

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

IN COOPERATION WITH THE TEXAS AGRICULTURAL EXPERIMENT STATION.

SOIL SURVEY OF DALLAS COUNTY,
TEXAS.

BY

WILLIAM T. CARTER, JR., IN CHARGE, AND A. H. BAUER, OF THE
U. S. DEPARTMENT OF AGRICULTURE, AND J. F. STROUD, W. B.
FRANCIS, AND T. M. BUSHNELL, OF THE TEXAS
AGRICULTURAL EXPERIMENT STATION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1920.]



WASHINGTON :
GOVERNMENT PRINTING OFFICE.
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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.]

CONTENTS.

	Page.
Description of the area.....	1213
Climate	1216
Agriculture	1217
Soils	1223
Houston black clay.....	1227
Houston clay.....	1229
Chalk (Houston material).....	1232
Ellis clay.....	1232
Bell clay	1234
Lewisville clay.....	1236
Cahaba fine sand.....	1239
Cahaba fine sandy loam.....	1240
Leaf gravelly sandy loam.....	1242
Leaf fine sandy loam.....	1243
Amite fine sandy loam.....	1244
Kalmia fine sand.....	1244
Irving fine sandy loam.....	1245
Irving silt loam.....	1245
Irving clay	1246
Trinity clay	1248
Catalpa clay	1250
Frio loam	1250
Frio clay.....	1251
Ochlockonee clay loam.....	1252
Gravel pits	1252
Summary	1252

ILLUSTRATIONS.

PLATES.

	Page.
PLATE XX. Fig. 1.—Levee along the Trinity River to protect the bottom land (Trinity clay) from overflow. Fig. 2.—Farm home on the Houston black clay.....	1224
XXI. Fig. 1.—Cotton on Houston black clay. Fig. 2.—Cotton and corn on Bell clay.....	1240

FIGURE.

Fig. 36. Sketch map showing location of the Dallas County area, Texas	1213
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MAP.

Soil map, Dallas County sheet, Texas.

SOIL SURVEY OF DALLAS COUNTY, TEXAS.

By WILLIAM T. CARTER, Jr., in Charge, and A. H. BAUER, of the United States Department of Agriculture, and J. F. STROUD, W. B. FRANCIS, and T. M. BUSHNELL, of the Texas Agricultural Experiment Station.

DESCRIPTION OF THE AREA.

Dallas County is situated in the northeastern part of Texas. It lies about 140 miles west of the Louisiana State line, and two counties lie between it and the Oklahoma State line, which is about 70 miles to the north. The county, which is almost square, has a length and width of about 30 miles and an area of about 890 square miles, or 569,600 acres.

Physiographically Dallas County is a plain dissected by numerous streams that have cut shallow and in many places broad valleys. Over the greater part of the county the topography is gently rolling. A belt of rough and rather steeply sloping land, a mile wide in places, occurs in the southwestern part of the county. This is a part of the White Rock cuesta, which extends through the State from the Red River southward to Austin. It consists of outcrops and steep ledges of white chalk leading down to eroded broken slopes and hilly areas adjacent to the Mountain Creek bottom lands. It is bounded on its western side by an escarpment which faces westward and is about 300 feet higher than the low lands to the west. It reaches from near the southwest corner of the county northward with a slight trend to the east, to near Eagle Ford, where it turns eastward and extends parallel to the West Fork bottom lands to Dallas, a part of Oak Cliff, a suburb of Dallas, being on this escarpment. Here the escarpment is cut through by the Trinity River. North of Dallas it extends from near Love Field due north to the county line, but this part of it has lost its blufflike character and is marked by a gentle westward slope of 50 to 100 feet drop, merging with the level areas below.

Wide bottom lands occur along the Trinity River and its West, Elm, and East Forks, and along the larger creeks of the county. The bottom lands of some of the latter are bordered by steep slopes 100 feet or more high, but many of the river bottoms abut on terraces

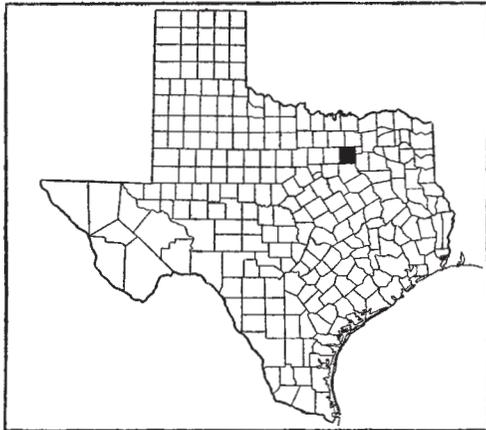


FIG. 36.—Sketch map showing location of the Dallas County area, Texas.

(second or third bottoms) only 10 to 40 feet higher than the present flood plains.

The greater part of the county is a broad rolling prairie cut by many small stream valleys and a few large ones. There are many good-sized level areas in various parts of the county. Some of the largest of these occur around Irving, Grand Prairie, Florence Hill, New Hope, Cheisa, and Seagoville. Probably 90 per cent of the county is topographically well suited to cultivation, permitting the use of any type of farm implement.

The elevation of the county ranges from about 350 feet above sea level in the Trinity River bottom near the southeastern corner to 820 feet at Cedar Hill in the southwestern part of the county. The greater part of the county lies between 400 and 600 feet above sea level. The elevation at Dallas is about 500 feet, at Lancaster 512 feet, at Garland 551 feet, at Coppell 516 feet, and at Grand Prairie 528 feet. The general slope of the county is toward the southeast.

All of the county is drained by the Trinity River. The Elm Fork of the Trinity enters the county near the northwest corner, flows in a southeasterly direction for 8 or 10 miles, and joins the West Fork, which enters the county from the west. The Trinity River, formed by the confluence of these forks near Dallas, flows in a southeasterly direction and leaves the county at the southeast corner. The stream channel is 100 to 200 feet wide between steep banks 15 to 25 feet high. The flow is sluggish and the water is shallow except after heavy rains. The level first bottom is from one-half mile to 4 miles wide. The principal tributaries of the Trinity River are the East Fork Trinity River, White Rock Creek, Mountain Creek, Fivemile Creek, and Tenmile Creek. The larger creeks that drain into the East Fork are Muddy, Duck, and Mesquite Creeks. These creeks are sluggish, winding streams, which are almost dry during long periods of dry weather. Practically all of the smaller streams in the county are dry except after rains. Many of the smaller streams have no main channels through the larger bottom lands of the main streams, but spread into a number of poorly formed shallow channels and low places.

All parts of the county are reached by creeks or small branches, and the drainage is adequate over the greater part of the uplands, though on some level areas water stands after rains. On many of the valley slopes the run-off is rapid enough to cause erosion. The bottom lands are subject to overflow, except where protected by levees.

The supply of drinking water is adequate over all parts of the county. Artesian wells supply good water from depths of about 2,500 feet. Artesian water is obtained in wells not nearly so deep, but the water is not so good. Shallow dug wells furnish good water, though in dry seasons the wells on the high prairies sometimes fail. Dug wells on the old stream terraces usually furnish good water throughout the year.

Dallas County was formed in 1846. Originally the territory now comprising the county was under the jurisdiction of Nacogdoches County. The first settlers came about 1841 from Kentucky, Tennessee, and Wisconsin. Later some French, Belgian, and Swiss settled in the county, but most of the population of the county during

the period of its early development was composed of settlers from the older Southern States. There is not a very large colored population in the rural districts.

According to the 1920 census the population of Dallas County is 210,551. This is an increase of 74,803 over the figures for 1910. Much of the increase in population was in the city of Dallas, which in 1920 had 158,976 inhabitants. The population classed as rural is 51,575, or a little less than 25 per cent of the total. Ten years earlier the rural population was 32.2 per cent of the total. Much of the rural population lives in small towns throughout the county. Nearly all parts of the county are thickly settled with a farming population, but very few people live in the broad bottoms of the larger streams. Outside of Dallas and vicinity, the main industry of the county is agriculture. Dallas is one of the largest and most important cities of the State. The more important small towns of the county are Grand Prairie, Garland, Mesquite, Lancaster, Irving, Carrollton, Hutchins, Richardson, and Seagoville.

In and around Dallas there are a number of manufacturing plants turning out a variety of products. Dallas is an important railroad town and is a wholesale center for a large territory in Texas and surrounding States. Many large firms dealing in farm machinery and other goods use Dallas as a distributing center for the Southwest.

Transportation facilities are excellent throughout the county. Steam and electric railroads radiate from Dallas in many directions, and no farm in the county is more than 6 or 8 miles from a railroad shipping point.

The Trinity River is not used for navigation at present, and at some seasons the water is not deep enough for large boats. For some years the Government has been working on a project to make the stream navigable to the Gulf by constructing a system of locks and dams.

Dallas County has many good roads. Some of these are macadamized roads with asphalt surface, some are concrete, and many are of gravel. The majority of the roads, however, are earth roads, which, where they traverse the sticky black clay soils, become impassable for automobiles after heavy rains, and if wet conditions are long continued for any sort of vehicle. Dallas County recently voted bonds of more than \$6,000,000 for road building.

All parts of the county are reached by rural mail delivery routes and telephone lines. Good schools and churches are located in all sections.

Dallas is the principal market of the county, and all the markets of the United States are available by reason of the numerous railroads which pass through the county.

Although the soils of the county constitute its most valuable resource, there are several other natural resources of great value. One of these consists of the deposits of sand and gravel which are abundant in many parts of the county. The gravel deposits are extensive and there are many pits from which gravel and sand are taken for use in construction work of many kinds and for road building. Two large cement factories operate near Dallas, the cement being made from limestone and shale which outcrop along

the White Rock Escarpment. The limestone (Austin chalk) also makes a good quality of lime, and some is manufactured in kilns at Dallas.

Large deposits of clays in Dallas County are suitable for brick making, and brick is manufactured in plants near Dallas, near Mesquite, and near the southern county line just north of Ferris in Ellis County.

Flour mills are located at Dallas and in several of the smaller towns. A number of cottonseed-oil mills and many cotton gins are scattered through the county.

CLIMATE.

Dallas County has a warm, temperate climate. The summers are long, with rather high temperature during the most of the time. The winters are short and mild. Periods of cold weather occur with the advent of sudden cold winds from the north, locally called "northers." These cold spells last only a few days but as the early stages are often preceded or accompanied by rains, the chilly, damp weather is very unpleasant. Periods of several days of pleasant weather follow the "northers" and cold snaps. Freezing weather is not unusual, but is of short duration. Occasionally light snows fall, but do not remain long on the ground.

The mean temperature for the winter is 46.3° F., for the spring 64.7° F., for the summer 82.7° F., and for the fall 66.1° F. The mean annual temperature is 64.9° F. The lowest recorded temperature is -10° F. and the highest is 115° F.; but these extreme temperatures are seldom even closely approached. The average date of the last killing frost in the spring is March 19, and of the first in fall, November 11, giving an average growing season of 237 days. The date of the latest killing frost in spring is April 25, and of the earliest in fall, October 22.

The county lies within the humid region, the mean annual precipitation being 38.04 inches. This is fairly well distributed through the growing season, the mean for spring being 11.68 inches, and for summer 10.25 inches. The total amount of rainfall for the driest year (1909) shown by the records was 17.98 inches, while that for the wettest year (1888) was 59.53 inches.

Although the rainfall is usually ample for growing crops, there are times when droughty conditions last for a sufficient length of time to cause crops to suffer. Short dry spells in early summer frequently cause crops, especially corn, to suffer. By plowing deep in order to permit a maximum storage of water in the soil, and by frequent shallow cultivation of the soil when crops are growing, the evil effect of these occasional short periods of dry weather is usually largely overcome. The heavy soils of the county are likely to dry out and crack badly in fields unless cultivated frequently to a depth of 2 or 3 inches to insure a top layer of friable soil. Fortunately, most of the heavy soils lend themselves to this practice, as they contain sufficient lime to make the surface soil break down readily into a light friable mass. The sandy soils with clay subsoils hold soil water well, and the loose surface soil retards evaporation from the lower soil mass.

Hailstorms sometimes occur in the summer and damage or destroy crops in local areas. Property loss from winds or electric storms is comparatively rare.

The table below, compiled from the records of the Weather Bureau station at Dallas, gives the normal monthly, seasonal, and annual temperature and precipitation. These records cover a period of 26 years.

*Normal monthly, seasonal, and annual temperature and precipitation at Dallas.*¹

[Elevation, 512 feet.]

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1909).	Total amount for the wettest year (1888).	Snow, average depth.
	° F.	° F.	° F.	Inches.	Inches.	Inches.	Inches.
December.....	46.9	85	8	2.72	2.58	4.27	0.5
January.....	45.1	95	2	2.59	.33	1.69	1.2
February.....	47.1	89	-10	2.69	1.35	4.92	1.1
Winter.....	46.3	95	-10	8.00	4.26	10.88	2.8
March.....	56.4	98	16	3.59	1.22	4.06	T.
April.....	64.8	98	30	3.98	1.01	7.20	.....
May.....	72.9	103	36	4.11	1.05	5.17	.....
Spring.....	64.7	103	16	11.68	3.28	16.43	.....
June.....	80.7	108	48	3.94	4.41	10.16	.....
July.....	84.0	108	57	3.30	T.	1.54	.....
August.....	83.6	115	52	3.01	1.58	13.67	.....
Summer.....	82.7	115	48	10.25	5.99	25.37	.....
September.....	77.5	107	40	2.87	.32	2.01	.....
October.....	66.0	100	26	2.46	2.22	.50	.....
November.....	54.8	92	15	2.78	1.91	4.34	.1
Fall.....	66.1	107	15	8.11	4.45	6.85	.1
Year.....	64.9	115	-10	38.04	17.98	59.53	2.9

¹ According to the meteorologist at the Dallas Weather Bureau station, the extremes of temperature, -10° and 115°, are not exactly comparable with present observations, as these temperatures were taken when the station was a volunteer station. The instruments were kept close to the ground, and sheltered by buildings. Radiation from walls caused the recorded temperature to be somewhat too high, and because of the shelter from winds the low temperature was perhaps 1 or 2 degrees too high.

AGRICULTURE.

The first settlement in Dallas County was about 1841. The early settlers located along the streams, where water was near and wood was available for fuel and building. They raised cattle, horses, and sheep on the open range and cultivated small patches of corn and vegetables. As settlement increased, larger bodies of land were placed in cultivation, but stock raising remained the important occupation for many years, because the prairies supported a heavy growth of grass and the climatic conditions favored the keeping of cattle on the range the year round. The first cotton was grown about 1851, and wheat became an important crop probably as early as cotton. Cotton was taken to Galveston on flat boats down the Trinity in the early days. Wheat was ground into flour or hauled

by ox teams to San Antonio, Shreveport, and towns in southeastern Texas.

