SOIL SURVEY OF ELLIS COUNTY, TEXAS.

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DESCRIPTION OF THE AREA.

Ellis County, containing an area of 587,520 acres, or 918 square miles, is situated in the northeastern part of Texas. It is bounded on the north by Dallas and Tarrant Counties, on the east by Kaufman and Henderson Counties, on the south by Navarro and Hill Counties,

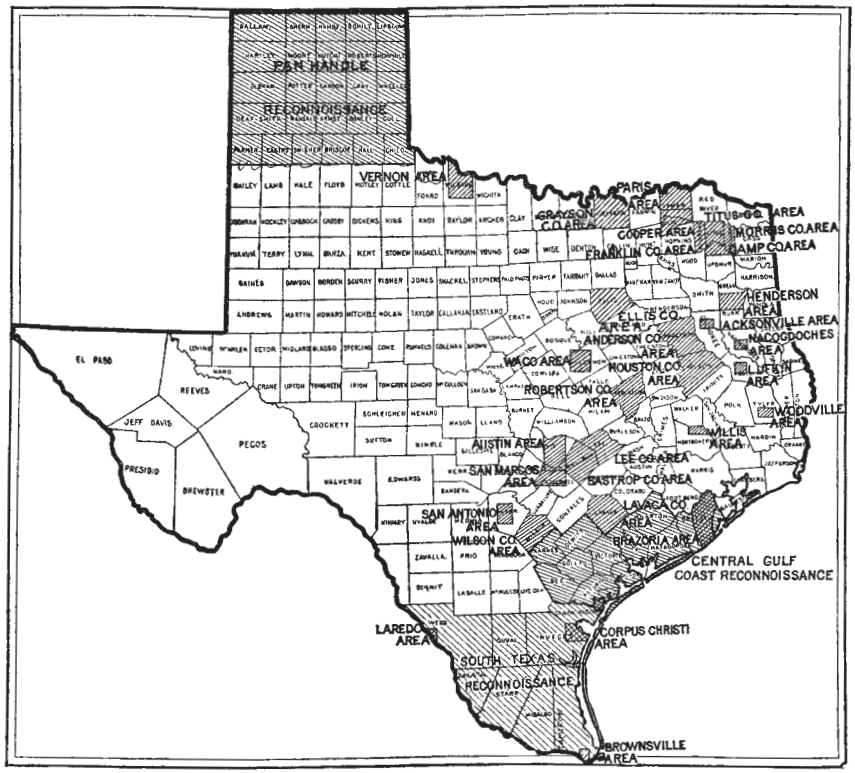

FIG. 23.—Sketch map showing location of the Ellis County area, Texas.

from which it is separated by the Trinity River, and on the west by Hill and Johnson Counties. The topographic features vary from those of a hilly section cut by streams flowing in narrow V-shaped valleys to those of a level country. The more broken surface is found

in the western part of the county, extending from the county line directly north of Midlothian down to Milford. Along the western edge of the county, between Maypearl and Britton, is a broad valley varying in width from 3 to 6 miles, the topography of which varies from level to gently rolling. There is a distinct bluff line between this valley and the dissected section first described, the difference in elevation ranging between 50 and 100 feet. The black-land belt, which extends through the center of the county, varies in surface features from gently rolling to level. The more level areas are found in the southern part of the county, principally in the vicinity of Italy, along Chambers and Mill Creeks, although there are other areas of similar topography over the county. In the vicinity of Ennis, especially south and southeast, there occur comparatively wide areas of more sandy country with a level topography.

The country ranges in elevation from about 450 to 750 feet above sea. The following elevations are shown for Houston & Texas Central Railroad stations: Ennis, 571; Waxahachie, 551; Midlothian, 733; and Ferris, 471. Practically all of the streams in the county, with the exception of Mountain Creek, flow in an easterly or southeasterly direction. The southern and southwestern portions of the county, or about three-fourths of the area, are drained by Mill, Chambers, Onion, and Waxahachie Creeks. All of these streams come together at the southeastern edge of the county and find their outlet into the Trinity River south of Ellis County. In the eastern and northeastern sections the Trinity River receives the drainage waters within the county limits, through Village, Grove, Red Oak, and Bear Creeks. A small portion of the extreme northwestern corner of the county has its drainage outlet through Mountain Creek. All of the streams become more sluggish as they approach Trinity River.

The early settlers of Ellis County came from the Carolinas, Georgia, Tennessee, and Kentucky, the greater number from Tennessee. More than half the present population are direct descendants of these settlers. There are a large number of Bohemians in the eastern part of the county. These, with a few Hungarians and Germans, compose the foreign element. There are a good many negroes in the county, but the greater percentage of these are found in the towns.

Waxahachie, the county seat and largest town of the county, has a population of 6,205. Ennis, which is located 15 miles from Waxahachie, in the eastern portion of the county, is next in population, with 5,669. Ferris, Italy, and Midlothian are the next most important towns in the county, with populations ranging between 868 and 1,233.

The county is so well covered by railroads that no farm is more than 5 or 6 miles from a shipping point. There are three roads—the Missouri, Kansas & Texas, Houston & Texas Central, and Trinity &

Brazos Valley—entering Waxahachie, and two—the Houston & Texas Central and Texas Midland—entering Ennis. Italy and Midlothian are other towns that have two roads, the former being served by the Missouri, Kansas & Texas and the International & Great Northern, and the latter by the Houston & Texas Central and the Santa Fe. There are thus six different roads operating in the county. These roads give excellent transportation facilities to the northern markets as well as the local markets. Direct routes are available to St. Louis. Kansas City, Dallas, and Fort Worth are only a short distance away, and there are direct lines to Galveston and Houston.

The county roads are generally good in summer, but during the winter months or rainy seasons they are generally impassable. The precinct in which Waxahachie is located has issued bonds, the proceeds to be used for building roads of gravel, and they are rapidly being constructed. There is now such a pike from Waxahachie to Dallas, with the exception of 5 or 6 miles. It is likely that all precincts will follow the example set and that the county will soon have an excellent road system.

CLIMATE.

Ellis County has a mild climate, ordinarily free from extremes of heat or long-continued cold. While the summers are long and warm, the heat of the days is modified and the nights are generally cool. During January and February sudden changes of temperature are experienced, caused by "northers"—winds that sweep south from the colder regions to the north. These cross the Great Plains and cause a drop from a mild temperature to freezing in a few hours. A small fall of snow is not uncommon, but the ground seldom freezes to depths greater than 1 inch. These cold waves are generally of short duration and do not interfere materially with farming operations. The greatest damage done by the "northers" is to fruit, which is frequently killed, this being the greatest drawback to the peach industry. Crops suffer in about the same degree from drought and excess of moisture, although the extent of injury depends on the character of the soil. The worst drought known occurred during the summer of 1909. Crops were a complete failure on some of the shallow and lighter-textured soils; on the heavier soils, even under the unfavorable conditions, a fair crop was produced. Sometimes the crops are damaged or killed by frost in the bottom lands while they escape injury in the uplands. The warm temperature in spring is favorable for cotton, especially where the boll weevil exists, as the crop matures early.

The following tables, compiled from the records of the Weather Bureau station at Waxahachie, show the normal monthly and annual

temperature and precipitation, and also the dates of the first and last killing frost of fall and spring, respectively:

Normal monthly and annual temperature and precipitation at Waxahachie.

Month.	Temperature.	Precipitation.	Month.	Temperature.	Precipitation.
	° F.	Inches.		° F.	Inches.
January	44.8	2.14	August	84.6	1.75
February	46.2	1.91	September	77.2	3.26
March	56.6	3.29	October	65.9	2.86
April	64.7	2.89	November	54.9	2.81
May	75.0	5.35	December	45.9	2.48
June	82.5	3.67	Year	65.2	35.44
July	83.6	3.03			

Date of first and last killing frosts at Waxahachie.

