in texture. In some areas the heavy clay subsoil is encountered at a depth of 15 or 20 inches and is a bluish-gray, sticky, plastic clay. A few scattered iron concretions are present below 24 inches. Both surface soil and subsoil are noncalcareous, although here and there a lime nodule occurs in the lower subsoil, but the material surrounding it does not react to the lime test. Small dome-shaped sandy mounds and alkali spots are numerous on areas of this soil, the mounds giving a billowy appearance to the surface.

The flat surface of Edna clay loam land results in poorer drainage as compared with other prairie soils. The smaller areas usually occur in slight depressions from 6 inches to 2 feet below the general level of the surrounding prairies, in which water often stands for long periods.

ORANGEBURG FINE SANDY LOAM

The surface soil of Orangeburg fine sandy loam is grayish-brown loamy fine sand underlain at a depth of 6 or 8 inches by brownish-red loamy fine sand or fine sandy loam. At a depth of about 20 inches the material becomes red, friable, and fine sandy clay loam in texture, and at a depth of about 26 inches is underlain by red friable gritty clay which contains considerable fine sand. In some patches the sandy clay subsoil occurs at depths varying from 12 to 20 inches. The topsoil and subsoil are noncalcareous, though a few iron concretions are present in both, and in places some quartz and chert gravel are encountered. The organic-matter content of the surface soil is low.

As mapped in Harris County, areas of Orangeburg fine sandy loam include patches of Orangeburg clay loam, Ruston fine sandy loam, Caddo fine sandy loam, and on some of the steeper slopes areas resembling Susquehanna fine sandy loam. These included patches are too small and too closely associated with Orangeburg fine sandy loam to be mapped separately.

Orangeburg fine sandy loam occurs in the northern part of the county, most commonly on the slope to Spring Creek, though the areas are not of great extent.

This land varies from sloping to undulating or gently rolling, with good drainage. On some of the steeper slopes considerable erosion has taken place and many deep gullies have formed. This is a forested soil, but there are a few treeless areas, which are used either for pasture or cropping. The same agricultural practices are maintained, with yields similar to those obtained on the rolling phase of Hockley fine sandy loam. The forested areas support a tree growth similar to that on Caddo fine sandy loam, consisting mainly of pine and oak, with some elm and other trees.

The current value of this land ranges from $10 to $40 an acre.

NORFOLK FINE SAND

Norfolk fine sand is a grayish-brown fine sand from 3 to 5 inches deep, overlying pale-yellow fine sand, which continues to a depth of 3 or more feet without change. In places there are some faint reddish-yellow mottlings in the lower subsoil. The degree of color of the surface soil varies a little in different locations. The subsoil may contain a few iron concretions, but these are rare, and no lime is present. The content of organic matter of the surface soil is very low. Small areas of Norfolk fine sandy loam and Norfolk sand are included with this soil type as mapped.

All the Norfolk fine sand in Harris County is forested, the principal growth consisting of short-leaf pine, post oak, blackjack oak, and other oaks. On cut-over areas a dense growth of scrubby oak comes up in some places.

Areas of Norfolk fine sand vary from gently undulating to rolling and hillocky. This soil frequently occurs on tops of small hills. This soil is confined entirely to the northern part of the county, the principal areas being along Spring Creek. None of this soil is in cultivation and the land is valued at $20 or more an acre, depending on the quantity and quality of the forest growth.

Small areas of Norfolk sand are included, the surface soil being a gray or brownish-gray sand, underlain at 4 or 6 inches by pale-yellow, loose, medium sand, which continues to a depth of 3 feet or more. In places the lower subsoil is slightly heavier in texture and decidedly gray in color, and in other places it approaches a clay loam and has a few faint mottlings of gray, yellow, and brown. The percentage of organic matter is very low, and the soil is noncalcareous to a depth of 6 feet or more. Iron concretions in the subsoil are not common.