With the building of the Houston & Texas Central Railroad into the county in 1872 and the Texas & Pacific a little later, providing connections with outside markets, settlement became more rapid and the production of crops was greatly increased. A marked impetus was given to farming when barbed wire came into use for fencing between 1870 and 1880. Cotton early became the chief cash crop and has held first place to the present day. Corn, oats, and wheat also have been very important crops for a long time. Vegetables and fruits have been produced in increasing quantities as the population grew, and Dallas has become an important market for these products.

As the population grew and the land was cut up into farms, the raising of livestock under the ranching system was discontinued. Livestock is now raised on the farms in a small way, but even under this system the aggregate production is considerable.

At present the agriculture of Dallas County consists mainly of general farming, the principal crops being cotton, corn, oats, wheat, and sorghum. Considerable market gardening is done for the local markets. Some fruits are raised in a small way for home use and local markets. Milk and cream are produced on the farms in considerable quantities for sale in Dallas. Probably 90 per cent or more of the land in the county is in cultivation.

The table below, giving the acreage and production of the leading crops, as reported by the last five censuses, shows the general trend of agriculture in Dallas County in the last 40 years.

Acreage and production of the leading crops in 1879, 1889, 1899, 1909, and 1919.

Year.	Corn.		Oats.		Wheat.		Hay and forage. ¹		Cotton.	
	Area.	Production.	Area.	Production.	Area.	Production.	Area.	Production.	Area.	Production.
	<i>A cres.</i>	<i>Bushels.</i>	<i>A cres.</i>	<i>Bushels.</i>	<i>A cres.</i>	<i>Bushels.</i>	<i>A cres.</i>	<i>Tons.</i>	<i>A cres.</i>	<i>Bales.</i>
1879.....	44, 004	575, 667	8, 306	209, 281	26, 854	186, 460	4, 512	3, 644	44, 377	21, 469
1889.....	58, 494	1, 802, 407	15, 723	417, 484	23, 584	243, 873	10, 516	13, 916	54, 284	20, 815
1899.....	89, 957	3, 302, 620	28, 282	1, 022, 850	46, 090	709, 560	14, 030	19, 158	92, 028	41, 012
1909.....	73, 180	959, 697	10, 204	154, 226	3, 793	40, 429	14, 738	11, 134	150, 364	37, 712
1919.....	49, 151	1, 639, 816	41, 421	1, 448, 541	40, 239	584, 399	18, 802	39, 391	150, 302	37, 020

¹In 1879 and 1889 only hay was reported.

From this table it will be seen that the acreage in all crops is greater than it was 40 years ago; that the gain has been greatest in oats, hay and forage, and cotton, less in wheat, and least in corn. Corn and wheat occupied larger acreages in 1899 than at present; the other crops show steady increases, except oats and wheat in 1909. This was a year of drought, and undoubtedly considerable areas were abandoned. In 1920 the acreage in cotton was about equal to the acreage of all the other field crops considered in this table.

Cotton is thus the main crop produced and receives more attention than any other crop. It is sold to buyers in the various towns in the county and is shipped to various parts of the world. Mebane

is grown largely, though Rowden and Truitt also are planted. Many farmers are beginning to grow the Lone Star, or Bennett, and Acala, which have longer staple than the other varieties. Some of this longer staple is $1\frac{1}{16}$ to $1\frac{3}{16}$ inches long. Much of the soil in the county is capable of producing as high as 1 bale per acre. Many things, however, such as unfavorable seasons, insect pests, and diseases, cut the yields down considerably, so that the average for the whole county is probably about one-third bale per acre.

Cotton is usually planted the latter part of April and in May. In some seasons, such as that of 1920, wet conditions prevent early planting, and the yield is reduced by the greater weevil damages.

Corn ranks second in importance to cotton and is grown on nearly every farm. It is used mainly for feeding work stock, and in some years not enough corn is produced to supply local needs. Much of the land in the county is capable of producing 50 or 60 bushels of corn per acre in favorable seasons. The bottom-land soils, some terrace soils, and the Houston black clay are especially valuable for growing this crop. However, the seasons are often unfavorable to the best development of the corn crop. The early spring rains are usually sufficient to promote good growth, but often in early summer, just before the grain has matured, there is a dry spell of sufficient length to reduce the yield. It is probable that the average yield for the county is not over 20 bushels per acre. Some corn is grown for silage. Many farmers have silos and use silage to feed beef and dairy cattle. Corn is usually planted from the 1st to the 15th of March. The main varieties grown are Surcropper, Yellow Dent, and Bloody Butcher.

Wheat varies in yields according to seasons, but on the whole it is a successful crop. It is grown mainly on the Houston soils and to some extent on the Bell, Irving, and Lewisville clays. Practically all of it is ground into flour in the county. Most of the wheat is sown in October. A small part is sown in the spring and in some seasons is successful, though as a rule spring wheat is not recommended. The leading varieties are Mediterranean and Turkey.

Oats are grown extensively on the heavier upland soils and to some extent on the light-textured soils, though on the latter mainly for grazing. The crop is used chiefly for feeding stock or is sold in local markets, although considerable quantities are shipped out of the county for seed. The Texas Rust Proof seems to be the best variety. Barley, a minor crop, was grown on 1,855 acres in 1919.

Sorgo or saccharine sorghum is grown by most farmers for forage, and a considerable acreage is cut for silage. A little is used in the manufacture of sirup in small mills on the farms. The sorgo grown on sandy soils produces the best grade of sirup.

Millet, Sudan grass, and other tame grasses are grown for hay. Very little prairie hay is cut, as most of the prairie area has been placed in cultivation. On a few farms large pastures remain in the native grasses, which are cut for hay, yielding about 1 ton per acre at a cutting, two cuttings being made in some years. Sudan grass is a splendid crop for summer pasture and will doubtless be grown more extensively as its good qualities become known. It yields heavily when cut for hay, and two or three cuttings a season may be made.

Alfalfa is grown in a number of small fields in the county. Alfalfa does well on many of the soils, and it would seem that this important crop could be grown more extensively.

Considerable market gardening is carried on within a few miles of Dallas, and some gardens are 10 or 15 miles from the city. This industry is most extensive on the sandy soils, but various other soils are utilized. Dallas and the smaller towns of the county are good markets for vegetables, and the local production is not sufficient to supply home demands. There are large areas of soil in the county adapted to vegetable growing and market gardening could well be extended. Practically all kinds of vegetables are grown in the market gardens.

Usually some berries, peaches, and pears are grown on the farms, as well as vegetables. Late frosts sometimes kill the fruit, but it is estimated that good crops are obtained about three years out of five. Large areas of the soils are well suited to fruits and berries. Many of the orchards are neglected, and the trees become diseased and are short lived.

A number of small orchards of improved pecans are growing in the county and more are being planted. The pecan tree grows well and produces good nuts on many of the soils, but especially on the Cahaba fine sandy loam.

Sweet potatoes are an important crop and find a good market locally. Peanuts are grown on some of the sandy soils with success. Most of the peanut crop is left in the field to be harvested by hogs.

Kafir and milo are grown in small quantities, but it is said that the seasons are unfavorable to the maturing of the grain, and the midge sometimes damages the crop. Kafir, milo, and spur feterita do well, especially if planted in March, which allows the grain to mature before the midge can get into it.

Broomcorn is grown to some extent, with good yields, and a ready market is found in local broom factories. It is grown mainly around Grand Prairie on the Lewisville clay and Bell clay and yields one-fourth to one-half ton per acre. Broomcorn does best on the rich, heavy, dark soils, and as much as 1 ton per acre has been produced on the Trinity clay.

There are no large stock ranches in the county, although purebred cattle, hogs, and sheep are raised on stock farms, often in connection with general farming. Only a few beef cattle are raised.

Most farmers raise a few hogs for home use and sell the surplus in local markets. Many farmers have small flocks of sheep which thrive and are usually profitable as well as useful in clearing land of weeds. Many beef cattle are fattened on the farms, the feeders being obtained at the stock yards in Fort Worth. The steers are fattened on ensilage, cottonseed meal, and hay. Considerable numbers of purebred beef and dairy cattle, sheep, hogs, and poultry have been brought into the county in the last two or three years for the small stock farms.

There are a number of dairies in the county, supplying Dallas with milk. Many of the farmers also produce milk. Several creameries are being operated in or near Dallas, but they do not make nearly enough butter to supply local needs. Considerable butter is shipped to Dallas from outside the county, and even from other States as far as Kansas.

Poultry is raised on all farms, and the surplus chickens and eggs are sold in Dallas, but these are not enough to meet the demand.

The importance of the adaptation of crops to soils is recognized in a general way by most farmers in Dallas County. The Trinity, Catalpa, and Frio clays are considered the best soils for cotton, corn, sorghum, and alfalfa, but owing to poor drainage and damage by overflow, the crops are not grown profitably every year. This condition is being overcome by a system of levees (Pl. XX, fig. 1) and by ditching to provide surface drainage. The Houston black clay is likewise considered as well suited to these crops and also to wheat and oats. The Houston clay and the Houston clay, shallow phase, are thought better suited to the small grains, especially wheat and oats, than to corn, and only moderately suited to cotton. The Bell clay and Irving clay are recognized as well adapted to cotton and the small grains. The Bell clay is considered a good corn soil and better suited to that crop than the Irving clay. Many farmers realize that the better drained areas of the Trinity, Frio, and Catalpa clays are especially adapted to the production of alfalfa. It is a matter of general knowledge that the Cahaba fine sandy loam is especially suited to vegetables and fruits, and it is also well known that with proper fertilization and culture this type is a good corn and cotton soil. The Lewisville clay is known to be especially suited to small grains and cotton. Although vegetables and fruits do well on the Leaf fine sandy loam, it is well known that these crops are not so well adapted to this type as to the Cahaba fine sandy loam. This knowledge is utilized in practice in varying degrees; some farmers pay little or no attention to crop adaptation.

No definite system of rotation is practiced in Dallas County. On many farms cotton or grain is grown year after year on the same land. However, there are many other farmers who realize that the yields are not so satisfactory and that the soil becomes gradually less productive under the continuous production of one crop, and accordingly alternate cotton with corn, wheat, or oats.

In preparing the land for crops the general practice is to "bed" the land in high ridges with a lister or "middle buster." This is done in the fall or winter. On some farms the land is bedded in the spring by turning the former water-furrow position into a ridge or bed and leaving the water furrow where the bed was. This method is a quick way of preparing the land, but better results are obtained when the land is plowed in the fall before bedding. The old practice was to plant the seed on the ridgelike bed after it had been smoothed down, but in late years it has been found advantageous to plant the seed in the water furrow and, as the plants grow, to work the soil to the plants with cultivators until at the last cultivation the surface is flat.

Where small grain follows a similar crop, the stubble land is plowed as early as possible in the summer. A very good practice consists of drilling wheat or oats between the stalks of cotton in the fall and running a stalk cutter over the land in the winter to break down the cotton stalks. This has proved to be a very successful method of growing the small grains. Many farmers then break the stubble land after harvest the following summer and let it lie until planted to corn the next spring.

The farm improvements are good in most parts of the county. (Pl. XX, fig. 2.) Many good houses and fair outbuildings are on the farms operated by owners, but as a rule the farm buildings of the tenants are small and poor. Modern machinery and implements are used generally. The work stock consists of good mules and horses of medium draft weight.

Commercial fertilizers are not generally used. It is the general opinion that the use of commercial fertilizers would not be profitable, except on the lighter soils or for special crops like potatoes and other vegetables. Little barnyard manure is used, though it is well known that its use is remarkably beneficial on most of the soils and for practically all crops. The supply of manure made in this county is very inadequate. More stock should be raised in connection with the general farm crops to build up the land and maintain its productiveness. Cotton stalks and other crop residues are often burned to clear the land for crops. This practice, though perhaps necessary under boll-weevil conditions, together with the absence of rotations supplying organic matter to the soil, has resulted in the depletion of humus in the soil, and a consequent decline in yields. Forms of vegetation that do not offer protection to the weevil should be grown and turned under.

There is a constant drain on the soil by surface erosion where the land is sloping. Only small areas are eroded into gullies, but a very great drain is suffered in the almost unnoticeable wash which removes a certain portion of the top soil at every heavy rain. To prevent this terraces have been made on a few farms with excellent results, and terraces will doubtless be extended to many other fields with sloping surfaces.

The most troublesome weeds on the heavy soils are Johnson grass and Colorado ("hurrah") grass. On the sandy soils crab grass gives the most trouble. It is difficult to eradicate. Heavy yields of good hay are obtained from Johnson grass where allowed to grow.

Not enough care is given to the selection of seed. The seed is often not only poor in germinating quality, but in many cases of inferior varieties or strains. Many farmers are beginning to pay more attention to this question.

During the last few years farm labor has been scarce and very high priced. This is doubtless due to such conditions as are usually found around cities, where much labor for industrial works is required. Authorities state that at present farm laborers are becoming more plentiful. Although much of the labor is performed by the farmer and his family, it is necessary to hire considerable help, especially in the planting season and during harvest and cotton-picking time. Laborers hired by the month are paid \$40 to \$60 a month without board or \$25 to \$30 a month with board. In 1920 farm hands were paid \$2 or more a day for chopping cotton and \$1.50 to \$2 per 100 pounds for picking. Many of the laborers are negroes or Mexicans.

According to the census, 82.4 per cent of the land area of the county was in 5,379 farms in 1920, the average size of the farms being 84.2 acres, each tenancy being enumerated as a farm. Of the land in farms, 79.1 per cent was classed as improved. The smaller farms are on the sandy soils, where they range ordinarily from 10

or 20 acres up to 100 or 160 acres. In other sections the farms range in size from 80 to 200 or 300 acres. Some individual holdings in the county include 2,000 or 3,000 acres, but the larger holdings are ordinarily subdivided into small farms, which are operated by tenants.

A very large proportion of the land is farmed by tenants. In 1920, 63.2 per cent of the farms were operated by tenants, 35.8 per cent by owners, and 1 per cent by managers. The proportion of tenant farms has steadily increased; it was only 36.6 per cent in 1880.

Farm lands are leased usually on a share basis, the tenant delivering one-third of the grain crops and one-fourth of the cotton to the owner for the use of the land and farm buildings and furnishing all labor and expense connected with growing the crops. Some farms are leased on the half-and-half plan, where the owner furnishes stock, implements, and seed, and receives one-half of all produce. Tenants with families usually work 35 to 50 acres of land. Some operate much larger farms, with the aid of hired help.