Year.	Last in spring.	First in fall.	Year.	Last in spring.	First in fall.
1900	Mar. 16	Nov. 10	1906	Mar. 21	Nov. 1
1901	Apr. 4	Nov. 4	1907	Feb. 16	Nov. 12
1902	Mar. 31	Nov. 26	1908	Apr. 30	Nov. 14
1903	Mar. 1	Nov. 17	1909	Apr. 9	Nov. 17
1904	Mar. 28	Nov. 11	Average	Mar. 21	Nov. 10
1905	Feb. 22	Nov. 30			

AGRICULTURE.

Ellis County was formed from Navarro County in 1849. The first permanent settlement was made about 1844, in the vicinity of Forreston. It is stated that some of this land has been cultivated since that date, and it is still very productive. The early settlers were engaged in stock raising, the broad, fertile prairies being covered with a luxuriant growth of native grass and the mild climate being well suited to this industry. The cultivation of the soil was begun in a limited way soon after the county was first settled. The early settlers grew small grain principally for home consumption, although some of it was taken to east Texas and traded for lumber. The first settlers generally took up land along the streams. This they did for several reasons. They were to a certain extent protected by the streams from the prairie fires, and they were near a water supply. The timber growth along the water courses was also attractive, supplying wood for fuel and building material. The black lands and white rock lands were both settled about the same time. Cotton was grown in small quantities, but in the early days lack of transportation facilities and distance from markets prevented extensive cultivation and only a limited acreage was devoted to its cultivation.

Before the railroads entered the county Houston and Shreveport were the markets. The Houston & Texas Central Railroad was the first to enter the county in 1871. It was about this time that really marked the beginning of a change from a vast cattle range to one of the most prosperous agricultural sections in the State. As the county gradually became more thickly populated the large herds of cattle were either sold or driven farther west. Later, with the coming of barbed wire, large tracts were fenced. Small grain, especially wheat, has not been grown very extensively since 1880 or 1885. It seems that at about this time it did not prove profitable, the yields having decreased, probably because the crop had been grown for so many years on the same land without rotation. Cotton took the place of grain and has always been the money crop, and the present prosperous condition of the county is due to this product. The cattle ranches are a thing of the past. These large tracts have gradually been cut up, until in 1900, as shown by the census, the average-size farm contained 87.5 acres.[1] At the present time it is likely that they are still smaller. There are left some large holdings of 1,000 to 5,000 acres, but practically all of the land is used for agricultural purposes. There is very little waste land in the county. The most extensive areas of such character are bottom land—Trinity clay—though other small areas occur where the land is rough and eroded.

The county is naturally divided into five agricultural sections, each one having its advantage and being well adapted to certain crops. Passing from west to east the first division is the valley land, which is well adapted to cotton and corn, and in some portions to alfalfa. The next division is the "White Rock" section. This is especially adapted to small grain, principally wheat and oats. There is more grain grown here than in all of the other portions of the county. The next and most important division is the "Black Land Belt," which is especially adapted to cotton, to which crop it is principally planted, only a small percentage being devoted to oats and corn. The sandy-land section is found in the eastern part of the country and is especially adapted to the growing of truck, fruit, and peanuts. These special adaptations are recognized by the farmers, but the soils are used to a very limited extent for the growing of such products, the majority of the farmers devoting practically all their energy to the production of cotton.

The census returns show that in 1880 the average-size farm was 118 acres and that in 1900 it had decreased to 87.5 acres. In 1880 the total acreage in farms was 339,652, while in 1900 it was 521,644. The percentage of farms operated by the owners was 38.6 in 1890. The number operated in 1900, 29.2 per cent. The rapid development

[1] The individual holding is larger than this, as the census classified each tenancy as a farm.

of the county is indicated by the rapid increase in the value of the farm lands and improvements, which in 1890 amounted to $7,936,560 and in 1900 to $13,517,190, an increase of more than 70 per cent. From 1900 to the present time it is probable that the values have almost doubled.

The acreage in corn in 1880 was 57,568, while in 1890 it had reached an area of 103,629 acres, and by 1900, 197,828 acres were in this crop. In 1880 the acreage in wheat was 18,500; in 1890 only 11,260 acres were in this grain. Oats, on the contrary, increased in acreage from 5,533 acres in 1880 to 13,265 acres in 1890.

The greater part of the farming—more than two-thirds of the farms are cooperated—is done under the tenant system. Under this plan the tenant gives the landlord one-third of the grain and one-fourth of the cotton. One man and team generally handles from 40 to 50 acres. When 50 acres are cultivated, 35 to 40 acres are put in cotton and the remainder in corn, with sometimes a small area in oats.

The present price of labor ranges from $15 to $20 a month with board, or about $25 without board. By the day the wage ranges from $1 to $1.50. Cotton choppers are paid from 75 cents to $1 a day, cotton pickers from 50 cents to 75 cents per 100 pounds. The price for picking cotton varies with the character of the crop and season, the higher prices being paid in the late fall, when much of the crop has been gathered and the work is slower and more laborious. Sometimes it is February before the entire crop is picked.

The ordinary price for ginning cotton is about $3 a bale, though where there is much competition it is sometimes less. About one-third of the cotton is sold in the seed. This custom has been gradually growing for the past five years, owing principally to the increase in the demand for seed.

In preparing the seed bed for cotton the land is usually broken with a double mold-board plow ("middle buster") drawn by four mules or horses. After the first furrow is made only one trip across the field is required to make a ridge. These ridges are about 3 feet apart. The depth of plowing is from 3 to 4 inches. This preparation is done during the winter. In the spring just before seeding a drag or harrow is run over the ridges, leaving them from 4 to 6 inches high. At the same time the old stalks are usually raked together and burned. What is locally known as "flat breaking" is considered better than using the "middle buster." Under this method the preparation is done with a turning plow; the cost is a little more, but the soil is thoroughly pulverized and in much better condition. Many think the extra work pays. The beneficial effects are noticeable during a drought, as the soil is much more capable of holding moisture. The preparation for corn is the same as that for cotton. Cultivators are

used in the subsequent working of both cotton and corn. Corn is planted from the last of February to the first of April; cotton from last of March to June.

The greatest weed pests in the cotton and corn fields are Johnson and Bermuda grass, although they have not yet taken possession of very extensive areas. It is rather difficult to get rid of these grasses. The method generally used is to plow the field constantly all the summer and to sow wheat or oats in the fall. The boll weevil has never caused great damage in Ellis County. At its worst stage it was confined principally to the bottom lands, but it has now almost entirely disappeared.

Before the county was so thickly settled wild hay was plentiful, but at the present time only a comparatively small amount is produced, not nearly enough for home consumption. A little Johnson grass is cut for hay, but it brings rather a low price and as the farmers are afraid that the grass may spread to their cultivated fields the acreage is not being extended voluntarily. Sorghum is also sown to a certain extent for forage.

Alfalfa is the most important hay crop and the acreage of this is limited, though the hay brings from $12 to $20 a ton. This is a crop that should be given serious attention. The soil best adapted to it is the Trinity clay, and the type can be used for this crop to much better advantage than for any other. Almost every farmer has a little land adapted to alfalfa and such land should be used for this purpose. The seed may be sown either in the fall or spring, but taking everything into consideration it is generally thought that fall seeding is the better plan. The greatest drawback to fall seeding is liability to drought and the resulting failure of the seed to sprout. If seeded in the spring there is danger that grasses and weeds of more vigorous early growth may smother the young plants. Where there is a failure to secure a stand of alfalfa the farmer is frequently discouraged and never attempts it again, whereas a thorough understanding of the requirements of the crop would have led to success. It is very necessary that the seed bed for this crop be first put in the very best condition. It is equally important to see that the weeds and grass have been kept down for a year prior to seeding. This crop on the black land, or Houston black clay, seems to suffer from a root rot similar to that affecting cotton, though on the level areas, especially near streams, it does very well. One cause for failure of alfalfa on the rolling black land is nearness of the water table in the depressed areas and the texture of the subsoil, which is frequently more open and less resistant to the roots, which penetrate the saturated zone and are injured by excess of water.