CADDO FINE SANDY LOAM

Caddo fine sandy loam topsoil consists of grayish-brown or brownish-gray loamy fine sand or fine sandy loam, underlain at a depth of 4 or 6 inches by pale-yellow or grayish-yellow fine sand or loamy fine sand, which at a depth of 12 or 18 inches, grades into mottled gray and yellow friable fine sandy clay loam material. At a depth of about 24 inches occurs gray or grayish-yellow gritty clay mottled with yellow and some red, and containing enough fine sand to render it fairly friable. A few scattered iron concretions are present in the subsoil and in a few locations they are apparent at the surface. The soil is noncalcareous in the topsoil, subsoil, and substratum. Variations in the surface soil show a fine sandy loam which may grade into the sandy clay subsoil at depths of 15 or 18 inches. Some parts of the lower subsoil are slightly plastic and may have a little bluish-gray mottling.

Caddo fine sandy loam is similar to Norfolk fine sand, having the same grayish surface soil, yellowish subsurface and subsoil, and being friable throughout, the chief difference lying in the contrast between the highly mottled subsoil of Caddo fine sandy loam and the almost solid yellow subsoil of Norfolk fine sand. Low sandy dome-shaped mounds occur in many places.

Areas of Caddo fine sandy loam are flat or gently undulating. This type of soil is of small extent, occurring in the extreme northern part of the county. It is typically a forested soil, but there are some inextensive treeless areas. Cleared areas are usually utilized for pasture but if cultivated, they are given the same treatment and are planted with the same crops as on the surrounding Hockley fine sandy loam, rolling phase. On the forested areas shortleaf pine, post oak, willow oak, sweet gum, and elm abound and in some localities French mulberry and blackberry briers are abundant.

The selling price of land of this kind ranges from a few dollars to $30 an acre.

Mapped areas of Caddo fine sandy loam include small patches of Caddo clay loam, Norfolk fine sandy loam, Norfolk very fine sandy loam, Lufkin very fine sandy loam, Orangeburg fine sandy loam, and some Susquehanna fine sandy loam.

KALMIA SAND

Kalmia sand is a grayish-brown or gray loose medium sand, from 6 to 12 inches deep, underlain by loose yellow or pale-yellow sand. The topsoil and subsoil are noncalcareous, and no iron concretions are present.

Mapped areas of this type of soil include patches of Kalmia fine sand and fine sandy loam, and Ochlockonee fine sandy loam, fine sand, and sand, all these soils being in close association.

Kalmia sand is a terrace soil of small extent occurring mainly on the terraces of San Jacinto River, on small mounds or knolls surrounded by overflow land, as well as on large flat areas. The surface varies from nearly level to undulating and hillocky, and the drainage is good. The forest growth consists principally of shortleaf pine, oak, ash, and elm. Land values are low, and none of the land is in cultivation.

KALMIA FINE SANDY LOAM

Kalmia fine sandy loam is a brownish-gray or grayish-brown fine sandy loam, underlain at a depth of about 6 inches by yellowish or pale-yellow loamy fine sand which, at a depth of 15 or 18 inches, grades into friable yellow or pale-yellow, fine sandy clay loam material. The surface soil in some places approaches fine sand which becomes loamy a few inches below the surface. In some locations, where the surface is slightly depressed and where water stands for some time after hard rains, the color of the surface soil may be more nearly gray with yellowish mottling. The subsoil in such areas is usually mottled with gray, brown, and yellow, and may be rather plastic. The sandy mounds common to the prairie soils very seldom occur on this soil. No evidence of lime carbonate is present either in the surface soil or subsoil, and iron concretions are not present.

Kalmia fine sandy loam is similar to Norfolk soils except that it is a terrace soil and usually has a lighter-textured subsoil. It occurs chiefly on terraces along San Jacinto River in the northern and eastern parts of the county, occurring in small scattered areas and in long irregular strips parallel to the river. It is so closely similar to the Ochlockonee soils of the first bottoms of this river that in many

places the boundary lines must be drawn arbitrarily. Kalmia fine sandy loam occurs on many small islandlike mounds within areas of Ochlockonee soils, and as mapped it includes small areas of Ochlockonee fine sandy loam, Ochlockonee fine sand, and Ochlockonee sand, as well as of Kalmia fine sand and Kalmia sand.