The prices of farm lands in Dallas County have increased greatly in the last few years. Land prices vary according to size of farm, character of the soil, improvements, distance from towns and neighborhood centers, and proximity to good roads. Probably little land of any kind can be bought for less than \$75 or \$100 an acre. Some farms have sold recently for \$300 or more an acre.

SOILS.

Dallas County lies within the region known as the Black Prairie or Black Waxy belt. This is a belt of dark-colored soils which extends from the vicinity of Red River southward to the vicinity of the Colorado River, lying between the belt of light-colored soils of the forested region of east Texas and that of the East Cross Timbers. The belt varies from about 50 to 60 or 70 miles in width; it supports the densest population in the State.

There are two broad groups of soils in Dallas County, based upon process of formation, with a large number of well-defined groups differing from one another in physical and chemical aspects dependent upon the origin of the material or the processes of weathering through which the material has gone. These broad groups are (1) the uplands proper, which represent materials derived from the underlying strata and which have been markedly influenced by the character of these underlying materials, and (2) the water-laid soils occurring as recent deposits in the overflowed bottoms and as old deposits upon terraces which were overflowed in past time.

The principal upland soils (the Houston soils) are composed of material derived through the disintegration of the underlying beds of highly calcareous rocks, which are referred to as Chalk (Austin chalk) and to marl or calcareous clay (Taylor marl). The residual material derived from these strata contains much lime carbonate, but the content is considerably lower than that of the parent material, especially in the upper or surface soil. This rather low content of lime is due, of course, to the fact that part of the lime has been dissolved and carried away by rain water. The accumulation of decayed vegetable matter under the prevailing humid conditions

and in the presence of lime carbonate has caused the surface soil of the greater part of these prairie soils to have a decidedly dark or black color. Where erosion has been more active, the color of the surface soil is not so dark, which means that there has been less opportunity in such places for the accumulation and preservation of organic matter in the soil.

Bluish or greenish shales are associated with the limestone in parts of the county. These shales, upon weathering and breaking down, give rise to a brown soil having normally a greenish cast and containing very little lime carbonate either in the soil or subsoil. This is the Ellis clay.

The alluvial soils vary considerably in the source of the material forming the deposits from which they are derived. The soils along the local streams, where the material comes entirely or largely from the Houston soils, are dark colored and calcareous. These are the Trinity soils. Those first-bottom soils having the same origin as the Trinity, but with a lighter color, that is, a brown color, are the Catalpa and Frio soils. These also are generally calcareous from the surface down. Other first-bottom soils, derived largely from the noncalcareous soils of the East Cross Timbers region, contain very little lime carbonate. They represent a distinct group of first-bottom soils which have been given the name Ochlockonee.

On the old stream terraces or benches, that is, those which are no longer subject to overflow, there are developed a considerable number of soil series, one group of which contains much lime and another very little lime within the 3-foot section. The first group includes the Bell and Lewisville soils; the second the Cahaba, Amite, Kalmia, Leaf, and Irving series.

The dark-colored Bell soils of the stream terraces superficially resemble closely the Houston black clay, but there is less of the whitish, chalky, limy material in the subsoil, and gravel beds occur locally in the substratum. The fact that gravel beds, cemented in places into a conglomerate by the lime leached from above, may be found under any of the stream-terrace soils, is an important distinction between these old-alluvial soils and the upland soils. In other words, the upland soils, formed by disintegration of the underlying materials, nowhere have gravel in the substratum.

The Lewisville soils are much like the Bell, differing principally in having a brown surface soil, instead of a dark to black soil as in the Bell.

The Irving soils appear to represent material which originally was like that of the Bell, but which has been leached of its lime carbonate by the more rapid percolation of rain water through this soil, or by reason of the longer period to which these soils have been subjected to leaching, as the Irving soils are doubtless older than the soils of the Bell series.

The Cahaba, Amite, Kalmia, and Leaf soils differ from the other terrace soils apparently because the material from which they are derived is different. It is believed that a considerable proportion of the soil-forming material in these noncalcareous, water-deposited soils was derived from the noncalcareous soils of the East Cross Timbers, and possibly to some extent from the West Cross Timbers. Undoubtedly there has been considerable leaching since the original

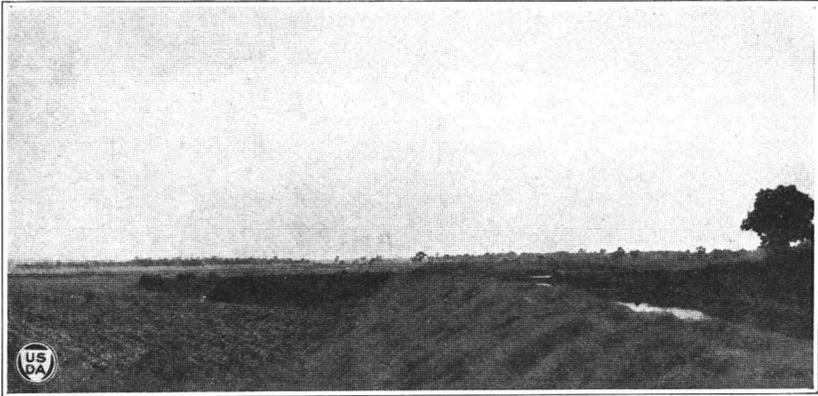


FIG. 1.—LEVEE ALONG THE TRINITY RIVER TO PROTECT THE BOTTOM LAND (TRINITY CLAY) FROM OVERFLOW.

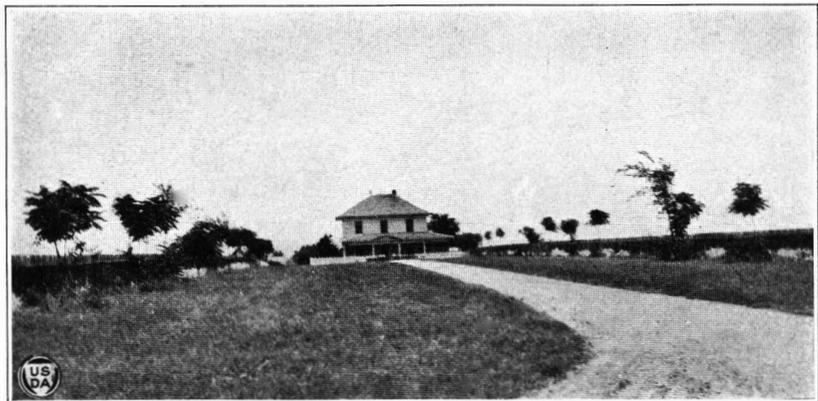


FIG. 2.—FARM HOME ON THE HOUSTON BLACK CLAY.

material was laid down, as it is not likely that lime-free deposits could have been carried any considerable distance along the Trinity River, upon whose terraces these soils are found. It may be that oxidation or advanced weathering in the red soils has had much to do with the origin of the color.

In the system of soil classification developed by the Bureau of Soils the various types are grouped in series. The soil type is the unit of soil mapping, and a soil series consists of types that are similar in origin, color, topography, and structural characteristics, but differ one from another in texture of the surface soil. A description of the various series appearing in Dallas County follows.

The surface soils of the types in the Houston series are black or brown, and the subsoil is brown, yellow, grayish, dark bluish gray, or black. The soils and subsoils are characteristically calcareous; the surface soils generally contain enough lime carbonate to effervesce with hydrochloric acid. The soils are residual from calcareous rocks. The Houston black clay; Houston clay; Houston clay, shallow phase; and Chalk (Houston material) are mapped in Dallas County.

The Ellis series includes types with brown to greenish-brown soils and a greenish-brown to olive-drab subsoil. These soils are derived from noncalcareous shales, such as the bluish and greenish-brown shales of the Eagle Ford formation of the locality where they were originally mapped, that is, Ellis County, Texas. The parent shales in places include thin strata of limestone or calcareous shale, which give rise to occasional strips of calcareous soil like the Sumter. In places gravel of limestone and other rock from overlying formations is present on the surface. One type, the Ellis clay, has been mapped in Dallas County.

The Bell series consists of types with black surface soils and a black or bluish-gray subsoil. Both soil and subsoil are characteristically calcareous. The soils of this series are composed of sediments washed to a very large degree, apparently, from the calcareous soils of the Black Prairie and the Fort Worth Prairie. Much of the Bell series occupies very high old stream terraces, in places more than 100 feet above the present stream beds. One type, the Bell clay, and also a low phase of that type are shown on the soil map.

The types in the Lewisville series have brown to dark-brown surface soils and a light-brown to yellowish-brown subsoil. In places the color is greenish brown in the upper subsoil and greenish yellow in the lower subsoil. The substratum contains gravel, consisting mostly of limestone, quartz, chert, and sandstone. In places the gravel is cemented with lime into a hard conglomerate known as "concrete." Gravel is present in places in both soil and subsoil. The material is calcareous from the surface down. These soils occupy old high terraces and low more recent terraces and are well drained. The material was washed largely or entirely from the limy soils of the Coastal Plains, the Houston clay, and black clay, and associated soils. The Lewisville soils are the brown correlatives of the Bell soils. One type, the Lewisville clay, with three phases—the eroded phase, the gravelly mixed phase, and the low phase—is mapped.

The Cahaba series includes types with grayish to brownish surface soils and a brown to yellow subsurface layer. The subsoil is characteristically reddish in color and friable. These soils in Dallas County represent sediments which, to a considerable extent, apparently have been transported from the Eastern and Western Cross Timbers, mixed, of course, with materials from other sources. They occur mainly on old high terraces that are no longer subject to overflow. The Cahaba fine sand and fine sandy loam are mapped.

The types of the Leaf series have grayish-brown or brown surface soils, a yellow or brown subsurface layer, and a heavy, stiff, mottled red, yellow, and gray clay subsoil. These soils occupy stream terraces and are formed of sediments of a generally noncalcareous character. The Leaf soils are closely associated with the Cahaba soils. They are more poorly drained than the Cahaba. Two types are mapped, the Leaf gravelly sandy loam and the Leaf fine sandy loam.

The Amite series is represented in this county by one type, the fine sandy loam. This series includes types with brown or reddish-brown to red surface soils and a red friable subsoil. This series closely resembles the Cahaba, is developed in similar positions, and has the same origin, but the Amite soils have been oxidized more completely than the Cahaba and have a more reddish color in the surface.

The types of the Kalmia series have grayish or brownish surface soils and a yellow subsoil. Only the Kalmia fine sand was mapped.

The types in the Irving series have ashy-gray to black surface soils, underlain by an ashy-gray, dark-gray, or black, stiff, plastic clay subsoil. These soils occupy flat stream terraces lying above overflow. The material was probably carried by streams from the black prairie lands, but contains some material from the soils of the Cross Timbers. The material is noncalcareous; that is, it shows no effervescence with hydrochloric acid. Three types have been mapped in Dallas County, the fine sandy loam, the silt loam, and the clay.

The Trinity series includes types with dark-brown to black soils, overlying a subsoil of similar color and texture. The soils are derived from recent alluvial deposits washed from the calcareous soils of the Black Prairies. They are characteristically calcareous throughout the soil section. One type, the Trinity clay is mapped.

The types of the Catalpa series are characterized by brown surface soils and a subsoil of about the same or a little lighter color. These soils are composed of recent alluvial deposits coming largely from the calcareous prairie soils, and they are calcareous throughout. The Catalpa clay is mapped in this county.

The types in the Frio series have grayish-brown or brown surface soils and a subsoil similar but a little lighter in color. These soils, which are alluvial, are composed of sediments washed to a large degree from limestone areas, and the soil and subsoil are strongly calcareous. Two types are mapped, the loam and the clay.

The Ochlockonee series includes types with grayish-brown to brown surface soils and a brown to yellow subsoil. These types are alluvial in origin. They are derived in large measure from sediments washed from areas of noncalcareous rocks and do not effervesce with acid. One type is mapped in Dallas County, the Ochlockonee clay loam.

The table below gives the names and the actual and relative extent of the various soils mapped in Dallas County. Their distribution is shown on the accompanying soil map.

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Houston black clay.....	139,392	24.5	Chalk (Houston material).....	14,528	2.6
Houston clay.....	30,656	16.2	Irving clay.....	11,712	2.1
Shallow phase.....	61,376		Frio clay.....	6,208	1.1
Trinity clay.....	87,040	15.3	Cahaba fine sand.....	4,672	.8
Bell clay.....	59,200	11.4	Irving fine sandy loam.....	2,688	.5
Low phase.....	5,760		Kalmia fine sand.....	2,048	.3
Lewisville clay.....	44,800	9.3	Leaf gravelly sandy loam.....	1,792	.3
Eroded phase.....	3,584		Amite fine sandy loam.....	1,216	.2
Low phase.....	2,752		Irving silt loam.....	1,152	.2
Gravelly mixed phase.....	1,600	4.6	Ochlockonee clay loam.....	832	.1
Cahaba fine sandy loam.....	18,304		Frio loam.....	768	.1
Low phase.....	8,128	4.3	Gravel pits.....	512	.1
Leaf fine sandy loam.....	24,320				
Catalpa clay.....	17,856	3.1			
Ellis clay.....	16,704	2.9	Total.....	569,600	.....

HOUSTON BLACK CLAY.

The surface soil of the Houston black clay is a very dark bluish gray to black clay, 12 or 15 inches deep. The subsoil in flat or slightly depressed areas is a dark bluish gray or black clay, much like the surface soil, though as a rule it has a slightly lighter or grayer color. On sloping areas the subsoil is in many places dark brown, grading through brown to yellowish brown with increasing depth. Where the type is underlain by chalk at depths of 3 to 5 feet, the lower subsoil may be yellow or greenish yellow and contain white, soft, chalky particles. At depths of more than 3 feet below the surface the yellow clay grades into soft, partly weathered chalk and finally into the harder parent rock. Where the soil overlies marl and calcareous clay, the chalky material is not so abundant, though the material is characteristically calcareous throughout all areas. In some places the underlying chalk comes to within 2 feet of the surface. This type is locally called "black land" or "black waxy land." In uncultivated fields large, deep cracks form in this soil in dry weather, and a characteristic of this soil in all cultivated fields is that it crumbles down, on drying, to a mass of small aggregates or crumbs. Even clods turned up when the soil is wet will crumble at the first rain, and assume a desirable tilth.

In the large areas north of Mesquite and around New Hope there are included patches, 20 to 50 feet across, that contain whitish salts and are called "alkali spots."¹ Crops do not grow well on these spots, and some of them are bare of growth or support stunted plants in cultivated fields. The surface in these areas bakes very hard on drying. The soil near these alkali spots does not effervesce with hydrochloric acid at the surface, and sometimes only very lightly in the subsoil. Such areas represent inclusions of Wilson clay.