Very little attention has been given to fruit culture, although some good orchards of pears and peaches are seen here and there over the county, especially in the eastern portion. Considerable nursery stock is produced. The black land seems especially adapted to the peach, plum, apricot, cherry, pear, berries, and grapes, but it is not well adapted to shade trees, with the exception of the black locust. It is an ideal soil for evergreens. The "dead spots," or places where cotton has the root rot, often affect nursery stock. It does not seem to affect the peach, but the young black locust trees frequently die.

The county records show a marked decrease in the number of farm animals, except in case of horses and mules, since 1900. In that year Ellis County had 34,062 hogs, while in 1909 the number was 14,334, a decrease of more than 50 per cent; in 1900 there were 22,479 head of cattle and nine years later only 15,262. This indicates a lack of interest in lines of industry that might be very profitably specialized, and that should at least be made important adjuncts to the production of cotton.

The great variety of soils in Ellis County makes it possible to engage in many lines of farming. The opportunities for the small farmer with limited means are especially inviting. He may choose dairying near the larger towns, hog raising, or the growing of alfalfa, peanuts, small fruits, and potatoes and many other special crops, with every prospect of reasonable profits. Many of these products are in great demand locally, thousands of dollars being spent annually by cotton planters so intent upon the production of this single crop that they give little thought to the production of forage, meats, and the other necessaries that should be produced upon their farms.

Diversification of crops, indeed, and its corollary, the rotation of crops, are the most important steps in promoting the future development of the agriculture of the county. Diversification will supply many of the products now purchased by the farmers at high prices and prevent the losses due to too great dependence upon the returns from a single crop; rotation will tend to increase the productiveness of the soils by improving their physical condition and it will further increase crop yields by keeping in check diseases and pests that prosper most when fields are kept continuously in those crops which they naturally affect.

SOILS.

Thirteen distinct types of soil are found in Ellis County, ranging in texture from a fine sand to a stiff clay. All of these soils, with the exception of the Trinity clay and Bienville fine sand, have been derived from the weathering of materials of Cretaceous age. During this period the entire region was covered by a sea which received

vast deposits of sediments from the streams that emptied into it. At the close of the period the land was elevated above the sea and subsequent weathering of the materials has produced the various soils.

The Cretaceous deposits here consist principally of marls and chalky limestone. The deeper soils are found where the softer materials occurred, the transformation to true soil having been here much more rapid.

While the various geological formations are not recognized by most of the farmers, they do appreciate the general differences in the character of the soil which follow the geological formation very closely. These divisions as they are locally divided are the valley lands, the white rock lands, black lands, sandy lands, and bottom lands.

There are three geological formations from which the residual soils are derived. The Eagle Ford covers the valley lands in the western part of the county. From this are derived the Durant clay and Ellis clay. The Austin chalk formation corresponds in extent to the white rock section and covers the eastern part of the county. This formation gives rise to the Houston stony clay, Crawford clay loam, and Houston clay. The difference in these types is due to the depth to which the limestone has weathered. In the case of the Crawford clay loam it has weathered to the greatest depth, with the Houston clay the weathering has not proceeded to so great an extent, and with the Houston stony clay the formation is little altered at depths of 6 to 8 inches. The Taylor marl is coextensive with the black-land section or Houston black clay. This type is a black calcareous clay, extending to a greater depth than any of the other upland soils. Complicated chemical and biological changes in the vegetable matter are believed to cause the black color. In the vicinity of Ennis considerable sand is found. This sand is very similar to the Woodbine formation, although it is not typically developed and covers a comparatively small area. The soil is the same as some of those derived from this formation. The principal types are the Durant loam and the Durant fine sandy loam.

The Wilson clay loam and the Durant very fine sandy loam are not traced directly to any single geological formation, but are gradation or reworked types. The Trinity clay is the most recent soil. It is of alluvial origin, and is still being deposited, principally along Trinity River and Waxahachie and Chambers Creeks. The Susquehanna fine sandy loam has probably been influenced by both wind and stream action. What is known as the valley in the western portion of the county has very much the appearance of an old lake basin with a sharp bluff line following the eastern edge.

Thus in a general way the soils occur in large and uniform areas and are closely associated with the geological formations.

The following table gives the name and extent of the several soils. Their distribution is shown by means of colors in the accompanying map.

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Houston black clay	250,176	42.6	Houston clay	12,544	2.1
Trinity clay	87,872	15.0	Crawford clay loam	8,448	1.4
Houston stony clay	78,336	13.3	Susquehanna fine sandy loam	5,632	1.0
Durant clay	39,936	6.8	Durant very fine sandy loam	2,752	.5
Wilson clay loam	37,504	6.4	Bienville fine sand	384	.1
Durant loam	27,776	4.7	Total	587,520	
Ellis clay	18,880	3.2			
Durant fine sandy loam	17,280	2.9			

TRINITY CLAY.

The soil of this type has a depth of 10 inches and varies from a brownish-black to black clay. The subsoil to a depth of 36 inches is a yellowish-brown or grayish-brown stiff tenacious clay. Sometimes the soil has a slightly yellowish tinge.

Immediately along the streams the soil is quite uniform, especially as to texture. At the foot of the bluff lines, or where some of the smaller streams flow into the river, the soil generally has a darker color, and in such cases it is possible that the soil is a little lighter in texture, owing to a somewhat higher percentage of organic matter. The lightest phase of this soil is found along Chambers Creek. This stream has its source in a sandy country and small quantities of sand have been brought down and deposited in the bottoms. This is most noticeable in the vicinity of Maypearl, along both the north and south prongs, where the sandy loam types border the bottom lands. Here the sandiest areas always lie next to the bluff. This phase being lighter in texture is easier to cultivate than the main type. Such spots would have been separated had they been large enough to be shown on the map. Along this creek in the southern portion of the county the texture of the type is very heavy. Where this type borders the Bienville fine sand or Susquehanna fine sandy loam there is an abrupt change, there being practically no gradation.

The Trinity clay is an alluvial soil and occurs principally along the Trinity River and Waxahachie and Chambers Creeks. The largest area along Chambers Creek is found on the east side after it crosses the Missouri, Kansas & Texas Railway and varies from about one-half to three-fourths mile in width. The largest area along Waxahachie Creek is found southeast of Bardwell, and at the mouth of Onion Creek it is about 1½ miles wide. Along Trinity River the areas vary

from one-half mile to 3 miles in width. A peculiar feature of the type is its location for the most part on the east side of the streams. While the east side of Trinity River is in Kaufman County and was not included in the survey, it is known that the greater proportion of the Trinity bottom is found on that side.

The topography of this type is level, with slight depressions scattered through it in the form of lakes and sloughs. There is frequently slightly higher land bordering the stream, which gradually slopes off to the interior of the bottoms. Just before the uplands are reached there is a gradual rise again, thus leaving a slight and broad depression between the stream and the uplands.

This type was originally covered with a dense forest growth, consisting principally of elm, hackberry, pecan, and oak. There is probably about 25 per cent of it under cultivation, the remainder being still in timber.