This land constitutes a considerable part of the river terraces. It is a forested soil and none of it is tilled. The forest growth consists mainly of pine, oak, elm, and sweet gum, with a dense growth of underbrush, such as French mulberry, blackberry briers, and other vegetation.

Areas of this soil vary from flat to gently undulating, and drainage is usually good. At long intervals some of the lower-lying areas are inundated for short periods, but as this is not a common occurrence the soil in such areas has not been materially affected by such overflows.

Land values here are extremely low.

Mapped areas of Kalmia fine sandy loam include small patches of Kalmia clay loam, which consist of grayish-brown or brownish-gray clay loam, underlain at a depth of 6 or 8 inches by grayish-brown or grayish-yellow clay loam, and at a depth of about 18 inches by sandy friable clay, usually grayish yellow in color and mottled faintly with light gray. In places in the northern part of the county the clay loam material continues below a depth of 3 feet, and in these locations the color of the subsoil is usually pale yellow, with little or no mottling.

SUSQUEHANNA FINE SANDY LOAM

The surface soil of Susquehanna fine sandy loam is a grayish-brown or light brownish gray very fine sandy loam about 7 inches deep, grading downward into a very light gray or pale-yellow very fine sandy loam, usually mottled with pale yellowish brown and underlain at a depth of about 15 inches by a light-yellow clay loam material mottled with yellowish brown and dark gray. This is underlain, at depths ranging from 12 to 24 inches, by a stiff, plastic clay mottled with red, yellow, brown, and gray, in which either red or yellow may dominate. Iron concretions occur, but no evidences of lime are present. This soil contains little organic matter.

This is a forested soil, not extensive in Harris County, and none of it is in cultivation. It occurs in the northern part of the county along Spring Creek and San Jacinto River. Some areas are along Cypress Creek in the vicinity of Westfield.

Areas of Susquehanna fine sandy loam are flat, gently undulating, or sloping. The more steeply sloping areas have been eroded and gullied to some extent, but the drainage on the level areas is poor. Low sandy mounds similar to those on the prairie soils occur in areas of this soil, but they are not so numerous as on the latter soils. Mapped areas of Susquehanna fine sandy loam include patches of Susquehanna clay loam and Susquehanna very fine sandy loam, besides some Orangeburg fine sandy loam.

The forest growth on this type of soil is similar to that on Susquehanna clay loam, consisting chiefly of pine, oak, elm, ash, and hickory. Land values are also about the same.

SUSQUEHANNA CLAY LOAM

Susquehanna clay loam is a grayish-brown or brownish-gray clay loam, about 6 or 8 inches deep, underlain by brownish-gray loam or clay usually faintly mottled with yellow. At a depth of about 16 inches this grades into mottled bluish-gray, yellow, and red clay, and at a depth of about 24 inches, into a stiff plastic clay mottled with red, yellow, and bluish gray. The redness in the subsoil varies in different locations, red usually predominating above 2 feet, and yellow or gray below this depth. Some red may appear in the surface soil, although seldom above 15 inches. The subsoil is usually very plastic, and may contain iron concretions. Susquehanna clay loam is noncalcareous, and no evidence of lime in the substratum appears to a depth of 5 or 6 feet, as shown in road cuts. The topsoil, especially in the virgin areas, contains a fairly high percentage of organic matter.

This soil occurs in the northern part of the county, principally along Spring Creek. It is a forested soil and none of it is cultivated. The tree growth consists mainly of shortleaf pine, oak, and sweet gum. French mulberry bushes and blackberry briers are abundant.