Some quartz gravel occurs over the Houston black clay in places,

¹ An analysis of the upper 6 inches of soil from one of these spots shows 712 parts of salts per million of air-dried soil.

and it is possible that some of the surface material is a remnant of old water-laid deposits.

The Houston black clay is the most extensive soil type in the county. It occurs in large bodies throughout the northern, north-eastern, and southern parts. Garland, Richardson, Reinhardt, and Lancaster lie within large areas of this soil.

This type has for the most part a gently rolling to rolling topography, though there are some areas that are quite level. Both surface and internal drainage are generally good, although on the level areas water may stand for some time after rains. While these level tracts have sufficient drainage for successful cultivation, they can be improved by ditching, which has been done in some places. The soil holds water well in dry weather, especially with frequent shallow tillage. Where the "white rock" or chalk comes to within 3 feet of the surface it is said that the soil dries out more quickly than where it is deeper. The subsoil forms a good reservoir for water, and although it is neither compact nor impervious, there is no leaching or rapid downward movement of moisture. Where unprotected, the surface soil washes or erodes to some extent on the steeper slopes, and this action is often intensified by the cultivation of crops in rows that run more or less up and down the slope. Some fields have been damaged in this way, but there is comparatively little gullying on this type of soil.

Practically all of the Houston black clay is in cultivation. There are only two or three large pastures of the type in the county that remain as virgin soil. Probably not more than 1 per cent of the type is uncultivated. In virgin areas the surface is covered with numerous regular small depressions and elevations locally called "hog wallows." This is prairie land and originally was covered with a heavy growth of grasses. A few clumps of elm and hackberry trees grow in places.

The leading crops on the Houston black clay are cotton, corn, wheat and oats. In addition to these, small quantities of sorghum, millet, and some other crops are produced. Cotton, the principal crop, is grown on nearly all farms of this type. (Pl. XXI, fig. 1.) It yields from one-half to 1 bale per acre, depending on the season, the average yield being around one-half bale. The yields are greatly lowered or are entire failures in years when boll weevils or boll worms, or both, are numerous. Corn ordinarily yields from 25 to 40 bushels, and under the most favorable conditions as much as 60 bushels per acre. Wheat yields 15 to 35 bushels per acre, and oats, 30 to 80 bushels or sometimes more. Sorghum, grown mainly for fodder, yields 2 to 4 tons per acre. Millet yields about 2 tons of hay per acre. Very little alfalfa was seen on this type, though the soil is well adapted to this crop. Sudan grass makes excellent yields on this soil. Kafir and milo grow well but are grown only in small quantities, as insect pests and climatic conditions are said to make the development of the grain uncertain. Small peach orchards produce some fruit in favorable seasons, but the trees are short lived and the soil does not seem well suited to the tree fruits. Berries and bush fruits are grown successfully in a small way for home use.

The Houston black clay in Dallas County is representative of large areas of this soil type throughout northern and central Texas. It

is naturally a strong, productive soil and has been cropped for many years without the use of manure or fertilizers, and without very great reduction in productiveness. On level areas, especially, the soil stands up under cultivation remarkably well; on sloping areas subjected to erosion it becomes gradually slightly less productive. The virgin land placed under cultivation becomes darker in the surface soil, but in fields on slopes the soil with continued cultivation becomes slightly brown or grayish. The cultivated soil has a very loamy structure, owing to the high content of lime.

If there is much rain during the winter and spring, such crops as oats and wheat do especially well, but under this condition the soil warms up slowly and prevents early seeding of corn and cotton, and these crops are late. With considerable rain during the spring and summer, corn does well, but cotton makes a very rank stalk growth, which is unfavorable to fruiting. Wet weather and rank growth favor insect pests such as the weevil and worm. Frequently the corn crop is damaged to a considerable extent on this soil by lack of rain in the early summer months.

The Houston black clay is well suited to the crops grown on it. The type also appears well suited to dairy farming, though very little of it is used for this purpose. Some farms show the presence of cotton root rot in many spots on the soil.

Farms on this soil sell for \$150 to \$300 an acre and sometimes bring higher prices. The highest prices are obtained for land situated on good roads.

HOUSTON CLAY.

The typical Houston clay is a brown or grayish-brown to dark-brown or dark grayish brown clay, which grades at about 5 to 12 or 15 inches into lighter colored grayish-brown or brown clay which abruptly passes into grayish-yellow clay containing whitish lime material of a decidedly chalky or friable nature. On drying the surface soil takes on an ashy-gray or dark ashy gray color, and the soil, of cultivated fields especially, assumes a distinctive crumbly structure. Frequently the subsoil, beginning as a yellowish-brown clay, grades into yellow clay, the yellow color increasing with depth. Where derived from chalk, the subsoil is a greenish-yellow, chalky, friable clay, grading in places into soft white chalky material at depths of less than 36 inches. On some slopes in the eastern part of the county, where the soil is derived from marl or clay, the surface layer of brown clay a few inches thick, quickly grades into yellow clay. Small spots of Sumter clay (a brown calcareous clay with a yellowish-brown to greenish-yellow calcareous clay subsoil, containing in many places white limy material of a chalky nature), Houston clay, shallow phase, and Crawford clay (a reddish-brown clay underlain at 10 to 12 inches by a dull-red or reddish-brown clay) are included in areas of the Houston clay. The typical soil is calcareous in both soil and subsoil, although effervescence with hydrochloric acid is not everywhere as strong in the soil as in the subsoil.

The Houston clay occurs in a large number of small areas and a few large ones principally in the southern and northeastern parts of the county. The areas in the southern part are derived mainly

from chalk; here the surface is often ashy gray when dry, and the subsoil is very calcareous and contains soft chalk fragments. In the northeastern part, where the type is derived from calcareous clay, it occurs mainly as long narrow strips occupying the slopes leading down from areas of Houston black clay. Several large areas lie in the southern part of the county around DeSoto and just west of Hutchins.

The topography of the Houston clay is rolling, with many rather steep slopes, although not so steep as to prevent cultivation. Both the surface and internal drainage are good. In places the surface washes rather badly, gullies forming readily, and for this reason some of the steeper slopes are used as pasture land.

Probably 90 per cent of the type is in cultivation, the remainder representing virgin prairie land. A few elm or post oak trees appear in places. Mesquite grass and other grasses grow on the virgin areas.

The principal crops are cotton, corn, oats, wheat, and sorghum. Cotton yields one-half to three-fourths bale per acre; corn, 20 to 40 bushels; wheat, 15 to 30 bushels; oats, 30 to 60 bushels; and sorghum hay, 1 to 3 tons per acre. Yields vary according to the season and the condition of the soil with respect to erosion. The most productive fields are those with the smoothest surface and gentle slopes. The soil absorbs rainfall abundantly and drains out quickly, thus being favorable for early spring planting. On the other hand, droughty conditions cause the crops to suffer sooner than on the more nearly level Houston black clay, with which the type is associated. The soil is said to be better suited for the small grains than for corn.

Peach trees grow well in the small home orchards on this soil and yield well in favorable seasons, though the type is not considered especially suited to fruit. Vegetables also succeed in the home gardens in the spring and early summer months. The soil in the smoother fields is adapted to alfalfa, though it is not utilized for this crop. It is a good type for dairy farming.

The soil is not fertilized, but it is said to respond well to barnyard manure. Plowing under vegetation and increasing the humus content improves this soil. Growing and plowing under leguminous crops would likely prove especially beneficial. All sloping areas, without exception, should be terraced to prevent or check erosion. It is uneconomic, indeed veritable folly, to allow this valuable soil to be wasted through the slow but insidious erosion that goes on on all unterraced slopes.

Farms composed of this type of soil entirely or to any considerable extent sell at the present time for about \$50 to \$200 an acre, according to location, condition of the land, and character of farm buildings and other improvements.

Houston clay, shallow phase.—The soil mapped as Houston clay, shallow phase, consists of brown, grayish-brown, or black clay, underlain at depths ranging anywhere from 2 or 3 inches to 10 inches or more by either (1) whitish to grayish-yellow, and in some places greenish-yellow, chalky or marly material, or (2) harder chalk (semi-indurated limestone) or compact marl.

In places the surface soil grades downward into brown or yellowish clay and this in turn grades into soft chalk, which is underlain

a few inches deeper by harder chalk or marl. In places the chalk lies as deep as 18 inches, but usually it is reached at much shallower depths. The surface soil of many areas is strewn with hardened, whitish fragments of the parent rock, ranging in size from small particles to fragments several inches wide. These are turned up by the plow and are very numerous in many places, sparse in others, and wanting altogether in other places, particularly where the soil is deep.

This soil is rather extensive in Dallas County. Good-sized areas occur around Cedar Hill and Duncanville in the southwestern part, and northward to the west of Dallas. Many small areas occur in the northern part along White Rock Creek and other streams. This phase is developed mainly along or near the slopes of some of the larger drainage ways in that part of the county underlain by chalk. The soil is shallowest on the steeper slopes. Extending back from the stream valleys the depth of the soil increases and the quantity of rock fragments on the surface decreases. The black included areas represent a shallow phase of Houston black clay; the most severely eroded whitish patches represent Chalk (Houston material).

The surface is rather steeply to gently sloping. Where the slopes are steepest the white chalk outcrops, and the largest of such areas have been mapped as Chalk (Houston material). The surface is usually smooth and not so steep as to prevent cultivation, many areas having a very gentle slope. The drainage is good throughout, many small draws or streams of intermittent flow reaching into areas of this soil. The chalk fragments turned up by the plow weather rapidly into soil, but erosion removes much of this as fast as formed.

This soil is locally termed "white rock" land. It is prairie land, and in virgin areas it supports a growth of mesquite grass and other grasses and an occasional post oak, elm, or hackberry tree.

The productiveness of the soil varies according to depth of soil material over chalk. The crops as a rule suffer quickly from lack of moisture in dry periods. However, crops do much better than would seem possible on such shallow soil. Probably about 90 per cent of this soil is in cultivation. The principal crops are cotton, corn, oats, wheat, and sorghum. During very dry seasons crops may be almost complete failures, but in seasons of heavy rainfall good yields are obtained. Cotton yields about one-fourth to one-third bale per acre, corn 15 to 30 bushels, wheat 10 to 15 bushels, and oats 20 to 40 bushels per acre, the better yields being obtained in favorable seasons from the areas having the deeper soil. The type appears to be better suited to small grains than to corn or cotton.

Some vegetables and small fruits are grown in the home gardens. Some peach trees are planted in home orchards but the trees are short lived. Grapes were apparently doing fairly well in the few small plantings seen.

Farms of this land sell for \$75 to \$150 an acre at the present time (1920), the price depending upon improvements and the relative area of the shallower soil. Much of the soil is included in farms with Houston black clay, and the selling price of the farm is higher or lower as the relative area of the latter type is greater or less.

The land should be terraced to prevent erosion and in places where small gullies are encroaching on the land, embankments or

dams should be constructed to check the waste. Barnyard manure and other vegetable matter, especially pea vines or other legumes, plowed into the soil will prove very beneficial. The soil may be too shallow for the continued maintenance of a good stand of alfalfa, but the crop can be grown, especially where the soil is deepest. Sweet clover will succeed and will improve the soil.

CHALK (HOUSTON MATERIAL).

Chalk (Houston material) represents areas where the chalk—"white rock"—comes to the surface or is covered by not more than 2 or 3 inches of grayish soil. Some very small unimportant areas of Houston clay, shallow phase, were included in mapping this type. In many places the semi-indurated limestone or marl is exposed at the surface, without any covering of vegetation, but generally there is some loose light-grayish or whitish marly material, with numerous limestone fragments, varying in depth from about 1 inch to 6 or 8 inches over the harder material. This soil represents an advanced stage in the erosion of the Houston soils. It is purely the product of wasteful washing.

Chalk (Houston material) is mapped in some good-sized areas and numerous small ones. The principal area is along the White Rock Escarpment in the southwestern part of the county. This extends from just west of Cedar Hill in a general northerly direction to a point west of Dallas. Many small areas lie along the valley slopes of Fivemile and Cedar Creeks south of Dallas, along other steep slopes near Dallas, and along White Rock, Spring, and Rowlett Creeks and other streams in the northern part of the county.

The Houston chalk lies on steep slopes, and in places, as along the White Rock Escarpment, the slopes are precipitous and rough. Over practically all the type the run-off sweeps away the fine earth about as rapidly as it is formed.

None of this type is in cultivation, except on occasional small included patches where the Chalk has 2 or 3 inches of surface soil. A little cotton, sorghum, and small grain is grown, with rather low yields. The surface is covered with a thicket growth of small trees consisting of cedar (juniper), oaks, elm, hackberry, box elder, red-bud, honey locust, sumac, mesquite, smilax ("bamboo"), prickly pear and bear grass. The oaks are shin oak (*Quercus brevilobata*) and an oak resembling red oak (*Quercus texana*).

The land is valued mainly for the scant pasturage it affords, some grass growing in the crevices and valleys where soil accumulates. The land has little agricultural value. It commonly forms parts of farms composed mainly of other soils and depreciates the selling price according to its area. Sweet clover succeeds on land of this kind and has been used successfully for reclaiming badly washed areas in parts of the South. By the construction of dams and terraces and the growing of such crops as sweet clover and peas, portions of this badly washed land in Dallas County could be restored to use.

ELLIS CLAY.

The Ellis clay is a brown or slightly greenish brown, waxy, heavy clay, underlain at about 8 to 12 inches by greenish-yellow or light

greenish brown, plastic, sticky (when wet), heavy clay, becoming more yellowish with increasing depth. The subsoil normally has a distinct greenish shade. Locally the lower subsoil consists of a friable mixture of greenish-yellow clay and greenish-brown to bluish, partly decomposed shale. In places no shaly material is found within the 3-foot section, while in some eroded areas it is present within the surface soil. Where there is much of this shale the material is friable.

In places the soil and subsoil are calcareous, as the result of wash from higher lying calcareous soils. Such areas are in reality small inclusions of Sumter clay. On the steeper slopes the surface soil is only 2 or 3 inches deep. On some areas hard limestone blocks of considerable size fallen from above are found. In other places small gravel of limestone and quartz is scattered over the surface. This coarse material comes from higher lying gravel beds occurring in old stream terraces.

The Ellis clay is not a very extensive type, though it occupies several good-sized areas in the western part of the county. Some of the main areas lie just west of and below the White Rock Escarpment. Others lie along the larger stream valley slopes a few miles southeast of Coppell.

The topography is very rolling to hilly, and many of the slopes are very steep. The surface is subjected to severe erosion and is cut by gullies and the beds of small intermittent streams, which reach into all parts of the type.