When wet this type is very waxy and gummy, but when dry and well cultivated it is friable and comparatively easy to till. All this type is subject to overflow, though some of it is more frequently flooded than other portions. The areas of this soil under cultivation are in the most elevated portions, generally near the streams or along the outer edge of the bottoms.

The great productiveness and durability of the soil are well known; there is no more fertile soil in the State, but the great drawback is insufficient drainage. In a way this is one of the most important types in the area. It is the cheapest land in the county, the uncultivated portion being valued at $10 to $20 an acre. The timber in many places is worth more than the present price of the land, especially where a market can be easily reached.

That portion of the type which is cultivated produces excellent yields of cotton and corn. The most of it is planted to corn, which yields from 40 to 60 bushels per acre. It is especially adapted to alfalfa, which yields ordinarily from 4 to 5 tons per acre. Much interest is now being taken in a drainage system for the reclamation of these lands.

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

Mechanical analyses of Trinity clay.

No.	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.*	*Per cent.*
23633, 23635	Soil	0.1	0.5	1.3	4.4	2.3	29.4	60.1
23634, 23636	Subsoil	.0	.2	1.6	12.6	3.8	26.6	55.0

DURANT FINE SANDY LOAM.

The surface soil of this type, to a depth of 8 or 10 inches, is a brown to grayish-brown fine sandy loam, having a relatively high content of silt. Below this is a yellowish-gray sandy loam slightly heavier than the surface soil. The lighter color of this stratum is due to a smaller percentage of organic matter. This extends to about 15 inches, where it changes to a dingy yellow or yellowish-drab clay loam, which extends to a depth of 3 feet, the color becoming lighter as the depth increases. The sand in this subsoil is about the same in texture as that found in the soil. Below 10 inches from the surface reddish-brown iron stains sometimes occur, which are due to decomposed iron concretions. Both the soil and subsoil change in color and the type also in productiveness with change of topography.

The surface ranges from level to gently rolling and the level areas have a darker and deeper soil than those that are more rolling. The soil in the more level areas also contains a rather high percentage of silt and very fine sand. The subsoil in such phases is often brown, sometimes being slightly mottled, and does not contain as high a percentage of silt and very fine sand as in other parts of the type. As the elevation increases both the soil and the subsoil gradually become lighter in color and texture and the productiveness slightly decreases. The texture of the sand in the more level areas seems to be finer than that in the soil of higher elevation. The subsoil of this type and of the Durant loam are very similar, especially in the vicinity of the boundary between them. To a certain extent the Durant fine sandy loam has a tendency to drift. Where this is the case along the boundary line mentioned above, the sandy material is blown over the Durant loam, thus giving a sandy loam surface with a Durant loam subsoil. In other phases this drifting slightly reduces the depth of the soil in exposed areas and also builds up sandy areas.

Compared to some of the other types, this soil does not cover a very extensive area, but it is one of the most important types on account of its adaptation to a greater variety of crops than any other soil of the county.

A narrow strip of this type varying from about one-fourth to three-fourths mile in width occurs south of Ennis on each side of Cummins Creek. This same area extends north, passing through Ennis, becoming much broader and following the Texas Midland Railroad to Village Creek. Other small areas are found scattered along this creek. Another comparatively large area is found in the vicinity of Bristol.

Owing to the open structure of this soil it has good surface and underground drainage. For this same reason it is easily cultivated,

and any clods that may be formed in plowing are readily broken down by light harrowing. The type is planted principally to cotton, although some corn and oats are grown. Cotton averages about one-fourth bale, although three-fourths bale per acre is sometimes secured. Corn yields from 20 to 30 bushels per acre and oats about the same. Cowpeas and peanuts, which are almost unknown in the county, would do well on this soil and would also make it more productive by the addition of organic matter and nitrogen. Much better returns could be secured from this soil by the growing of truck and fruit than with the crops to which it is at present devoted. It is used very little for special crops, though some blackberries, dewberries, and melons are produced, and occasionally a few fruit trees are seen.

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

Mechanical analyses of Durant 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.*	*Per cent.*
23623, 23625.....	Soil.....	0.0	0.1	0.4	31.4	24.0	30.0	14.6
23624, 23626.....	Subsoil.....	.0	.2	.2	9.2	30.8	30.1	29.4

DURANT VERY FINE SANDY LOAM.

The Durant very fine sandy loam varies rather widely, but on an average it consists of a yellowish-brown very fine sandy loam, underlain by a pale yellowish gray sandy loam, somewhat more tenacious than the soil. The texture varies from a heavy fine sandy loam to a light loam. There are sometimes found thin layers of limestone running through the type which are occasionally broken up and scattered over the surface. In the subsoil thin layers of almost pure fine sand are sometimes encountered.

The Durant very fine sandy loam occupies next to the smallest area in the county, the smallest being Bienville fine sand. It is found in two areas on the southeast side of Grove Creek, the largest of which averages about three-fourths mile in width and 4 miles in length. It follows along the stream, bordering the Trinity clay. The other area is only a half mile down the stream from the larger one, and between these two areas is the Durant loam. The type is broken and hilly and cut by numerous short and narrow V-shaped valleys. It is probably more than 100 feet higher than the country on the north side of Grove Creek. It is in the form of a slope or hillside. Very little of it is under cultivation, being used chiefly for grazing, to which purpose

it is best adapted. It is too hilly and eroded to cultivate very easily. If the sod were broken the soil would soon be washed down into the valley.

The results of mechanical analyses of soil and subsoil are given in the following table:

Mechanical analyses of Durant very 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.*	*Per cent.*
23613.....	Soil.....	2.3	2.4	2.5	21.1	54.4	14.4	3.2
23614.....	Subsoil.....	1.5	2.4	3.3	18.0	48.9	21.2	4.8

DURANT LOAM.

The soil of the Durant loam, to a depth of 10 or 12 inches, is a dark-brown to dark-gray loam containing some fine sand and a rather high percentage of silt. There is no sharp line of demarcation between the soil and subsoil, the one passing into the other gradually through a zone from 4 to 6 inches thick. This soil becomes heavier in texture and lighter in color as the depth increases. The subsoil varies from a bluish or drab clay loam to a yellowish mottled clay, sometimes containing reddish-brown spots due to the decomposition of iron concretions. The mottled subsoil is generally found in depressions. In such cases the soil is heavier, darker in color, and extends to a greater depth. The heaviest phase, besides the depressions of the type, is found along the boundary line between this soil and the Wilson clay loam, which always borders it on at least one side. Along the contact between the Durant loam and the Durant fine sandy loam is found a lighter phase of the former type. This phase also occurs in the elevated areas. On the other hand, in the more level areas or in depressions the soil frequently approaches a clay loam and contains very little fine sand. The depth of the soil varies with the topography, in depressions reaching 15 or 20 inches and gradually decreasing with the increase of elevation. The accumulation of organic matter is also greater in the depressions.

The topography of the type varies from level to slightly rolling, although by far the greater portion of it is level. The rolling or sloping areas are found along the stream courses. It is traversed by enough streams to give it good drainage, and along the slopes of the streams it is sometimes slightly eroded. There are some slight depressions where open ditches would prove beneficial.

This type is of such a texture that it will stand both wet and dry seasons better than any other type in the area. The largest body occurs south of Ennis, beginning about the city limits and extending

south to the county line. It is found on each side of the narrow strip of Durant fine sandy loam that follows Cummins Creek. Other areas are scattered along Village Creek and its tributaries, or near these streams, the largest of which is west of Crisp. When the soil is plowed clods are formed, but these are readily pulverized. The type is not a difficult one to cultivate and when in good condition forms a mellow loam.