The surface of this land varies from flat to gently undulating, and where it borders streams it may be rather steeply sloping. Drainage is deficient on the flat areas but good on the sloping locations and some of the steeper slopes are considerably eroded.

Land values range from $10 to $25 or more an acre, depending on location and timber.

LUFKIN CLAY LOAM

The surface soil of Lufkin clay loam is a light gray or mottled white and gray clay loam, in many places faintly mottled with pale yellow about 8 inches deep. This grades with depth into an ashy-gray clay with yellow mottling, and at a depth of about 20 inches into a stiff ashy-gray clay which usually shows similar mottlings. Iron concretions are not present as a rule and no sign of lime carbonate appears. Some dome-shaped mounds of a sandy nature, similar to those on the prairie soils, may occur. In variation the surface soil may be ashy-gray clay loam mottled with some white, and underlain at depths varying from 12 to 30 inches by pale-yellow clay less tough than typical ashy-gray clay. The surface soil in some locations is brownish gray with light-gray mottlings, and the lower subsoil contains some mottlings of yellow, red, and bluish gray.

Lufkin clay loam, as shown on the accompanying soil map, includes small areas of Lufkin very fine sandy loam and some of the lower-lying Norfolk soils. Where this soil occurs adjacent to areas of Acadia very fine sandy loam, as in the northern part of the county north of San Jacinto River, it is difficult to differentiate between the two. Much of the soil here was classed in the Acadia series, although it usually has the characteristics of the Lufkin soils. Areas of Lufkin clay loam are usually flat and the drainage poor.

This soil is of small extent, occurring in the northern part of the county mainly along Spring Creek, and along Cypress Creek near Westfield. It is a forested soil, none of it being under cultivation.

The main tree growth consists of shortleaf pine, sweet gum, water oak, willow oak, post oak, and elm.

Land values range from $5 to $25 or more an acre, depending on the quantity and quality of available timber and the proximity to good roads and towns.

Some patches of Lufkin very fine sandy loam are included in mapped areas of the clay loam, consisting of grayish-brown or gray very fine sandy loam, 4 or 6 inches deep, underlain by light-gray or grayish-brown very fine sandy loam or loamy very fine sand. At a depth of about 16 or 18 inches this grades into a light bluish-gray very fine sandy clay loam material which may have some faint yellowish mottlings. In some localities the subsoil is an ashy-gray clay, with or without faint mottlings of yellow or white and in other places it is a yellowish very fine sandy loam or clay loam material. Both topsoil and subsoil are noncalcareous and free from iron concretions. Some sandy, dome-shaped mounds are on this land.

TRINITY CLAY

The surface soil of Trinity clay to a depth of 4 or 6 inches is a dark-brown or nearly black clay grading downward into a calcareous brown clay. The subsoil, occurring at a depth varying from 18 to 24 inches, is a stiff plastic dark-brown or black clay, usually calcareous. Some sandy layers or pockets are present in the subsoil, and in some locations the surface is calcareous and the dark-brown or black color may continue to depths below 3 feet. In other places the topsoil is a brown clay about 6 inches deep, underlain by a brownish-yellow, very plastic calcareous clay, which, at a depth of about 24 inches, takes on a more yellowish appearance. The latter areas are somewhat similar to Catalpa clay.

Trinity clay is a first-bottom soil subject to overflow, and usually lying somewhat lower than the Ochlockonee soils. In Harris County it occurs along streams in the southeastern part especially along San Jacinto River. Mapped areas include patches of the heavier Ochlockonee soils and some lighter Ochlockonee soils which occur on small mounds or ridges.

None of this type of soil is under the plow, and unless protected from overflow by levees, it will continue to be of very low agricultural value. It is forested with ash, sweet gum, elm, water oak, red haw, and hackberry.