Probably not more than 20 per cent of the type is cultivated. It is mainly used for pasturage, as it is a prairie soil with a good growth of grass, of which a considerable part is mesquite grass. Some of the badly eroded slopes are bare of vegetation, but most of the soil has a covering of grass and weeds, and a scattering growth of small mesquite trees.

The cultivated land is used mainly for oats and wheat, and a little sorghum and cotton. In favorable seasons oats yield 20 to 40 bushels per acre; wheat, 10 to 20 bushels; and cotton one-fourth to one-half bale per acre, but in dry seasons the yields are very light.

This soil requires considerable rain, as the topography is such that most of the rainfall runs off rapidly. In dry weather the soil bakes very hard. Much of the type is unsuitable for cultivation because it is eroded, the surface being cut into rough, gullied and steep slopes. Where smooth enough for cultivation, the soil appears to be more adapted to oats and wheat than to other crops. Doubtless the soil is better suited for pasture than for cultivated crops. The mesquite and other grasses growing in virgin areas afford fair grazing. Some farms are composed partly of this type, and tracts made up principally of the best grade of this type are reported as selling for \$75 to \$100 an acre.

This soil is better suited for pasturage than for anything else. Where cultivated, measures should be taken to prevent erosion and washing. Also barnyard manure or other organic matter should be incorporated to make the soil more productive.

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

Mechanical analyses of Ellis clay.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
445457	Soil, 0 to 8 inches.....	0.7	8.7	5.0	7.3	2.7	29.9	45.9
445458	Subsoil, 8 to 36 inches..	.8	10.3	6.4	14.8	4.1	27.9	35.7

BELL CLAY.

The typical Bell clay consists of a black or dark ashy gray clay, which either shows but little change in the 3-foot section or passes into ashy-black or dark ashy gray clay having a faint bluish cast. In the very flat areas the grayish color of soil and subsoil is more pronounced than elsewhere. In some places the lower subsoil is a greenish-brown clay containing whitish lime particles or concretions, this being noticed particularly in the shallow development of the type over the Eagle Ford shales, as at Arcadia Park.

Generally the soil and subsoil are calcareous, and small lime concretions appear throughout the soil section in many places. In some areas the surface soil does not effervesce with hydrochloric acid, and in places there is no effervescence above 24 inches. Small areas included with the type show no effervescence throughout the soil section; these are included areas of the Irving clay.

A very few areas of the type show a spotted brown and black surface in freshly plowed sod land. This is due to the presence of "hog wallows" where the slight elevations are brown and the depressions black. This difference in color and the inequalities called "hog wallows" tend to disappear with cultivation, but the fields maintain, at least for a long time, the spotted appearance.

The Bell clay is underlain at variable depths by beds of gravel. In many places these beds are several feet thick; in others they are very thin. The gravel is for the most part composed of hard chalk and limestone, though in places quartz and sandstone appear. The gravel is principally in a friable yellowish clay matrix, with considerable soft lime or whitish limy clay. Locally it is cemented into a hard stratum or "concrete."

The soil of the Bell clay is very sticky when wet, but when moisture conditions are favorable it is easily cultivated, breaking into a very friable mellow or crumbly seed bed. A mulch is easily maintained throughout the growing season by shallow cultivation. In appearance this type resembles the Irving clay, but it differs from the latter in that it is calcareous, does not bake so hard, and is more friable.

The Bell clay is a rather extensive soil type occurring in practically all parts of the county. It is locally called "black land" and considered in the same class as the Houston black clay. In many places where these types adjoin a separation is rather difficult, and boundary lines between them have to be drawn arbitrarily. The Bell clay occurs as old stream terraces high above the stream bottoms. One of the principal as well as most typical areas is located in the northern part of the county along the Trinity

River bottom, just east of Carrollton and Farmers Branch. This terrace is much higher farther north and in Denton County the soil on it was mapped as Bell clay, high-terrace phase. Love Field and much of the city of Dallas lie on this type. Large areas occur in the eastern part of the county bordering the East Fork of the Trinity River and Rowlett, Duck, Mesquite, and Muddy Creeks, and the Trinity River bottoms in the southeastern part of the county. Other large bodies of this soil lie around Lancaster in the southern part, around Grand Prairie in the western part, and Coppell in the northwestern part, and one large area is located just west of Pleasant Grove in the east-central part of the county. Small areas occur along many of the streams in practically all sections.

The surface of the Bell clay is almost level. (Pl. XXI, fig. 2.) Some areas are slightly depressed. In its original state the surface of much of this type is covered with so-called "hog wallows," but these disappear after the land is broken and put in cultivation.

Surface drainage is rather poor, but sufficient to allow cultivation. On many farms the drainage has been improved by ditching. In wet seasons crops suffer from an excess of moisture, and in wet springs planting is often considerably delayed.

A good feature of this type is that nearly everywhere a constant supply of water for home use is obtained in wells not more than 30 or 40 feet deep. The water is found in the gravel or sand beds which underlie this type.

Practically all this type is in cultivation, there being probably not more than 1 per cent uncultivated. Part of the type was originally open prairie land, but much of it was covered with a growth of elm trees, with some hackberry and post oak. In places there was a heavy growth of trees and underbrush, which gave rise to the local name of "thicket land."

The Bell clay is a very productive soil, and, owing to its freedom from erosion, it is possibly more productive than many areas of the Houston black clay.² The crops are those commonly grown in the

² The Bell clay is very similar to the Houston black clay, especially where the latter type is flat. Chemical analyses of the upper 6 inches of the two soils show that this similarity is carried out in the constituents of the soil material.

Chemical analyses of the surface soil of the Bell clay and Houston black clay.

Constituent.	No. 445411. Houston black clay, 0 to 6 inches, 3½ miles south of Garland.	No. 445412. Houston black clay, 0 to 6 inches, 3¼ miles south of Garland.	No. 445413. Bell clay, 0 to 6 inches, 1 mile northeast of Cheisa.	No. 445414. Houston black clay, 0 to 6 inches, Pleasant Valley.	Constituent.	No. 445411. Houston black clay, 0 to 6 inches, 3½ miles south of Garland.	No. 445412. Houston black clay, 0 to 6 inches, 3¼ miles south of Garland.	No. 445413. Bell clay, 0 to 6 inches, 1 mile northeast of Cheisa.	No. 445414. Houston black clay, 0 to 6 inches, Pleasant Valley.
	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
SiO ₂	71.67	74.90	65.09	61.30	P ₂ O ₅	0.09	0.05	0.18	0.10
TiO ₂	0.69	0.80	0.89	0.79	SO ₃	0.08	0.04	0.05	0.10
Fe ₂ O ₃	2.69	3.48	4.30	4.45	N.....	0.21	0.18	0.09	0.15
Al ₂ O ₃	8.74	10.05	12.90	13.29	Ignition loss.....	10.27	7.82	8.92	11.18
MnO.....	0.08	0.05	0.05	0.04	Moisture.....	4.85	3.55	7.00	6.60
CaO.....	3.02	1.36	5.10	6.00	CO ₂ (from carbonates)	1.05	None.	1.24	2.30
MgO.....	0.73	0.64	1.33	1.32	Organic matter.....	4.18	3.96	2.18	3.12
K ₂ O.....	0.78	0.64	1.29	1.49					
Na ₂ O.....	0.50	0.49	0.64	0.55					

Analyst, G. J. Hough.

county—cotton, corn, wheat, and oats, with some sorghum and millet for hay.

Cotton yields from one-half to 1 bale per acre, corn 20 to 50 bushels, wheat 15 to 35 bushels, and oats 30 to 80 bushels. Sorghum and millet produce good yields of hay, ranging from 2 to 4 tons per acre. The soil, where well drained, is well suited to alfalfa, but almost none is grown. The soil is not especially well suited to vegetables or fruits, but enough can easily be grown to supply the home.

Farms on this type have sold for \$200 to \$300 an acre. The price varies with the location, character of farm buildings, and the location with respect to good roads and markets.

Bell clay, low phase.—The surface soil of the Bell clay, low phase, is a black to dark-gray clay about 12 inches deep, and the subsoil is a dark bluish gray or dark-gray clay, ranging in places to dark brown or black. The soil and subsoil are prevailingly calcareous, although there are some areas where the surface soil does not effervesce with hydrochloric acid, and the subsoil but slightly. These places are in rather poorly drained situations, and here the surface is inclined to pack somewhat on drying. Usually the soil is friable when cultivated properly and a shallow surface of friable crumbly structure is easily maintained. In places at depths of a few feet there are beds of gravel, consisting of well-rounded particles of quartz, sandstone, and limestone.

This phase is very similar in most respects to the typical soil. The chief difference is that it occurs on a low terrace only a few feet above the stream bottoms, but not so low that it is overflowed by backwater from the main streams.

Although not very extensive, this soil occurs in a number of small bodies bordering the Trinity River bottom lands. From Letots northward the Missouri, Kansas & Texas Railway follows a narrow area of it. Other small areas lie just south of Dallas and east of Hutchins and Wilmer.

The surface is level or essentially so, resulting in only fair drainage. The underdrainage is better. Ditches have been dug over most parts, but in seasons of heavy rainfall the land is sometimes too wet for the best development of crops. As the soil lies at the foot of slopes, it often receives much surface water. This is being prevented by ditching.

The same crops are grown and practically the same yields obtained as on the higher lying areas of Bell clay. This land is practically all in cultivation and constitutes a valuable soil. Originally it supported a heavy growth of elm, hackberry, and oak, and some pecan. Alfalfa is grown very successfully in small fields on this soil. Farms composed largely of this soil have sold for \$200 to \$300 an acre.

LEWISVILLE CLAY.

The surface soil of the Lewisville clay is a brown to rather dark brown clay about 8 to 12 inches deep, and the subsoil is a light-brown to yellowish-brown clay gradually becoming more yellow and less brown with increasing depth. At about 24 to 36 inches the subsoil is yellow or greenish yellow and in places very friable, owing to the presence of whitish limy material of a chalky nature. The

subsoil has a greenish cast in places, and may be greenish brown or greenish yellow in the lower part. In many places there is some small gravel of limestone and quartz on the surface and throughout the soil and subsoil. In other places gravel beds, from a few inches to several feet thick, lie several feet below the surface. This gravel in places is largely of chalk or soft limestone and in some beds it consists mainly of quartz, chert, sandstone, and limestone. Locally the gravel is cemented with lime, forming a hard conglomerate or "concrete."

Included with this type are a few small areas which closely resemble the Abilene clay. The surface soil here has a faint reddish or chocolate color. Some very small areas of Lewisville loam also were included with the Lewisville clay.

In appearance and texture this type is similar to the Houston clay, and in places where these types adjoin they are separated with difficulty. The two soils differ materially in their origin, the Lewisville coming from old terrace deposits and the Houston being residual, i. e., derived in place from the underlying rock.

The Lewisville occurs in nearly all sections of the county. Some of the largest areas lie in the western part, one area of several square miles is mapped between Coppell and Sowers, and others west and south of Grand Prairie. These large areas occupy old terraces high above the present streams and as high or higher than some of the residual soils. The other areas are also on old stream terraces, and although generally rather high, they are apparently of more recent development than the large areas mentioned, and their relationship to certain streams is more apparent. These occur near the Trinity River, its East Fork, Mountain Creek, Tenmile, Fivemile, White Rock, Rowlett, and other creeks in practically all parts of the county.

The topography is prevailingly gently rolling, only small areas having a nearly level surface. In many places the slopes are rather steep, reaching down from the level areas of the Bell clay to the stream bottoms below. The surface drainage is good, and in places the soil washes rather badly. Where the slopes are considerably eroded, an eroded phase has been mapped. Some areas of this character, too small to map, were of necessity included with the Lewisville clay.

Some of the main areas of this type were originally prairie land, with a heavy sod of mesquite and other grasses and a scattering growth of post oak, elm, and mesquite trees. On others a rather heavy growth of post oak and elm and some hackberry trees grew. Probably 85 per cent or more of the type is in cultivation. Some of the steeper slopes are used for pasturage.

The land is esteemed as a productive soil. It has good internal drainage and dries out and warms up early in the spring, as compared with the more nearly level soils. The main crops grown are cotton, corn, wheat, oats, and sorghum. In ordinary seasons cotton yields one-half to three-fourths bale per acre, corn 20 to 40 bushels, wheat 15 to 35 bushels, and oats 30 to 80 bushels. Under especially favorable conditions the yields are materially larger. The soil is suited to alfalfa, but the crop is not grown. It also produces good yields of broomcorn. It seems better adapted to wheat and oats and probably to other small grains, than to corn. This soil requires somewhat more rain than the heavy more nearly level soils.

The Lewisville clay is very sticky when wet, and bakes rather hard in uncultivated fields, but if plowed when moisture conditions are just right, the soil becomes very friable or crumbly to a depth of 2 or 3 inches and is easy to keep in this condition. The land should be terraced to prevent erosion. It would respond well to applications of barnyard manure and the turning under of vegetable matter. Farms on the Lewisville clay sell for \$150 to \$250 an acre.

Lewisville clay, eroded phase.—The Lewisville clay, eroded phase, includes areas on steep slopes where the greater part of the original brown surface soil of the type has been removed by erosion. The surface soil is a yellow or yellowish-brown clay grading at 6 or 8 inches into yellow clay, which continues to 36 inches. Both soil and subsoil are calcareous, and the lower subsoil is very friable and contains soft chalky fragments. In places 2 to 6 inches of brown clay constitute the surface layer; these places represent small included areas of a shallow phase of the Lewisville clay. Small rounded gravel of quartz and limestone is scattered over the surface and throughout the soil and subsoil in many places, and here and there the underlying beds of gravel lie within 3 feet or less of the surface.

This phase occurs in a number of narrow strips occupying slopes in the western part of the county near Grand Prairie, and in some small areas in the northeastern part.

The surface is rather steeply sloping and the run-off is rapid, washing the soil badly and in many fields forming gullies. The type is utilized principally for pasture. Such crops as are grown give only moderate yields. Cultivated fields should be terraced to prevent erosion, but the phase is best suited for permanent pasture.

Lewisville clay, gravelly mixed phase.—The gravelly mixed phase of the Lewisville clay consists of brown or dark-brown clay, 8 to 12 inches deep, overlying yellowish-brown or yellow clay, with locally a greenish cast. The soil and subsoil are both calcareous. Small rounded quartz and sandstone gravel is found in varying quantities on the surface and throughout the soil and subsoil. Included with this soil are numerous small spots of deep black clay, some calcareous (Bell clay) and some non-calcareous (Irving clay); and some areas of dark-brown to black clay overlying dull-red clay with yellowish-brown mottling, the yellowish color increasing and the red decreasing with depth (Leaf clay). The spots of Leaf clay are only a few feet across, yet they constitute as much as 50 per cent of the surface in places. There are also many small spots consisting of gravelly sandy loam, shallow gravelly clay loam, and gravelly clay, all of the Leaf series.