The Durant loam is one of the most desirable soils found in the area, ranking with the Houston black clay, the Wilson clay loam, and the Durant clay. It is well adapted to general farming. Cotton yields from about one-third to three-fourths bale per acre, corn from 30 to 40 bushels, and oats from 35 to 50 bushels. This type is also well adapted to fruit, peanuts, and potatoes, though these products are not grown to any extent.

The average results of mechanical analyses of soil and subsoil of this type are given in the following table:

Mechanical analyses of Durant 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.*	*Per cent.*
23627, 23629.....	Soil.....	0.0	0.0	0.4	13.9	25.8	43.0	17.0
23628, 23630.....	Subsoil.....	.0	.3	.2	11.2	24.0	37.1	26.6

DURANT CLAY.

The soil of the Durant clay to a depth of 8 inches is a dark-brown to almost black clay, sometimes having a slightly grayish tinge. The subsoil from 8 to 36 inches is a stiff, heavy, pale yellowish drab clay, sometimes having a dark bluish color. Scattered over the surface and throughout both soil and subsoil are lime concretions or gravel. Occasionally spots are found where the gravel is so numerous that such areas would be classed as a gravelly loam were they large enough to be shown on the map. There are a few spots where there is a small quantity of stone scattered over the surface, these being generally found along the border line of the Houston stony clay and the Ellis clay. As a rule where the stones occur the soil is not typical of the main body of the type. The color of both soil and subsoil varies with the topography, the darker color being found at the lowest elevation and gradually becoming lighter as the elevation increases. The lighter colored areas are found bordering the Ellis clay. North of the Santa Fe Railway, near the county line, traces of fine sand are sometimes found.

This type of soil predominates in the valley west of a distinct bluff line, running in a general north and south direction, near

Midlothian and Oak. That portion of the valley in this county starts in the northwest corner and runs straight south along the western edge of the county for about 20 miles, and at this point it takes a southwesterly direction, passing out of the county. Most of the type lies north of the north prong of Chambers Creek and occurs as a broad, uniform area, being broken only by the Ellis clay. The remaining portion of it is found south of the south prong of Chambers Creek, and a comparatively small area lies between the two creeks.

The Durant clay is derived from the Eagle Ford formation and is the residuum of marly clays. There is a striking resemblance between this type and the Houston black clay, but their origin is different. The principal difference is in the lighter color of the Durant clay, although in some places it is as black as the lightest colored phase of the Houston black clay. The topography, drainage, texture, and agricultural value of the two types are about the same. It seems better adapted to alfalfa than the Houston black clay. The soil is very sticky when wet and hard when dry, and where it is not cultivated during a dry season large cracks are formed. It breaks up in clods when plowed, but it is easily put in good condition by harrowing.

The topography varies from level to gently rolling, though probably the greater proportion of it is almost level. The drainage is fairly good, but open ditches are an advantage on the level areas during a wet season. Owing to the texture and topography of the Durant clay it suffers more from an excess of moisture than from drought. When crops are being drowned out on this valley land, as it is locally known, they are good on the high hills, or on the Houston stony clay, which is adjacent to this type on the east and south. The conditions are just the reverse in times of drought. Cotton yields about one-third to three-fourths bale per acre, corn 30 to 40 bushels, and oats 40 to 50 bushels. During a very favorable season the yields are sometimes greater.

The value of this land varies from $50 to $75 an acre, depending on the improvements and location.

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

Mechanical analyses of Durant 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.*	*Per cent.*
23619, 23621.....	Soil.....	2.0	1.8	1.0	2.7	4.3	54.2	33.8
23620, 23622.....	Subsoil.....	.6	1.1	.9	5.7	4.7	50.6	36.0

BIENVILLE FINE SAND.

The Bienville fine sand to a depth of 8 inches is a light yellowish gray medium to fine sand, underlain to a depth of 36 inches by an orange-colored sand. There is practically no difference in the soil and the subsoil, except that the soil contains a little more organic matter.

This type occurs in the Trinity bottoms in the form of sand ridges, and is surrounded by the Trinity clay. The line of separation is very distinct and the gradation from one to the other takes place within a very short distance. However, along this boundary line the Bienville fine sand is much darker in color, becoming a brown or yellowish brown, the soil extending to a greater depth, and being much more loamy than the main body of the type. Here the subsoil is a brown sandy loam. This phase is such a narrow strip that it is practically of no importance.

The Bienville fine sand has the smallest extent of any type in the survey, its total area being hardly more than one-half square mile. Practically all of it is found around Sand Lake; another very small area is found east of Telico. The topography is almost level, being slightly sloping in places. It is elevated high enough above the bottom lands not to be subject to overflow, except along the edges during unusually high water. The open texture of the soil and subsoil promotes good surface and underground drainage. This soil is not cultivated to any extent. It would be better adapted to truck than to any other crop if it were more favorably located. On account of its being in the bottoms, crops would be more subject to frost than those grown on higher land.

The results of mechanical analyses of the soil and subsoil of this type are given in the following table:

Mechanical analyses of Bienville fine sand.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
23631	Soil	0.0	1.0	12.3	76.4	5.0	2.7	2.5
23632	Subsoil	.0	.8	12.0	77.2	5.1	2.2	2.8

HOUSTON CLAY.

The surface soil of the Houston clay, to a depth of 6 inches, varies from a gray to a brownish-gray clay, containing a high percentage of silt. The subsoil is a light-gray to pale yellowish gray, and sometimes almost a white, clay containing a high percentage of silt. Both the soil and subsoil frequently contain lime concretions and fragments of limestone. This soil is not typically developed in the county, all

of the areas being small and lacking uniformity. Many of them are very similar to the Houston stony clay. The main difference between the two types is that the Houston clay has a lighter color and a greater depth.

Practically all of the type is found along the slopes of the streams, although some spots are on knolls. The main body of this soil is the result of erosion and to this cause is due its varied composition. As a general rule the underlying limestone or white rock lies from 18 to 30 inches below the surface. Just before the white rock is reached there is often several inches of almost white silty material. Both the depth and color of this soil vary with the topographic position. The darker colored areas occupy the more level places, while on the slopes the color of the soil is usually of a lighter shade, and in places, especially where it is surrounded by Houston black clay, it appears at a distance to be almost white. Eroded spots along the slopes show the exposed limestone. Areas of the Houston stony clay too small to represent on the map often occur in this soil. In like manner many small areas of Houston clay, too small to be shown, are found in areas of the Houston black clay and the Houston stony clay.

The topography of this type is generally rolling and hilly, although small level areas are sometimes found on the tops of hills. This soil and the Houston stony clay are frequently so near alike that it is difficult to determine the classification. The Houston clay is confined principally to the central and western parts of the county, being located along the south prong of the Waxahachie and Red Oak Creeks in small scattering areas. Owing to the hilly and eroded condition a large percentage of it is uncultivated. When wet it is very sticky, and on drying the surface bakes rather hard, but does not crack like the Houston black clay. It is comparatively easy to cultivate, and after it is plowed and the clods are broken it becomes quite loose and acts somewhat like a silt. When the subsoil is dry it has the appearance of a powder. This is a residual soil derived from the weathering of the Austin chalk.

The type is well drained and sometimes suffers from drought. On account of the various phases of this soil, which are generally of different depths, it is hard to estimate the crop yields. Oats seem to do better than any other crop, the yield ranging from 35 to 45 bushels. Cotton will probably produce from one-third to one-half bale and corn 20 to 35 bushels per acre. The Houston clay is better adapted to the growing of fruit than any of the other clay types.

HOUSTON BLACK CLAY.

The soil of the Houston black clay, to a depth of 10 inches, is a very heavy tenacious black clay, containing a high percentage of organic matter. The subsoil is a heavy black clay having practi-

cally the same characteristics as the soil, although it is a little lighter in color, owing to a smaller percentage of organic matter.