OCHLOCKONEE SAND

The surface soil of Ochlockonee sand may be brown, yellowish-brown, or grayish-brown loose medium sand, usually carrying considerable fine sand, although the material contains a higher percentage of medium and coarse sand than Ochlockonee fine sand, to which it is very similar. It is underlain at a depth of 5 or 8 inches by a pale-yellow or pale yellowish-brown incoherent sand which in many places contains considerable fine sand, and usually grades into a pale brownish-yellow coarse sand at a depth of 24 or 30 inches. Both topsoil and subsoil are noncalcareous.

This is a first-bottom soil subject to overflow, and in places is so closely associated with the Kalmia terrace soils that separation is difficult. Mapped areas of Ochlockonee sand include patches of

Kalmia sand, Kalmia fine sand, and Kalmia fine sandy loam, Ochlockonee fine sand, and Ochlockonee fine sandy loam. In some localities there are small depressions, representing the heavier soils of the Ochlockonee series, where water stands for some time after hard rains.

This soil is very low in organic matter, has little agricultural value, and is not in cultivation. Most of this sol is forested with the same growth as that on Ochlockonee fine sand. Swamp palmetto abounds in some localities.

OCHLOCKONEE FINE SAND

Ochlockonee fine sand to a depth of about 6 inches is brown fine sand, loamy in places and grading downward into yellowish-brown fine sand and below this into pale-yellow loose fine sand to a depth of 3 feet or more. The surface may be either a rich-brown or nearly gray fine sand, and the subsoil in places is a light-brown fine sand. Both topsoil and subsoil are noncalcareous, and no iron concretions are present.

This is a first-bottom soil subject to frequent overflow. It occurs along the larger streams of the county, the most extensive areas being in the eastern part along San Jacinto River. It is rather extensive in this location, but on account of its position is of very low agricultural value. This soil contains little organic matter.

This land varies from nearly flat to uneven with small mounds and low ridges. Drainage is usually good except during periods of inundation. Some areas occur as old sand bars formed on the inner side of sharp bends in the river.

Included with Ochlockonee fine sand as mapped are patches of sand and fine sandy loam of the Ochlockonee series and sand, fine sand, and fine sandy loam of the Kalmia series. Some areas resemble Bienville fine sand.

None of the Ochlockonee fine sand is farmed. Most of it supports a forest growth consisting of elm, bay, French mulberry, water oak, sweet gum, silver bell, shortleaf pine, ash, and cypress, with an undergrowth of grapevines, and yaupon.

OCHLOCKONEE FINE SANDY LOAM

Ochlockonee fine sandy loam varies from a brown to dark-brown or grayish brown fine sandy loam 6 inches deep, which grades into brown clay loam with faint mottlings of rusty brown or yellowish brown. At a depth of about 18 inches the material is bluish-gray or ashy-gray stiff plastic clay with some mottlings of rusty brown and pale yellow. In places there is a 3-inch or 4-inch layer of grayish-brown fine sand at the surface and on some areas the fine sandy loam material continues below a depth of 3 feet. In some locations the subsoil may be of lighter texture than the surface soil, and in others the heavy clay subsoil is encountered at a depth of 12 or 15 inches. This type of soil is noncalcareous both in the surface soil and subsoil.

Ochlockonee fine sandy loam is a first-bottom soil, subject to frequent overflow, and occurs along all the larger streams of the county but more especially along San Jacinto River. It includes many mounds and narrow ridges of sandy material as well as small depres-

sions where the surface soil is a clay loam or clay. On account of their close association many small areas of clay loam, fine sand, and sand of the Ochlockonee series, with some fine sandy loam, fine sand, and sand of the Kalmia series, are included with Ochlockonee fine sandy loam as mapped in the county.

The surface of the soil is flat, or may be uneven where mounds and ridges occur. The drainage is fairly good when the soil is not inundated, but water stands in some of the depressions where the soil is heavier for some time after hard rains.

This is an inextensive forested soil of low agricultural value, and none of it is farmed. The forest growth consists of sweet gum, elm, ironwood, magnolia, bay, pine, oak, rattan, silver bell, basswood, hackberry, ash, and pecan. Where the soil is slightly heavier swamp palmetto is abundant.