This phase of the Lewisville clay occurs in a few small areas in the northwestern part of the county. Some of these lie about 2 miles northeast of Sowers, and a mile or more northeast of Estelle. The largest area is a short distance northeast of Hackberry School and smaller areas are near Gentry School. This soil is closely associated with the Lewisville clay, and is likewise derived from old water-laid deposits.

The surface is gently rolling to nearly level and the slopes are smooth. Drainage is good. During heavy rains there is some surface wash.

This phase is prairie land, similar to the Lewisville clay. The same crops are grown and approximately the same yields are obtained as on the type. The selling price for this land is about the same as for the surrounding areas of the typical soil.

Lewisville clay, low phase.—The low phase of the Lewisville clay consists of brown or dark-brown calcareous clay, 10 to 14 inches deep, underlain by a light-brown to yellowish-brown calcareous clay. In places the subsoil has a greenish cast. Some areas show very little change within the 3-foot section.

This phase occupies a few small areas in the southwestern and western parts of the county, mainly along the edge of areas of the Catalpa clay, which forms the bottoms of Mountain Creek. In places the phase merges with the bottom lands in such a way that there is no well-defined line of separation. On the upper side the phase is bordered mainly by the Ellis clay, and here the soil consists largely of material washed from that type. A few small areas lie near Eagle Ford several miles west of Dallas.

This soil occupies stream terraces lying only a few feet above overflow. The surface is nearly level, but has a long very gentle slope toward the main streams and away from the adjoining uplands. The drainage is fairly good, the surface water flowing off gradually in most places after rains, without much erosion.

Probably 90 per cent of the phase is in cultivation, the uncultivated areas being used for pasture. There is a good growth of mesquite and other grasses and a scattering growth of small mesquite trees. Although rather heavy and sticky when wet, the soil works into a friable, crumbly mass. The leading crop is cotton, with smaller acreages of corn, wheat, and oats. The soil is productive and good yields are obtained in most years. Cotton yields one-half to 1 bale per acre, corn 20 to 50 bushels, wheat 15 to 30 bushels, and oats 25 to 75 bushels per acre. Sorghum yields 2 to 4 tons of fodder per acre. Alfalfa does well, though very little is grown.

This soil sells at the present time with other soils at about \$100 to \$200 an acre.

CAHABA FINE SAND.

The Cahaba fine sand is a grayish-brown to brownish-gray loamy fine sand grading at about 5 to 12 inches into yellow loamy fine sand having a slight reddish or reddish-yellow cast. The immediate surface dries out to a gray color. Where the soil has never been cultivated the brownish surface layer is only a few inches deep, while in cultivated fields it is somewhat deeper. Locally at about 30 to 48 inches, reddish friable sandy clay is reached, which in places contains beds of rounded quartz, sandstone, and limestone gravel.

Small areas of Kalmia fine sand and Cahaba fine sandy loam are included with this type as mapped. The surface soil of the Cahaba fine sand is so loose that in freshly plowed fields it sometimes drifts during the heavy winds of early spring. It is locally known as a "blowy" soil.

The Cahaba fine sand is not an extensive type in Dallas County. It occurs in a number of small areas on the low terraces of the Trinity River, West Fork, and Elm Fork bottoms. One area is about 2 miles north of Grand Prairie; others lie west of Letots, just

south of Dallas, and a few miles east and southeast of Hutchins. The surface is nearly level. The drainage is thorough, as water passes rapidly downward through the porous sand.

Probably 80 to 90 per cent of the type is in cultivation. The uncleared areas support a forest growth consisting mainly of black-jack oak, with some post oak and other trees. Wild grapevines flourish in the native forest. The soil is utilized to some extent for cotton, corn, and sorghum, but is too light for best results with these crops. With ample rainfall and a favorable season the land yields one-fourth bale of cotton and 10 to 20 bushels of corn per acre. The type is used to some extent for the production of vegetables, peanuts, sweet potatoes, watermelons, and fruit, and is well suited to these crops. Peaches yield well in favorable years. The soil is also well suited to grapes, plums, and other small fruits, though the production of these products is negligible. The soil is entirely too light for small grains or alfalfa.

The Cahaba fine sand should be utilized to a greater extent in growing vegetables, fruit, berries, peanuts, and melons. Barnyard manure and other organic matter, especially peavines, would add considerably to the productiveness of the soil.

CAHABA FINE SANDY LOAM.

The surface soil of the Cahaba fine sandy loam is a brown, grayish-brown, yellowish-brown, or pale-yellow friable fine sand to loamy fine sand, about 10 to 14 inches deep, and the subsoil is a red to reddish-yellow friable fine sandy clay. In places the subsoil is lighter in texture and somewhat compact in the lower part. Where the soil has never been cultivated a layer of 2 or 3 inches of the surface is brown, owing to accumulations of organic matter. In cultivated fields the immediate surface dries out to a grayish or grayish-brown color. Some eroded slopes with a shallow surface layer have a reddish color.

In a few small areas the surface soil contains considerable medium and coarse sand and even fine gravel. These are areas of Cahaba sandy loam too small to separate. Some areas near the Leaf or Irving soils have a rather stiff clay subsoil, slightly mottled with yellowish and reddish colors, and some patches of the Leaf and Irving fine sandy loams have been included with the type.

In many places at depths of several feet there are beds of smooth round limestone, quartz, and sandstone gravel imbedded in a reddish sand and clay matrix. The material does not effervesce with hydrochloric acid either in the soil or subsoil.

The Cahaba fine sandy loam occurs in several areas of more than a square mile in extent around Irving in the western part of the county. Smaller areas lie near Dallas and in the southern part of that city. Small bodies occur also in the southeastern part of the county, bordering the Trinity River bottoms.

The topography in general is gently rolling, though some slopes are rather steep and eroded. There are a few level or nearly level areas. The drainage is good. The type holds moisture well even in dry seasons, the heavy subsoil being a good reservoir for water.

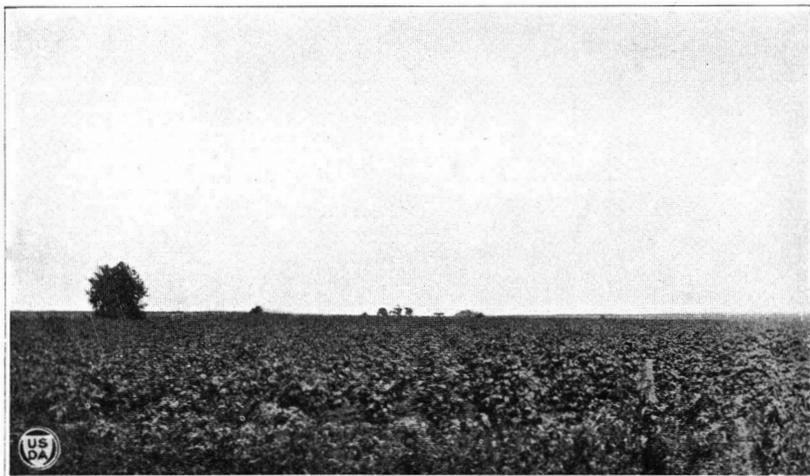


FIG. 1.—COTTON ON HOUSTON BLACK CLAY.

Showing level to undulating topography characteristic of this type.



FIG. 2.—COTTON AND CORN ON BELL CLAY.

This view shows the flat surface characteristic of the type.

Probably 90 to 95 per cent of this type is in cultivation. The uncleared land supports a forest growth of post oak, with some blackjack oak and a number of shrubs and vines.

The principal crops are cotton, corn, and vegetables. Small fields of oats are grown mainly for pasturage, though some of the grain is allowed to mature and is cut and fed in the sheaf. Crop yields vary according to the condition of the soil. Some land that has been in cultivation for many years is run down and does not produce large yields. On well-preserved fields of the type cotton yields one-fourth to three-fourths bale per acre, and corn 15 to 30 bushels per acre.

In places, especially around Irving, the type is utilized in growing vegetables for Dallas and other local markets. Some of these farms produce cotton, corn, sorghum, and vegetables; others are devoted entirely to the production of vegetables. The soil is well suited for this purpose. Many different truck crops are grown. Irish potatoes are grown with success, the Irish Cobbler and Tennessee Triumph being the most popular varieties. Potatoes give much the best results on land that has been manured heavily, yielding 100 bushels or more per acre. Sweet potatoes do well, the yield ranging from 200 to 300 bushels and more per acre. The Vineless, Dooley, and Pumpkin "Yam" are favorite varieties, though the Porto Rico variety is proving to be a good yielder. Some sorghum is grown, much of it for hay or roughage for stock, but on many of the farms a part is used for making sirup.

Fruit is grown in many small orchards for home use and some is sold locally. Grapes do especially well, the Moore Early variety being considered about the best. Peaches yield well when not injured by late frosts. It is estimated that a good crop of peaches is obtained about three years out of five. The Mamie Ross, Early Wheeler, Crawford, and Elberta are the leading varieties. Plums and other small fruits and berries do well and are produced in small quantities for the local markets.

A few fields of alfalfa were seen on the type. The crop was thrifty and had been on the land for several years, averaging 3 to 5 tons per acre per season from three or four cuttings. The land had not been fertilized or inoculated when the alfalfa was sown.

The soil of this type is productive where the fertility has been maintained by manuring or by turning under vegetable matter. In growing vegetables, barnyard manure has proved most valuable. The farmers use what manure is available, but it is scarce and the cost of hauling or shipping in is high. Not enough stock is kept by most of the farmers to furnish the needed manure. Commercial fertilizers have been used very little, but doubtless nitrogenous and phosphatic fertilizers would prove valuable. Where the surface of this type is sloping the land should be terraced to prevent erosion.

Good water is obtained in wells 26 to 40 feet deep, but some are drilled as deep as 300 feet and get a very plentiful supply. Here and there very small acreages are irrigated by pumps from wells. This has proved profitable in dry seasons.

Farms composed entirely or mainly of this type bring \$150 to \$300 an acre. Small, well-improved farms bring somewhat higher prices.

Cahaba fine sandy loam, low phase.—The Cahaba fine sandy loam, low phase, consists of brown or grayish-brown fine sand or loamy fine sand grading at about 4 to 8 inches into yellowish-brown, pale-yellow, brownish-yellow, or reddish-brown fine sand or loamy fine sand, which at 12 to 15 inches is underlain by red friable sandy clay. When dry the immediate surface has a grayish or brownish-gray color. The soil and subsoil of the phase are very similar to the typical soil in color and texture. Beds of rounded quartz and limestone gravel underlie this soil at depths of only a few feet. Some of the most valuable commercial gravel in the county is found in these beds.

This phase is not very extensive. It occurs in a number of small areas scattered along the bottoms of the West Fork and Elm Fork as well as the main stream of the Trinity River. Some of these lie west of Carrollton, Farmers Branch, and Letots, in the northwestern part of the county, others lie north of Grand Prairie, and some are in the vicinity of West Dallas. Small areas also occur in the Trinity River bottoms, in the southeastern part of the county.

The Cahaba fine sandy loam, low phase, is level to very gently undulating. It occupies terraces only a few feet above the bottom lands and in times of unusually high overflows some parts of the surface are overflowed. The drainage is sufficiently good, however, to enable successful cultivation. Good water is obtained in shallow wells.

Practically all this soil is cultivated. Small uncleared areas support a heavy growth of post oak, with some blackjack oak and other trees. The same crops are grown, and practically the same or slightly better yields obtained, as on the typical Cahaba fine sandy loam. The phase is especially well suited to vegetables, berries, and fruit, though it is utilized mostly for cotton and corn. Owing to the smoother surface and the absence of erosion, this soil is probably somewhat more productive than the Cahaba fine sandy loam of the higher terraces.

The same methods of keeping up the productiveness of this soil should be employed as on the typical soil. This land sells for about the same price as the typical soil.

LEAF GRAVELLY SANDY LOAM.

The surface soil of the Leaf gravelly sandy loam is a brown to dark-brown sandy loam, 8 or 10 inches deep. The subsoil is a stiff, plastic red clay or a mottled red and yellow or red and yellowish-brown, stiff, plastic clay, which with increasing depth becomes mottled with gray, and also with yellow where the upper subsoil is red. Small quartz gravel occurs throughout the soil and subsoil and scattered over the surface. When dry the soil is grayish brown at the immediate surface.

This type is of slight extent, occurring only in a few small areas in the western part of the county around and near Sowers. The surface is flat to gently sloping and the drainage is fairly good.

Practically all the type is cultivated, only a few small patches of the original post oak forest remaining. The leading crops are cotton, corn, wheat, and oats. Cotton yields one-half bale per acre; corn, 15 to 40 bushels; wheat, 12 to 25 bushels; and oats, 30 to 60 bushels per

acre. It is said that the wheat produced on this soil is of unusually good quality. Some vegetables are grown successfully for home use. Peaches, pears, plums, and berries grow well in the small home orchards.

This land has sold with associated soils for as much as \$200 to \$250 an acre.

LEAF FINE SANDY LOAM.

The Leaf fine sandy loam consists of brown fine sandy loam grading at about 2 to 4 inches into a yellowish-brown, brownish-yellow, or pale-yellow fine sand or fine sandy loam, which extends to a depth of 8 to 15 inches. Below this appears a subsoil of yellowish-brown sandy clay loam, passing at about 20 inches into heavy, stiff, plastic clay, mottled red, yellowish brown, and gray, the gray color increasing with depth and becoming dominant below about 24 inches. In cultivated fields the surface soil is a brown loamy fine sand to a depth of about 12 to 16 inches. When very dry the immediate surface has a grayish-brown color. Some small rounded quartz gravel occurs on the surface in places. Small areas of Irving fine sandy loam are included with this type as mapped, many of them being too small to show separately on the map. Small eroded areas of the Leaf fine sandy loam having a very shallow surface soil occur in some places in the southeastern part of the county. Such areas were too small to map.

The Leaf fine sandy loam is rather extensive in this county. One large area about 5 miles wide, composed largely of this type, occurs on a high terrace just south of Mesquite. Smaller areas occupy a high terrace around Irving in the western part of the county. A few small areas are situated on low terraces in the Trinity River bottoms.

The topography is flat to gently rolling. Some slopes are rather steep, but as a rule the slopes are occupied by the Cahaba fine sandy loam. On the more nearly level and the slightly depressed areas the surface drainage is poor, the subsoil being so stiff and heavy that water passes downward very slowly. In such places water stands in wet seasons and the soil remains saturated for a long time. In these depressions and flat spots numerous very small areas of the Irving soils occur. On some slopes the surface soil is eroded, and in places a considerable part of the soil has been washed away, and the subsoil is near the surface.