The type is locally known as "black land." When dry and well cultivated it is very friable and easily worked. When plowed too wet it forms clods, but after they have been exposed to the weather for some time they break down to a certain degree and the soil can be put into a good mechanical condition by means of a light harrow. If not tilled the soil cracks badly in dry weather; sometimes the cracks are several inches wide and several feet in depth. In wet weather, and especially during the winter months, this clay sticks to the wagon wheels in large quantities and it is frequently seen along the road in piles where it has been removed.

The Houston black clay is a residual soil derived from the weathering of the Taylor marl and the Austin chalk. In the eastern portion of Ellis County it is derived from the Taylor marl, and in the western part from the Austin chalk. The type is about equally divided between the two formations. The soil is very uniform, but the subsoil varies somewhat according to the formation from which it is derived. When it is derived from the Austin chalk, this chalk, or white rock, as it is locally known, often occurs at various depths. As a general rule it is from 4 to 8 feet below the surface. Occasionally it is within 30 inches of the surface, such places being along the slopes or near the boundary line of the Houston stony clay. In such cases the subsoil below a depth of 20 or 24 inches is a yellowish clay and becomes lighter in color as the depth increases. Where the rock lies at depths of 4 feet or more it does not influence the color of the subsoil to any great extent within 3 feet of the surface. Where derived from the Taylor marls the subsoil is black to a depth of 4 or 5 feet, sometimes having a bluish or bluish-gray tinge, which is more noticeable after a rain. This portion of the type is found principally in the southern and southwestern parts of the area and especially along the eastern side of Chambers Creek. The lighter-textured phase is found in the eastern part of the county, where the type borders the Wilson clay loam and the Durant loam. Here the gradation is sometimes broad and the line of separation is rather general in places. This was most noticeable between Boyce and Garrett.

Another phase of the type, known as "elm thicket land," generally occupies level or gently sloping areas paralleling the stream courses. It was originally covered by a dense timber growth, the greater percentage being elm. Though a few of these areas have never been cleared, the greater part has been cleared long enough to be free from stumps. One of the largest forested areas, parts of which have been recently cut over, is found northeast of Bardwell along Waxahachie Creek. Here the stumps are so thick that cultivation is diffi-

cult. This phase is considered a little more productive than the main body of the type. The soil is deep and very rich in organic matter.

In some places rounded gravel, varying from small pebbles to fragments the size of an egg, are found scattered through the soil and subsoil. This gravel does not occur in large enough quantities to interfere with cultivation. Such areas are small, most of them not being large enough to represent on the map. The most important, however, have been indicated by symbols. Frequently small concretions of calcium carbonate varying in size from small particles to pieces 1 or 2 inches in diameter are scattered upon the surface and throughout both soil and subsoil.

The topography of the Houston black clay varies from level to rolling. As a rule the most rolling areas are found along the line of separation between this type and the Houston stony clay. In other sections both rolling and level areas are found. On the east side of Chambers and Waxahachie Creeks the type is level or gently rolling. One of the largest and most level areas occurs on both sides of Mill Creek where the International & Great Northern Railroad crosses it. The drainage is good during an average season, but the level areas suffer from an excess of moisture during a wet season. Open ditches are sometimes found on the level areas and more of them would prove beneficial.

The Houston black clay is the most important soil in the area, covering more than one-third of the county. It occurs in one broad and very uniform body and one of smaller size. The largest body, with a width varying from 15 to 20 miles, extends diagonally across the county from the northeast corner to the southwest corner. This broad area is broken practically only along the stream courses. Here the Trinity clay is found, and along the bluffs or slopes small areas of Houston stony clay or Houston clay occur. The other area is in the southeastern corner of the county and is about 8 miles long and from 2 to 5 miles wide.

This is a very productive soil. It is well suited to cotton, corn, and small grain. The greater portion of it is planted in cotton, other crops being grown only to a small extent. Alfalfa does well on the level areas. On an average the yield of cotton is from one-fourth to one-half bale per acre, although during a favorable season 1 bale is not uncommon. Corn yields from 30 to 40 bushels, and oats from 40 to 60 bushels per acre.

The price of this land ranges from $60 to $125 an acre, depending upon the location and improvements.

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

Mechanical analyses of Houston black clay.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
23617	Soil	0.4	1.4	0.8	3.0	7.6	44.7	42.2
23618	Subsoil	1.2	2.4	1.2	2.4	1.4	48.0	42.9

HOUSTON STONY CLAY.

The soil of the Houston stony clay varies from about 4 to 8 inches in depth, and consists of a dark-brown or black clay. When cultivated it becomes comparatively loose and friable. A large number of limestone fragments of varying size are scattered over the surface and throughout the soil. At depths ranging from 5 to 10 inches the parent limestone is encountered in place. It sometimes lies at a little greater depth, but seldom deeper than 15 inches. Along the slopes and on some of the higher knolls, where erosion has been more active, the rock is exposed at the surface. In such areas spots of Houston clay too small to represent on the map were encountered and in some cases they were so thickly scattered through the type that it was difficult to determine which soil predominated.

The shallow phase of the Houston clay is generally found along these slopes, the soil being only from 3 to 5 inches deep and resting on the unweathered rock. Practically the only difference between these spots and the Houston stony clay is the color, the Houston clay being gray or yellowish gray, the light color being due principally to lack of organic matter.

The Houston stony clay is locally known as White Rock land, the name being suggested by the chalky limestone underlying the type. This limestone belongs to the Austin chalk formation. The rock crumbles very readily upon being exposed to the atmosphere and when fragments are turned up and left on the surface for any length of time they break down and rapidly form new soil. The rock is so soft that it can be turned up from the solid bed by means of the plow. In many fields a little is brought to the surface each year, and the soil is gradually deepened in this way.

This type occurs mainly as one large and almost unbroken area, extending north and south the entire length of the county. It is about 30 miles in length and ranges from 1 to 8 miles in width. The type is very uniform and is broken only by the bottoms along the streams and by small spots of Houston clay. Bordering this type on the east is the extensive area of Houston black clay, and where the streams pass from the Houston stony clay into this type, small spots or narrow strips of the former lie along them for some distance

into the Houston black clay areas. Such areas are due to erosion, the soil having been washed off almost as fast as it is formed. The change from this type to the Houston black clay on the east is comparatively gradual. On the west the line is abrupt, being formed by bluffs from 50 to 100 feet in height.

The topography of the Houston stony clay is for the most part rolling, though it becomes rough and hilly along some of the streams. The hills, however, are often broad and rounded, with gently sloping sides; along the streams there are often steep bluffs of white limestone, and the entire boundary line on the west, as already stated, is composed of such bluffs. On some of the broader hilltops there are comparatively large areas that are level.

The Houston stony clay is easily eroded and small areas where the underlying chalky white limestone outcrops are frequently seen on the hillsides and on the summits of the rounded knolls. Deep gullies extending from the hills to the streams are common. These gullies as well as some of the stream courses have cut down several feet into the white rock.

The numerous small streams with narrow V-shaped valleys traversing this soil type rapidly remove excess water in times of heavy rains and the topography is such that thorough drainage is maintained. The type is inclined to be droughty, although the moisture conditions are much better than would be thought, considering the fact that the soil rests upon rock so near the surface. This rock, however, is soft, and seamed, which enables it to hold a certain amount of moisture. There are sometimes in fields in this type small spots in which the crops are distinctly inferior, though there is apparently no difference between the soil here and in the rest of the field. One would at first think that the plants were diseased. A close examination shows that a very thin crust of hard limestone overlies the chalky material under these spots and that the plants are simply suffering from lack of moisture. This demonstrates the moisture-holding properties of the rotten limestone.