OCHLOCKONEE CLAY

Ochlockonee clay is a brown silty clay with faint rusty-brown mottling, grading into lighter-brown silty clay with some bluish-gray mottling, the bluish-gray increasing with depth and dominating the color of the lower subsoil except for some yellowish-brown mottlings. In places the soil is a mottled rusty-brown, bluish-brown, and gray silty clay, grading into mottled yellowish-brown and bluish-gray silty clay, the latter color increasing with depth. The subsoil is very stiff, closely resembling Bibb clay subsoil. Mapped areas of this soil include some Ochlockonee fine sandy loam, silty clay loam, sandy clay loam, and mounds covered with a few inches of freshly deposited yellowish sand. Neither the surface soil nor subsoil is calcareous.

This is first-bottom land which is subject to frequent overflow, and occurs along many of the streams of the county, but chiefly along San Jacinto River and Spring Creek.

Areas of Ochlockonee clay are flat or hummocky and the drainage is usually very poor.

None of this soil is in cultivation, practically all of it being covered by a forest growth of sweet gum, water oak, cypress, pecan, ash, hackberry, elm, and iron wood. Swamp palmetto, grapevines, and trumpet vines abound in some areas. Land values are very low.

Some areas of Ochlockonee clay loam are included which consist of brown, dark-brown, or grayish-brown clay loam or heavy clay loam, underlain at about 6 inches by brown or light-brown clay loam usually mottled with yellowish brown or grayish brown. With increased depth the subsoil assumes a bluish-gray color, which is predominant in the lower part. The clay loam may continue to depths below 3 feet, but usually at a depth of about 18 inches a stiff compact clay is encountered, being brown or bluish gray in color and mottled with rusty brown, in a few places with a little red and yellow. The subsoil may show little evidence of stratification, poorly defined layers of grayish or brownish sandy material alternating with layers of stiff clay or clay loam. The soil is noncalcareous.

HARRIS FINE SAND

The surface soil of Harris fine sand is grayish-brown or dark-brown fine sand, about 10 inches deep, underlain by pale-yellow, pale brownish-yellow or brownish-gray fine sand or loamy fine sand.

In places the surface soil is a fine sand and in other places it has a loamy texture. Some patches of Harris very fine sand are included in mapped areas of Harris fine sand.

Like Harris clay this soil is little more than a semideveloped soil, having a rather marshy nature in places. It lies between areas of tidal marsh and the higher prairie soils and is slightly better drained and has less salt than the tidal-marsh lands, but is subject to overflow by salt water from the Gulf in times of high-wind tide.

Areas of this soil are flat and the drainage is poor. The total area in Harris County is small and none of the land is in cultivation. The principal native vegetation consists of carpet grass, Bermuda grass, bulrush, wild coffee bean (senna), and some grasses suited to saline conditions. A few scattered trees of pecan, sycamore, hackberry, prickly ash, yaupon, and live oak occur and on some of the more sandy areas, as at Lynchburg, some pine and sweet gum grow.

HARRIS CLAY

Harris clay is a dark bluish-gray, dark-brown or black clay 6 or 8 inches deep showing a few mottlings of yellowish brown, bluish gray or rust brown. Below this depth and continuing to a depth of more than 3 feet the subsoil is a plastic and sticky dark bluish-gray clay, slightly mottled with yellowish brown. The subsoil is usually slightly lighter colored than the surface soil, and some pockets or thin layers of fine sand may be encountered in it.

Harris clay is a semideveloped soil representing the more or less marshy soils on the higher outer area of tidal marshes. Although the drainage is better than that of the tidal marshes, areas of Harris clay are subject to overflow by salt water from the Gulf in times of high-wind tides. Mapped areas include small areas of tidal marsh too small to be mapped separately.