Probably 90 per cent of the type is cultivated. The remaining forest growth is mostly post oak, with some blackjack oak, hickory, and hackberry. The main crops are cotton, corn, and sorghum. Small fields of oats are common. The soil where properly handled is productive. In good seasons cotton yields about one-half bale, and corn, 15 to 30 bushels per acre. Sorghum yields 2 to 4 tons of hay. Some sorghum is made into sirup on the farms.

The better drained areas of the type are well suited to vegetables and fruits, and on many farms these are grown for the local markets. Good yields of all kinds of vegetables are obtained. Sweet potatoes, watermelons, and peanuts are grown to a considerable extent. Much of the truck and fruit is grown on small farms in conjunction with cotton and corn.

Many small pear orchards have been established on this soil in the vicinity of Seagoville, Kleburg, and Rylie. While fruit is grown successfully in favorable seasons, it seems that many of the trees become infected with blight and are short lived.

In many fields the land requires artificial drainage. This can be accomplished in a measure by open ditches, but tile drains would be very beneficial. The soil responds well to barnyard manure. Plowing under vegetation, especially peavines, improves the productiveness greatly, and at the same time helps to prevent the strong tendency of the soil to bake and crust.

Farms in favorable locations sell at the present time for \$150 to \$200 an acre, according to location and improvements.

AMITE FINE SANDY LOAM.

The surface soil of the Amite fine sandy loam is a reddish-brown loamy fine sand 10 to 15 inches deep, and the subsoil a friable red sandy clay. In places the immediate surface is brown, but at a depth of a few inches it changes to reddish brown.

This type occurs in a few small areas on old terraces in the western part of the county along the Tarrant County line. It is closely associated with the Cahaba fine sandy loam and resembles that type considerably, the main difference being that there is more red color in the surface soil. The surface is level to gently sloping, and the drainage is good.

Over 90 per cent of the type is in cultivation, the uncleared areas supporting a growth of post oak and blackjack oak. This soil is utilized for the same crops as the Cahaba fine sandy loam, produces as well, and requires the same treatment to maintain its productiveness.

KALMIA FINE SAND.

The Kalmia fine sand is a gray or brownish-gray, loose, fine sand, 3 to 8 inches deep, underlain by pale-yellow, loose, fine sand. When dry the immediate surface has a very light gray color.

This type covers only a small total area. It occurs on terraces lying a few feet above the bottom lands along the Elm Fork and West Fork and the main stream of the Trinity River. The type is closely associated with the Cahaba fine sand and differs little from that type. It is also associated with the Cahaba fine sandy loam, low phase. One of the largest areas lies about 4 miles east of Hutchins. Other small bodies are mapped near Letots and Farmers Branch.

The Kalmia fine sand is level and has good drainage, water passing downward through the loose subsoil. Small areas are overflowed during exceptionally high floods. Some areas of the type have been formed within the last 20 years by the deposition of sand on the bottom lands.

Perhaps 75 per cent of the type is cultivated. The original vegetation consists mainly of blackjack oak. Some cotton and corn is grown with very small yields, probably somewhat less than on the Cahaba fine sand. Small amounts of vegetables, fruit, peanuts, and sweet potatoes are grown. The type is suited to early vegetables, grapes, and berries. The soil drifts badly where unprotected. For

best results heavy applications of barnyard manure are needed, and cowpea vines should be plowed under for the formation of humus. The soil dries out badly in dry weather and requires considerable rain for good yields.

IRVING FINE SANDY LOAM.

The Irving fine sandy loam consists of a dark-gray or ashy-gray to brownish-gray, heavy fine sandy loam, 8 to 12 inches deep, overlying the subsoil of dark-gray, heavy clay. In places the subsoil is bluish gray and is rather tough and compact in the lower part. Fine black concretions and some rounded quartz pebbles occur in places. On drying after rains the surface soil forms a hard crust, but if the soil is cultivated when the moisture conditions are just right, the surface becomes loose and friable.

This type occurs in numerous small areas, many too small to map, throughout large bodies of the Leaf fine sandy loam. Some areas lie around Irving in the western part of the county, but the main development is in the southeastern part of the county. One of the larger areas is near Rylie, and others are near Seagoville.

The surface is generally flat, and in many places the type occupies depressions only slightly lower than the surrounding Leaf fine sandy loam. The surface drainage is poor, and the heavy subsoil allows only a slow downward movement of water. Some areas occur at the heads of small draws, and here the drainage is somewhat better.

Most of the land is in cultivation, and only a small proportion remains in the original forest of post oak and blackjack oak. The important crops are cotton and corn. Cotton yields about one-half bale, and corn, 15 to 30 bushels per acre. Sorghum yields fairly well, being grown principally for forage. In one field, which has been drained adequately by ditching, alfalfa has been grown successfully for several years, and the yields have been good.

The Irving fine sandy loam is not so well suited for corn or vegetables as for cotton. It is said that garlic does unusually well on this type. Some pecan trees have also been grown successfully. Farms including this soil but composed mainly of other types, sell for \$150 to \$250 an acre.

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

Mechanical analyses of Irving fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
445474	Soil, 0 to 8 inches.....	1.0	4.9	8.3	40.1	19.0	21.1	5.6
445475	Subsoil, 8 to 36 inches..	.4	2.2	4.6	29.7	20.0	27.4	15.7

IRVING SILT LOAM.

The Irving silt loam is a gray or ashy-gray silt loam passing abruptly at depths of about 8 to 10 inches into an ashy-gray, sticky, plastic clay. When wet the soil is dark gray, but on drying it assumes a light ashy gray color, almost white at the immediate surface. Occasional slight mottlings of yellow or brown are found in the subsoil. In cultivated fields there is in places little difference in color

between the soil and subsoil. On drying the surface soil bakes quite hard, and if plowed when wet the material forms hard clods, which are difficult to pulverize. Neither soil nor subsoil effervesces in acid. The type resembles the Lufkin silt loam of the flatwoods of east Texas in its color and structural characteristics.

The Irving silt loam is a type of small extent in Dallas County. Three small areas lie near Irving in the western part of the county, and one about 6 miles southeast of Dallas near Prairie Creek School.

The Irving silt loam occurs on old terraces in close association with other soils of the Irving series and with the Leaf fine sandy loam. The surface is flat and the drainage is very poor. Water stands on the surface after rains, as the areas are somewhat lower than surrounding soils and the subsoil is almost impervious.

Probably 75 per cent of this land is in cultivation. The uncleared part supports a forest growth consisting mainly of post oak and blackjack oak, with a few hickory, hackberry, elm, and honey-locust trees.

The main crops are corn, cotton, oats, and sorghum. Corn yields 15 to 25 bushels per acre; cotton, one-fourth to three-fourths bale; oats, 20 to 40 bushels; and sorghum hay, 1 to 2 tons per acre; the yields varying according to the season and treatment. The soil requires considerable moisture in the summer for the best development of crops, but when the rainfall is heavy the fields become wet and soggy and crops are damaged. This wet condition is especially undesirable in the early spring, when plants are young or when the wet condition may prevent proper germination. Some wheat has been grown on the type, the yields averaging around 10 bushels per acre. The soil seems better adapted to small grains and cotton than to corn, vegetables, or fruits.

This land sells at the present time for \$100 to \$150 an acre along with associated soils.

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

Mechanical analyses of Irving silt loam.

Num-ber.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
445415	Soil, 0 to 8 inches.....	0.3	1.6	2.7	19.9	23.5	40.8	11.1
445416	Subsoil, 8 to 36 inches..	.6	2.3	2.3	15.4	15.4	31.3	32.7

IRVING CLAY.

The Irving clay is a dark ashy gray to ashy-black or very dark ashy brown clay about 12 inches deep, underlain by dark-gray, black, or bluish-gray clay, which is very tough, especially in the lower part. On the surface this soil looks very similar to the Bell clay. However, neither soil nor subsoil is calcareous. When dry the immediate surface assumes an ashy-gray cast. The surface soil dries out to a compact hard mass and is cultivated with difficulty, and it clods badly if plowed when wet. After several years of cultivation the surface soil seems to become somewhat lighter in color.

In places there are a few inches of sandy clay loam at the surface, as in an area about 5 miles southeast of Mesquite, where the soil is a very dark ashy brown to nearly black sandy clay loam 3 to 5 or 6 inches deep, grading into black or dark ashy gray clay or clay loam, which passes quickly into dark ashy gray clay, the lower subsoil changing to an ashy-gray sticky clay. In some patches the surface ranges to brownish fine sandy loam or loam and the subsoil to brown or grayish-brown sandy loam to sandy clay.

The Irving clay is not a very extensive soil type, although it occurs in a number of good-sized areas and some small ones scattered over a considerable part of the county. The main areas of the type are in the southeastern part of the county around Lawson and Simonds and just east of Pleasant Grove; in the southwestern part around Florence Hill; and in the western part north of Irving.

In most places the surface of the Irving clay is level or nearly level. In the vicinity of Lawson some areas are slightly sloping. The smaller areas are basinlike spots, usually at the heads of shallow draws. Drainage in many places is, therefore, rather poor, though usually sufficient to allow successful cultivation. In very rainy seasons crops suffer from standing water.

Most of the Irving clay is in cultivation; small patches are in pasture. The greater part originally supported elm and post oak trees, though some of it doubtless was prairie land. On virgin land there is now a scattering growth of small mesquite trees as well as a heavy growth of weeds and native grasses. Some volunteer lespedeza grows in places.

The chief crops are cotton, corn, oats, sorghum, and some wheat. The soil is quite productive and the yields of these crops are good when seasons are at all favorable. Cotton yields one-half to three-fourths bale per acre; corn, 20 to 30 bushels; oats, 30 to 60 bushels; wheat, 10 to 20 bushels; and sorghum hay 1 to 3 tons per acre; according to the season and soil management.

The soil appears to be better suited to small grains than to corn, and it is well suited to cotton and sorghum. The climatic conditions are quite important on this type. If there is considerable rain in early spring it is difficult to get a good growth of plants, owing to the saturation of the soil through lack of adequate drainage. If there is only a light rainfall in the spring and summer months, the surface bakes and the crops suffer. Although vegetables and small fruits are grown on this type in home gardens, the soil is not well suited to these crops. This land sells for \$100 to \$200 or more an acre.

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

Mechanical analyses of Irving clay.

Num-ber.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
445420	Soil, 0 to 12 inches.....	1.2	3.6	5.6	26.0	9.8	24.2	29.7
445421	Subsoil, 12 to 36 inches.	.9	3.7	5.2	25.1	10.4	24.7	29.9

TRINITY CLAY.

The Trinity clay is a very dark brown to black clay, about 12 inches deep, which grades into light-brown, brown, or black clay. There is little difference between the soil and subsoil in color and texture, the surface soil being a shade darker. In many places the surface soil and subsoil both consist of a dark bluish gray clay. The material is calcareous throughout. As a rule the type is brownish on the surface near the banks of streams, and in places the surface and subsoil here are lighter in texture than a short distance back from the stream, where the soil is uniformly dark in color and heavy in texture. When cultivated the surface soil forms a very friable mellow seed bed, and under shallow cultivation there is formed a surface layer 2 or 3 inches deep that is very loamy.

In a few places southeast of Kleburg in the southeastern part of the county some sand has been washed in and mixed with the soil. Such areas are so small that no separation could be made. They vary greatly in texture of surface and subsoil; in some places the surface has an admixture of fine sand, in other places it is heavy but the subsoil is quite sandy. The soil in such areas is not calcareous.

Locally in the river bottoms this type merges gradually into the Catalpa clay, and the boundaries are somewhat arbitrary. In many of the creek bottoms the soil is a brown clay and the subsoil is a light-gray very calcareous clay. In small strips adjacent to higher limy soils the Trinity clay has a gray surface and subsoil owing to wash from the adjoining slopes, but these areas are too small to map separately. In many places beds of limestone, quartz, and sandstone gravel are found 3 to 6 or 8 feet below the surface.

The Trinity clay is an extensive type and widely distributed throughout the county. It occupies the bottom lands along most of the rivers and smaller streams. The largest areas occur along the Trinity River in the central and southeastern parts of the county. Large areas also are mapped on Elm Fork and West Fork of the Trinity. The type occupies narrower strips along East Fork of the Trinity River, and Rowlett, Muddy, Mesquite, Duck, White Rock, Fivemile, and Tenmile Creeks, and many smaller streams. The bottom lands forming this type range in width from less than one-fourth mile along small streams to 4 miles or more along the Trinity River in the southeastern part of the county.

The surface is flat. Near the stream banks the land is slightly higher than most of the type. There are numerous dry shallow channels which assist in carrying off surface water from the lower areas back of the front lands. Where the land has not been cultivated the surface is characterized by "hog wallows," like those on the Houston black clay. On land that has never been cultivated the water stands for a long time after rains, but in cultivated fields much ditching has been done, which promotes ready surface drainage, and only in very wet seasons is the land too wet for cultivation.

The type is subject to overflows that destroy crops. Several years may pass without an overflow, but on the other hand there may be several overflows each year for several years in succession. These sometimes come in the spring and make replanting of crops necessary, perhaps several times, thus causing very late maturity. In the case of cotton this occasions a greater loss from the boll weevil and

boll worm. Some overflows come in the fall and cause damage to the matured crops.

Besides overflow waters from the main streams, there is also considerable surface water from the adjacent uplands which in ordinary seasons flows onto the Trinity clay, making large areas wet. This run-off is diverted in some cases by running ditches through the bottoms at right angles to the slopes. Such ditches not only take care of the surface water, but of many small streams that enter the bottoms from the uplands and spread out over the lower parts of the bottom lands. In addition to open ditches for the drainage of the Trinity clay, there is also in process of construction a comprehensive system of levees along the main streams to protect the main areas of the bottoms from overflow. These levees are being built by the State under the direction of the State Reclamation Service, private land owners paying certain taxes to defray the cost. Many miles of these levees are already built along Trinity River, along Elm Fork, West Fork, and East Fork of the Trinity, and along Rowlett Creek. These levees have proved very beneficial to the farms on the Trinity clay, and the value of the land has been greatly increased. In places a levee is also built paralleling the upland to keep the overflow water from small local streams from draining or overflowing onto the Trinity clay. An example of this is seen east of Wilmer, where a levee along the upland holds back the overflow water from Cottonwood Creek, Gravel Slough, and other short branches, as well as surface water from the upland slopes.

Probably 75 per cent of the Trinity clay is in cultivation. However, there are still some large bodies of the type that have never been cleared. These support a heavy forest growth, consisting chiefly of elm and hackberry with some ash, black locust, pecan, spotted oak, and other species of trees and smaller plants.