The type varies somewhat in fertility with variation in depth. When there is only 3 or 4 inches of soil the yields are much smaller than when there is a depth of 6 or 8 inches. It is comparatively easy to cultivate, considering the stony character. The stones being soft, they are easily broken and are not as severe on farm machinery as harder stone would be. The yields on this type depend more on the seasons than upon any other one factor. Drought occasionally causes almost a total failure, when on the Houston black clay a fair crop would be produced. On the other hand, during a season of floods and heavy rains it produces better yields than the Houston black clay. The following are the yields ordinarily secured: Cotton, from one-third

to one-half bale; corn, 20 to 30 bushels; wheat, about 12 bushels; and oats, about 35 bushels per acre. The soil is especially adapted to small grains. The price of farm land of this type ranges from $30 to $60 an acre.

The following table gives the results of a mechanical analysis of a sample of the soil:

Mechanical analysis of Houston stony 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.*	*Per cent.*
23604.....	Soil.....	0.0	0.4	0.4	4.9	26.2	44.1	24.4

SUSQUEHANNA FINE SANDY LOAM.

The Susquehanna fine sandy loam has the widest variation of any type encountered in the county, and it would be a difficult matter to collect a representative sample. While the soil is a fine sandy loam, the content of sand differs greatly in different localities. There is also a wide variation in color. The greater portion of the type is a yellowish or reddish-brown fine sandy loam with a depth of 8 inches. The subsoil from 8 to 36 inches is an orange-colored or yellowish-red sticky sandy clay. The type occurs in small areas and its present condition is most likely due, to a large extent, both to stream and wind action. While it is not subject to overflow it is always found bordering the stream courses and bottom lands.

The type occurs along Chambers Creek and Trinity River, the greater portion being along Chambers Creek. The largest and most uniform area is found in the western part of the county, lying between the north and south prongs of Chambers Creek. The other areas occurring along this creek are found altogether on the eastern side of it. These areas are darker in color than the areas farther north. They are found along the slopes between the uplands and bottoms, and the soil here is a brown sandy loam, with a depth of 6 or 8 inches, underlain by a brown or yellowish-brown clay, often containing a very small percentage of sand. Spots of the predominating soil are scattered through these areas and are most noticeable in the area north of Fort Lake, where the soil in some places is almost a fine sand, orange or yellowish red in color. In other places this soil becomes so heavy that it approaches a loam which is very similar to the Durant loam. About one-half of this type as it occurs along the Trinity River is found in one area in the extreme southeastern corner of the county. This area contains practically all the phases of the type. Several distinct soils may be found in a 10-acre tract. The soil to a depth of 8 or 10 inches may be yellowish

sand, or gray, yellowish, yellowish-red, or brown sandy loam, varying in texture from light to heavy. The subsoil may be a yellowish-red mottled or almost black clay. The lighter colors contain the greater percentage of sand, while the darker are sometimes almost free of sand. The other important areas along Trinity River are found east of Bristol.

The topography varies from level to gently rolling, the type being confined largely to the slopes along the streams. That found along the Trinity bottoms is sometimes in the form of ridges. This soil was probably formed by small amounts of sand brought down by the streams from the north and deposited and later reworked by the winds, the sand becoming intermingled with both the upland and bottom soils.

The crop yields vary with the different phases of the type, and it is difficult to give an average yield. The soil is easily cultivated and the drainage is good. During a dry season it suffers from lack of moisture. It is especially adapted to fruit and truck, though very little of it is cultivated to these crops. Probably about one-half of this type along the Trinity River has its original timber growth, which is principally black-jack and post oak.

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

Mechanical analyses of Susquehanna fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
23637	Soil	0.0	0.0	0.8	61.1	14.3	11.7	11.7
23638	Subsoil	.0	.0	.5	38.7	15.0	10.9	34.5

WILSON CLAY LOAM.

The soil of the Wilson clay loam consists of 10 inches of a dark-brown to almost black clay loam. The subsoil, to a depth of 3 feet, is a grayish-black or brown clay. The color becomes lighter as the depth increases and is frequently yellowish below 30 inches. Lime nodules are sometimes scattered through both the soil and subsoil, and white spots, due to their partial decomposition, are occasionally seen in the subsoil. The Wilson clay loam is a gradation type lying between the Houston black clay and types of a lighter texture, such as the Durant loam and Durant fine sandy loam. It is nearly always associated with the Houston black clay, bordering it on at least one side, and it is heavier near the boundary with the clay and lighter along contacts with the other types mentioned, in some cases approx-

imating a loam in texture. The subsoil of this phase is a yellowish or sometimes mottled clay, containing a very small proportion of fine sand, enough to give it a lighter texture than the typical subsoil.

The Wilson clay loam is scattered over the eastern part of the county, being restricted almost entirely to the region east of a line running north and south through Bardwell. The largest and most uniform area is found south of the town. Other important areas are developed along the eastern side of Mustang and Chambers Creeks and on the north side of Walker Creek. In the vicinity of Crisp is a comparatively large area, and another one is found about 2 miles east of Ferris.

The Wilson clay loam is derived from the Taylor marls, but its present condition is principally due to the intermingling of the Houston black clay and the lighter textured soils. There is a gravelly phase of this type represented on the map by symbols. Rounded gravel, varying in size from that of a small marble to an egg, is scattered over the surface and throughout both the soil and subsoil. These areas are not of any great importance, and do not materially change the crop value of the type. Where the gravel is very numerous the soil is a little more difficult to cultivate. The most of this gravel is found around Creechville, although some is found 1 mile north of Alma.

The Wilson clay loam has good drainage during an average season, with the exception of an occasional small depression. Along the slopes small eroded areas are sometimes found. The topography varies from rolling to level. The level areas sometimes suffer from an excess of moisture during a wet season.

The type is comparatively easy to cultivate. It sometimes breaks up into clods, but when these are crushed and the soil put in a good state of cultivation it forms a mellow loam. It is not so rich in organic matter as the Houston black clay and the yields are slightly less. It is especially adapted to corn, cotton, and oats. Corn yields from 30 to 45 bushels, cotton from one-third to three-fourths bale, and oats 40 to 50 bushels per acre.

The average results of mechanical analyses of the soil and subsoil of this type are given in the following table:

Mechanical analyses of Wilson clay loam.

Number.	Description.	Fine gravel.	Coarse sand	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
23605, 23607.....	Soil.....	0.3	0.9	0.9	9.5	14.5	55.2	18.6
23606, 23608.....	Subsoil.....	.0	1.2	1.0	14.4	21.5	41.1	20.9

CRAWFORD CLAY LOAM.

The Crawford clay loam consists of a chocolate-brown silty clay loam, with a depth of 8 inches, underlain to a depth of 3 feet by a light-brown, chocolate, or reddish-brown silty clay. The principal difference between the soil and subsoil is in the color, which is due to a greater amount of organic matter in the soil. This is a very uniform type, the main variation being in the depth to the underlying limestone. It is very seldom more than 4 feet from the surface and it is generally found at a depth of about 25 to 35 inches. It was sometimes rather difficult to separate this soil from the Houston stony clay. When the white rock was less than 12 or 15 inches from the surface it was classed as Houston stony clay. This was not the case very often, as there was generally a sharp line between the two types. Along this boundary line limestone fragments are sometimes scattered over the surface, and the soil is a little lighter in color. Partially decomposed limestone fragments or concretions often cause white spots in the subsoil. The Crawford clay loam, like the Houston stony clay, is derived from the Austin chalk, and the principal difference between the two is that the limestone underlying the former has weathered to a much greater depth.

The type is confined entirely to the eastern part of the county and is generally associated with the Houston stony clay. The entire type covers only a comparatively small area. The largest one found is at Midlothian. It extends north and south, passing through the eastern part of the town, and is about 3 miles in length and varies from about one-fourth mile to 1¾ miles in width. Other important areas are found along Gratehouse Branch and Mill and Red Oak Creeks.