Harris clay is of small extent, occurring chiefly along the Gulf and in a few small areas in the vicinity of San Jacinto battle field, along Buffalo Bayou, and San Jacinto River.

None of this soil is in cultivation. The principal native growth consists of marsh sedges and salt-loving thick-leafed plants and in places some large bulrushes and clumps of wild coffee bean.

TIDAL MARSH

Tidal marsh includes soils that are in the process of development, these being the lowest-lying and youngest soils in the county. Here the land consists chiefly of sediments which have been washed from the uplands and deposited along the edges of sounds, bays, and at the mouth of streams. The material consists largely of silt and clay of a dark bluish-black or ashy-gray color and contains considerable salt and is rich in organic matter. This soil is of small extent, occurring usually in narrow strips, and has little or no agricultural value. Large, coarse bulrushes of heavy growth comprise the native vegetation.

MADE LAND

Made land, as its name signifies, includes filled-in areas. Here the character of the material is determined chiefly by its original loca-

tion and the depth from which it was taken. It is a mixture of surface soil, subsoil, and some material from the deep substrata. Made land occurs mainly along the Houston Ship Channel, where the material was removed by dredges. It is of small extent and none of it is under cultivation. Vegetation, where it occurs, consists largely of weeds and grasses.

SUMMARY

Harris County is in southeastern Texas, the southernmost point being about 30 miles north of Galveston. The county is irregular in shape, being roughly about 50 miles east and west by about 35 miles north and south. The area of the county is 1,765 square miles, or 1,129,600 acres.

Most of the county lies in the coastal prairie subdivision of the coastal plains, but a narrow strip along the northern edge is in the interior flatwoods subdivision.

The greater part of the county is flat or gently undulating, though the northern part is gently rolling or hilly. The general slope is toward the southeast, principally toward San Jacinto River, which flows through the eastern part of the county in a southerly direction, and which with its tributaries carries most of the drainage water of the county. The altitude of the greater part of the county varies from 15 to 200 feet above sea level, with some of the bottomland soils occurring practically at sea level, although in the northwestern part of the county an elevation of around 300 feet is attained.

In 1920 the population of Harris County was 186,667, of which 44,311 were classed as rural. There were 16,514 people of foreign birth and 42,734 negroes. Houston, the county seat, is the largest city, with a population of 138,276 in 1920. Numerous small towns are located throughout the county, practically all of which are connected with Houston by good surfaced roads and with Houston and points in other parts of the State by the numerous railways which center at Houston. Houston has been made a seaport by the ship channel which connects it with Galveston Bay and the Gulf of Mexico.

Most of the county is reached by rural mail service. Telephones are in general use and good schools and churches are numerous in the rural districts as well as in the towns.

The climate is mild, but in winter is subject to sudden changes. The mean annual temperature as recorded at Houston is 68.9° F., the average annual rainfall 46.22 inches, and the average growing season 281 days.

Agriculture of Harris County consists chiefly of general farming, the principal crops being cotton, corn, rice, oats, hay, peanuts, sorgo for feed and sirup, with vegetables and small fruits for market and home use. Cotton bought in Harris County is shipped to various parts of the world. The production of beef cattle is an important branch of the livestock industry in some parts of the county and many farmers feed a few cattle in connection with general farming. A great deal of the livestock raised on the ranges of the county is shipped elsewhere to be put into a finished condition. Dairying is carried on to a considerable extent. There are many purebred herds in the county. Goats, sheep, and hogs are raised to some extent on many farms.

Systematic crop rotations are practiced by a few farmers. Large quantities of commercial fertilizers are used in some parts of the county, but very little green manure is plowed under, and no method of soil improvement is in general use. The number of farm laborers is usually adequate.

The census of 1920 reported 2,880 farms in the county with an average of 131.7 acres in each. Farms comprise 35.8 per cent of all land in the county, and a little over half of this is improved. The price of farm land at the time of the survey ranged from less than $20 to $150 or more an acre.