The principal crops are cotton and corn, in fact little else is grown. In favorable seasons cotton yields 1 bale and corn 40 to 60 bushels per acre. In wet seasons the crops get a late start, and the cotton stalks attain very large size. This makes conditions favorable for the boll weevil and boll worm, and the yields are cut materially. It is reported that in the season of 1920 the yields were so light in most sections that in some large fields of hundreds of acres no attempt was made to pick the cotton.

Some sorghum, grown for feed, produces very large yields. Alfalfa is grown in small fields on the type and yields around 1 ton or more at a cutting, with 4 or 5 cuttings in a season. Doubtless alfalfa will be grown more largely as the drainage problems are overcome. Small quantities of wheat and oats are grown on this soil, and in some seasons good yields are obtained. However, the growth of straw is often so rank that the crop lodges. Johnson grass grows very rank on this soil and is usually considered a pest, but in some fields it is allowed to grow and produces heavy yields of good hay. The Colorado or "hurrah" grass is also a great pest in cultivated fields. Most of the farming on this type is on large plantations.

The Trinity clay is a very rich and productive soil, and is comparatively easy to cultivate when the moisture conditions are right. Uncleared and unprotected bodies of the land sell for about \$100

to \$150 an acre, but farms that are in cultivation and that are protected from overflows are held for around \$200 to \$300 an acre.

CATALPA CLAY.

The Catalpa clay is a brown clay passing at about 6 to 12 inches into light-brown to yellowish-brown or grayish clay. The soil and subsoil are calcareous. In places the subsoil is brownish gray and contains soft particles of limy material and whitish concretions. This type resembles the Trinity clay except in color, which is lighter. Some beds of rounded gravel occur under this type. The soil is sticky when wet but crumbles on drying to a desirable crumb structure. In places along Mountain Creek the subsoil has a greenish color, as a result of wash from the greenish clay of the eroded areas of Ellis clay.

The Catalpa clay occurs as bottoms along Mountain Creek and some of its tributaries in the southwestern part of the county, and along the Elm Fork of the Trinity River in the northwestern part. In places these areas are 1 mile wide.

The surface of this type is level and the drainage is imperfect. By ditching the soil has been sufficiently well drained to allow cultivation. Some areas along Mountain Creek are protected by rather low levees, which hold back overflows except during the very heaviest freshets. The drainage problem is practically the same on this type as on the Trinity clay. Much damage is done to growing or matured crops by the overflows, and the land should be protected by strong, high levees.

Cotton and corn, with some sorghum, are the main crops. The yields are about the same as on the Trinity clay. The soil is well suited to alfalfa. The land sells for \$100 to \$200 an acre.

FRIO LOAM.

The surface soil of the Frio loam is a grayish-brown loam 6 to 12 inches deep, and the subsoil a brown, yellowish-brown, or yellow loam or fine sandy loam or in some places silty clay. In other places the surface soil is a loam grading through yellowish-brown fine sandy loam into bluish-gray heavy clay at about 20 inches. Small spots of Frio fine sandy loam occur within the areas of this type.

The Frio loam is developed in a few small areas in the western part of the county along the West Fork of the Trinity River and along Denton Creek. Most of it occurs in narrow strips and patches adjacent to the stream.

The surface is flat and is covered by overflows occasionally, but the drainage is fair. The type lies slightly higher than the main areas of the Frio clay with which it is closely associated.

Most of the Frio loam is under cultivation, being included in farms with the Frio clay. The crops grown and the yields obtained from these crops are much the same, the loam being probably a little less productive on the whole. The soil is well suited to vegetables, of which small quantities are grown. It is also well suited to alfalfa, but this crop is not grown at present.

The following table gives the results of mechanical analyses of samples of the soil, subsurface, and subsoil of the Frio loam:

Mechanical analyses of Frio loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
445424	Soil, 0 to 8 inches.....	0.2	0.2	0.2	19.9	40.5	20.6	18.4
445425	Subsurface, 8 to 20 inches.....	.0	.0	.1	21.1	50.9	18.1	9.8
445426	Subsoil, 20 to 36 inches.	.1	.6	1.8	11.1	23.6	35.4	27.2

FRIO CLAY.

The surface soil of the Frio clay is a brown or grayish-brown silty clay about 12 inches deep. The subsoil is practically the same as the surface soil, except that it is lighter in color, being a grayish-brown or light-brown to yellowish-brown silty clay. Near the banks of the streams the subsoil in many places consists of yellowish loam or fine sandy loam. The soil and subsoil are both calcareous. Included in the areas of Frio clay are small spots of Frio silty clay loam, Frio loam, and Frio fine sandy loam. These occur along the stream banks and are too small to map. Beds of quartz, sandstone, and limestone gravel underlie this soil in places at depths of several feet. The surface soil crumbles on drying and becomes very mellow and loose with cultivation. The extent of Frio clay is not great. The largest area lies along the West Fork of the Trinity River in the western part of the county. Smaller areas lie along Denton Creek in the northwestern part and along Walnut Creek in the southwestern part.

This is a first-bottom soil. It resembles the Catalpa clay, probably averaging somewhat lighter in color. The surface is flat but the drainage is sufficient to allow cultivation. Crops are sometimes destroyed by overflows, as none of this land is protected by levees.

About 80 or 90 per cent of this soil is cultivated. The forest growth of uncleared areas consists of hackberry, elm, pecan, and some ash and other trees. The main crops grown are cotton and corn. In most seasons good yields are obtained; sometimes overflows damage the crops greatly or destroy them. Cotton yields one-half to 1 bale, and corn 30 to 60 bushels per acre, according to season. Sorghum yields well. The soil is well suited to alfalfa, as shown by small patches of this crop growing at the time of the survey. Some vegetables have been grown successfully for the local markets. The type seems to have about the same productiveness as the Trinity clay. Farms sell for \$150 to \$200 an acre.

The results of mechanical analyses of samples of the soil and subsoil of the Frio clay are given in the table below.

Mechanical analyses of Frio clay.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
445430	Soil, 0 to 12 inches.....	0.3	5.1	6.3	9.2	4.6	39.5	34.9
445431	Subsoil, 12 to 36 inches.	.0	.4	.8	7.9	4.4	45.6	40.9

OCHLOCKONEE CLAY LOAM.

Typically the Ochlockonee clay loam consists of a brown or dark-brown clay loam or sandy clay loam, underlain at about 6 to 10 inches by yellow or brownish-yellow sandy clay loam or clay. In places on the surface there is considerable material recently washed in from adjacent sandy soils of the Cahaba and Leaf series and there are many variations in texture throughout the areas mapped. There are some included areas of fine sandy loam of small extent, as in the bottoms of Walnut Creek along the Tarrant County line.

This soil type occurs in 2 small areas in the bottoms along Bear Creek and Delaware Branch in the western part of the county. The type, although level, has fair surface drainage. It is subject to occasional overflows after heavy rains.

Originally this land supported a forest of elm, hackberry, spotted oak, and other trees, but most of the land has been cleared. Part of it is utilized for pasture and part in growing cotton, corn, and sorghum. This soil is productive, and when damaging overflows do not occur, cotton yields one-half to 1 bale, and corn, 30 to 50 bushels per acre.

GRAVEL PITS.

The areas mapped as Gravel pits include tracts of land that have been mined for the gravel occurring in the substratum. Most of the pits lie on the terraces of the Elm Fork, West Fork, and the main stream of the Trinity River, principally within areas of the Frio clay, the Trinity clay, and the Cahaba fine sandy loam and its low phase. The land has no value for agriculture.

SUMMARY.

Dallas County is situated in the northeastern part of Texas. Its area comprises 890 square miles, or 569,600 acres.

The topography is predominantly gently rolling, though some areas of level land and some of rolling to hilly land occur. A bluff-like and somewhat rough area known as the White Rock Escarpment runs through a part of the county. There are many strips of flat bottom land along the streams, which range from one-fourth mile to 4 miles in width. The greater part of the county is between 400 and 600 feet above sea level, but the extremes range from 350 feet to 820 feet. All the county is drained by the Trinity River and its tributaries, and the drainage is good in all sections except in the larger stream bottoms and on some level higher terrace lands.

In 1920 the population of Dallas County was 210,551. Dallas, one of the largest cities of the Southwest, is situated in the central part of the county. It has a population of 158,976. Most of the inhabitants outside of the city of Dallas are engaged in agriculture. Lancaster, Grand Prairie, Mesquite, Hutchins, Garland, Irving, Seagoville, and Carrollton are important small towns, and there are a number of others somewhat smaller in the county.

The county is provided with good transportation facilities, being traversed by several steam and electric railroads. Many improved wagon roads have been built through the county and more are being built. The earth roads are kept in good condition, but are difficult to travel when wet.

All of the county is reached by rural mail delivery, telephones are in general use, and schools and churches are plentiful.

Dallas is the principal market for vegetables, fruit, poultry, and dairy products.

The climate is mild and healthful. The mean annual temperature as reported at Dallas is 64.9° F., and the mean annual precipitation is 38.04 inches. The average growing season is 237 days.

The agriculture of Dallas County consists mainly of general farming, the principal crops being cotton, corn, oats, wheat, and saccharine sorghum. Considerable market gardening is carried on. There are some dairy farms around Dallas, and many of the general farms produce milk for the market in a small way. Some stock farming is done. Small orchards provide fruit for local use, but the fruit crop is uncertain owing to the late spring frosts.

About 83 per cent of all the land in the county is in farms. Most of the farms are well improved and have good buildings and work stock.

No systematic crop rotation is practiced, but many farmers change the crops from time to time. No commercial fertilizers and very little barnyard manure is used. Farm labor is rather scarce and expensive. A very large proportion of the land is farmed by tenants.

There are 5,379 farms in Dallas County, with an average size of 84.2 acres. Farm land sells for \$100 to \$300 an acre. Little good land is to be had for the lower figure.

The county lies within the Black Prairie region of Texas. The geological formations which give the residual soils belong to the Upper Cretaceous. They are (1) the Taylor marl which underlies the eastern one-fourth of the county, geographically known as the Taylor Prairie; (2) the Austin chalk, which underlies the central half of the county and comprises the underlying formation of the White Rock Prairie; and (3) the Eagle Ford shales, the formation underlying the Eagle Ford Prairie, which comprises the western fourth of the county. These prairies run in parallel belts from north to south and have no definite, easily recognizable dividing features except in the southwestern part, where the Austin chalk forms a high escarpment facing the Eagle Ford Prairie to the west. These prairies are interspersed with some broad, flat, alluvial bottoms along the streams and some high, level, old terraces composed of sediments laid down by ancient streams. Originally the alluvial soils all supported a heavy forest growth, but the most of this has been cleared off.

The marls and chalk give rise to the soils of the Houston series. The Eagle Ford shale has weathered into one type, the Ellis clay.

The old-alluvial deposits forming the stream terraces have given rise to the soils of the Irving, Bell, Leaf, Cahaba, Kalmia, Lewisville, and Amite series.

The recent-alluvial soils along the streams are correlated with the Trinity, Catalpa, Frio, and Ochlockonee series.

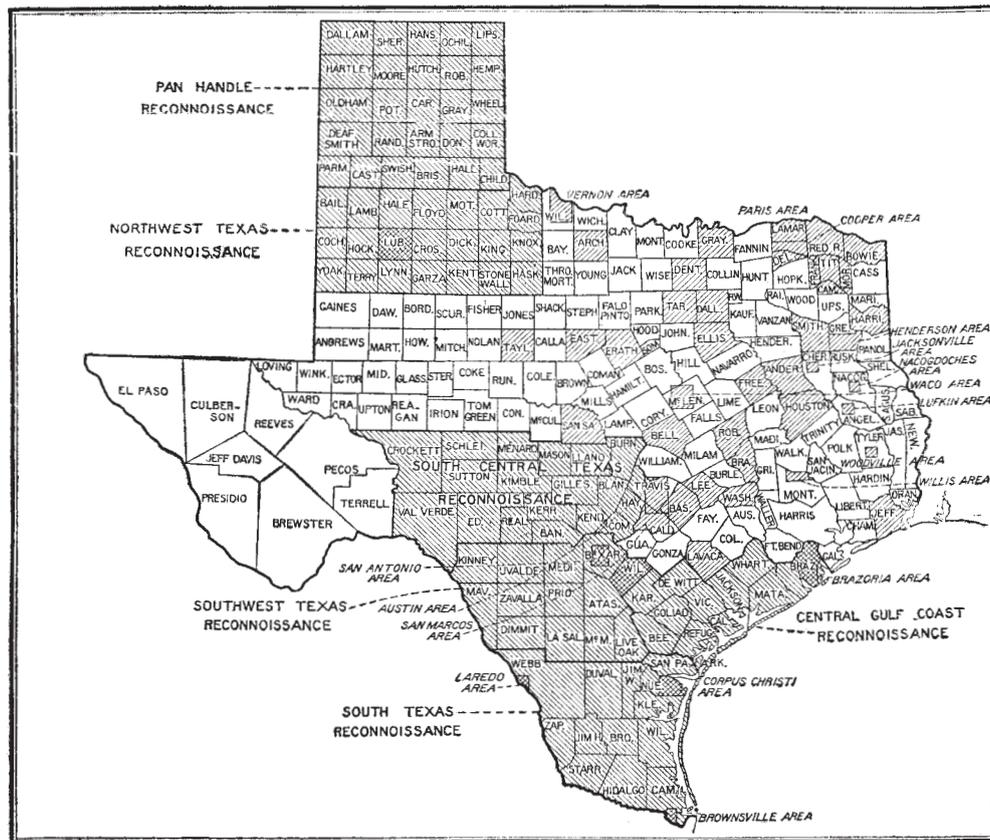
The Houston black clay is the most extensive soil type in the county. It is very similar in color and texture to the Bell clay, which is an equally important soil type in agricultural value. These two soils are very productive and well suited to cotton, corn, wheat, oats, forage crops, and grass. The Houston clay and Lewisville

clay are well suited to oats and wheat. The Houston clay, shallow phase, is better suited to small grains than to corn and cotton. The Ellis clay is better suited to wheat and oats than to corn or cotton. The Irving clay is well suited to wheat, oats, and cotton, and not so well suited to corn as the Bell clay and Houston black clay.

The Cahaba soils are especially adapted to the production of vegetables and fruits. The Leaf fine sandy loam is also well suited to vegetables, though not quite so well as the Cahaba fine sandy loam.

Trinity, Catalpa, and Frio soils are very productive bottom soils and with good drainage are especially suited to corn, cotton, alfalfa, and forage crops.





Areas surveyed in Texas, shown by shading.

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