The soil map of Harris County shows four belts, each characterized by different kinds of soils: A southern belt of rather poorly drained soils which have developed under a grass cover, as the Lake Charles soils; a west-central treeless belt in which occur Katy soils, principally Katy fine sandy loam; a northwestern grass-covered belt in which the Hockley soils are dominant; and a fourth area in which the Acadia, Norfolk, Orangeburg, Caddo, and Susquehanna soils are predominant.

Soils of the Lake Charles, Morse, Acadia, and possibly the Edna series are developed on Beaumont clays, whereas Katy, Hockley, and possibly Edna soils occur over Lissie gravel. The soils developed from the sands and clays, along the northern boundary of the county are classed as Norfolk, Susquehanna, Caddo, Orangeburg, and Lufkin soils. Ochlockonee and Trinity soils occur on recent-alluvial deposits along the streams, and on the older stream deposits on the valley terraces have developed the Kalmia soils. Along the edges of bays and gulfs, where soil material is in the process of deposition and where it is subject to tidal or salt water overflow, Harris soils and tidal marsh soils occur. Soil material that has been placed in its present position by man, that is, formed by dredging and excavating, and which is usually a mixture of materials from different localities, is classed as made land.

Lake Charles clay is the most extensive and important soil in the county. It is especially adapted to the growing of rice, corn, and cotton. Rice also does well on Katy soils. Hockley fine sandy loam, rolling phase, is well adapted to corn, cotton, peanuts, and especially to vegetables and small fruits.

Practically all soils of the county, more especially the sandy soils of the northwestern half, would be greatly improved by growing cowpeas, peanuts, or other leguminous crops, and by plowing under the vines and all crop residues. The prairie soils, with the exception of the rolling phase of Hockley fine sandy loam, would be greatly benefited by an adequate drainage system. Drainage is the first and most important step toward the improvement of agricultural conditions in Harris County.

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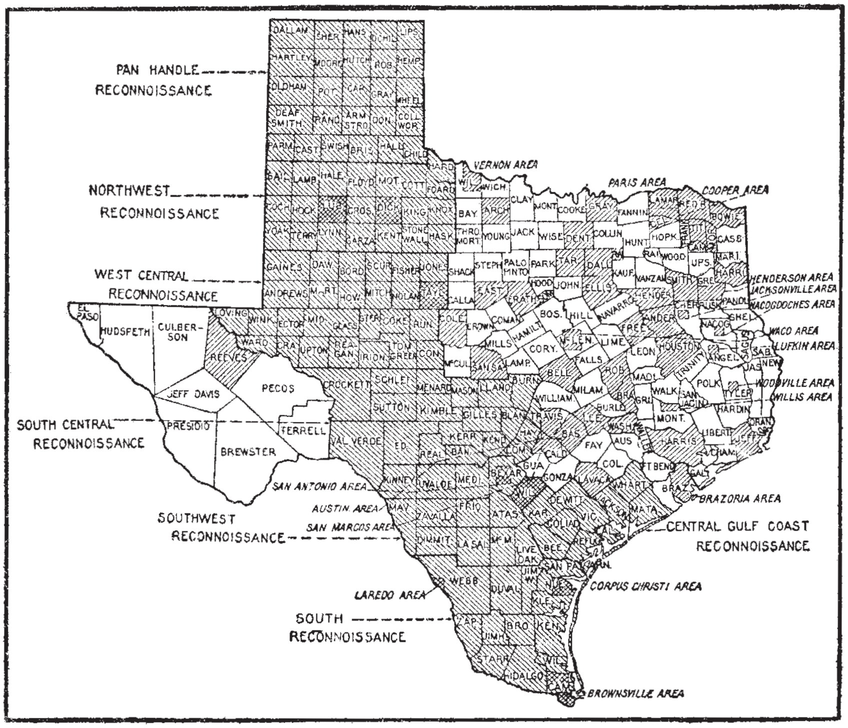

Areas surveyed in Texas, shown by shading

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