The topography of the type varies from rolling to gently rolling. On the tops of some of the hills are sometimes almost level areas. Owing to the topography the soil has good surface drainage. When put in a good condition it acts very much like a heavy loam, although it bakes some and is very sticky when wet. It does not crack like some of the clay soils nor stick to the plows so badly. While only of limited extent, it is considered one of the most desirable soils in the area, partly on account of ease of cultivation and partly because of natural productiveness.

The Crawford clay loam is well adapted to cotton, corn, wheat, and oats, and is especially well suited to small grain. Cotton yields from about one-third to three-fourths bale, corn 30 to 40 bushels, oats 40 to 60 bushels, and wheat from 12 to 20 bushels per acre.

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

Mechanical analyses of Crawford clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
23602	Soil	0.0	0.2	0.3	2.2	14.8	55.6	26.9
23603	Subsoil	.0	.2	.4	3.9	17.6	42.9	35.2

ELLIS CLAY.

The Ellis clay to a depth of 6 inches is a yellowish-brown clay, having a peculiar dark-green color. The subsoil is a heavy plastic clay to a depth of 3 feet or more. In many places scattered over the surface and throughout the soil and subsoil are fragments of hard limestone, these being so numerous in places that the soil might be called a stony loam. This hard brown limestone is somewhat characteristic of the type, although some areas are practically free of stone. The most stony areas of the type have been represented on the map by symbols. Occasionally lime concretions are also found scattered through the soil and subsoil. This soil is very sticky and plastic when wet and it bakes hard on drying. It is somewhat difficult to cultivate unless handled exactly at the proper time, when it is neither too wet nor too dry.

The surface features of the type vary from rolling to hilly and broken. The broken areas have been badly eroded by the numerous small streams which traverse them. It is on such areas that the streams are most numerous. Both the color and depth of the soil vary with the topography, its greatest depth and darkest color being in the most level areas. The depth of soil decreases and the color becomes lighter as the areas become more rolling and broken. On some of the knolls and slopes there is frequently only a very few inches of soil.

The greater part of the Ellis clay lies in the valley in the western part of the county. The largest single area mapped is situated northwest of Midlothian. It runs north and south for about 4 miles and varies from about 1 mile to 1½ miles in width. A narrow strip fringes the bluff line between the valley soils and the Houston stony clay. A number of smaller areas are found between Mountain Peak and Maypearl and in the vicinity of Chambers Creek. The small areas in the eastern part of the county occur in the form of narrow strips bordering the bottom lands along the Trinity River or some of the smaller streams. Such areas are on slopes and have been subjected to great erosion. Often small spots of this type occur in the Houston black clay along the slopes where erosion has been severe enough to expose the yellowish clay in the form of streaks extending up and down the hillsides.

In the western part of the county this type, like the Durant clay, is derived from the Eagle Ford formation and is the residue of marly clays, while in the eastern part it is derived from Taylor marl. One cause of the plastic and unproductive nature of this soil is its lack of organic matter, which has been brought about through the action of erosion. The drainage is good, with the exception of some of the more level areas. Practically all of it is surface drainage, as the dense structure of the subsoil does not favor the underground movement of water.

Because of its surface features and the difficulty in handling this soil, the greater proportion of it is generally used for pasturage, for which purpose it is best adapted. Practically all of the type that is cultivated is devoted to cotton. Cotton does better than any other cultivated crop, although it is often difficult to secure a good stand. The stalks are never large, but they fruit well. The yield ranges from one-fourth to one-half bale per acre.

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

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.*	*Per cent.*
23609, 23611.....	Soil.....	0.4	0.9	3.9	15.6	15.9	34.9	28.2
23610, 23612.....	Subsoil.....	.4	.4	1.7	4.3	11.6	30.7	51.0

SUMMARY.

Ellis County, Tex., area 918 square miles, is situated a little east of the north-central part of the State. The topography of the county varies from level to hilly. The western part is more broken than any other section, although there is a valley in the north-central part that has a level to gently rolling topography. The eastern half of the county varies from level to rolling.

The Trinity River, which is the eastern boundary line of the county, receives directly or through its tributaries practically all of the drainage of the county. The most of the principal outlets have their source within the county limits, these being Mill, Chambers, Waxahachie, Grove, and Red Oak Creeks. The drainage is mostly to the southeast.

The climate is comparatively mild. The summers are sometimes long and hot, but there is generally a good breeze. Cold waves are experienced during the winter, but they are of short duration and seldom do any damage except when they occur in the late spring.

The county has a population of 53,629. Waxahachie and Ennis are the two largest towns, having a population of 6,205 and 5,669, respectively. Both of these towns have excellent transportation facilities.

According to the census of 1900, 29.2 per cent of the farms were operated by the owners. The principal crop is cotton. The price of land varies from $10 to $125 an acre. The cheapest land is along Trinity River, while the most valuable is located near the large towns and is generally the Houston black clay.

The soils of the area are derived from the Cretaceous formation and vary from sand to clay. The Houston black clay occupies 42.6 per cent of the county. It is not only the most important type of Ellis County, but is the most productive soil of the famous "black-land belt" of Texas. While it is well adapted to general farming, by far the greater portion of it is planted to cotton. The type is well drained during an average season. Being a heavy clay, moisture is easily conserved, and, as a general rule, it suffers more from an excess of moisture than from drought. The price ranges from $75 to $125 an acre, depending on the location and improvements.

The Houston stony clay is also an important type in extent. It is especially adapted to small grains. The price ranges from $30 to $60 an acre.

The Durant clay is a desirable soil, occupying level to gently rolling areas. The drainage is good during an average season. It is well adapted to general farming, and in places alfalfa does well. The price ranges from $20 to $75 an acre.

The Durant loam has a level topography, good drainage, and is adapted to general farming. It is also well suited to truck and fruit, although it is used very little for this purpose. The value of this land ranges from $50 to $75 an acre.

The Durant fine sandy loam is one of the lightest textured soils of the area. It is the best soil in the area for the growing of truck and fruit, being especially adapted to small fruit. It also produces good yields of cotton and corn. The price ranges from about $45 to $65 an acre.

The Wilson clay loam is an intermediate type between the heavier and lighter soils. It has good drainage and is easily cultivated. Cotton, corn, and small grain do well on this soil. It has a value of $50 to $75 an acre.

The Crawford clay loam is not only adapted to cotton and corn, but is especially suited to wheat and oats, producing better yields than any of the other soils in the area. Its value ranges from about $60 to $85 an acre.

Probably not more than 25 per cent of the Trinity clay is under cultivation, this being the better-drained portion. The remainder of it is in need of drainage and is often subject to overflow. If it were drained and diked it would be one of the most valuable soils in the county. It is especially adapted to corn and alfalfa. The value of this land ranges from $10 to $65 an acre.

The Bienville fine sand, Susquehanna fine sandy loam, Houston clay, Ellis clay, and Durant very fine sandy loam occupy only comparatively small areas and are not of any great importance. The lighter-textured types are best adapted to fruit, and the Houston clay to small grain.

Ellis County is one of the leading cotton producing counties in the United States, and its present prosperous condition has been mainly brought about by the growing of this crop. Nevertheless the cultivation of a greater variety of crops would mark an important advance in its agricultural development. The variety of soils found here and their different adaptations offer opportunities for such diversification.

NOTE.—Chemical analyses on determinations of the calcium carbonate content of the soils of Dallas County, Texas, show that the following samples contained varying amounts in excess of one-half of 1 per cent:

Calcium carbonate determinations.

Type and sample number.	Calcium carbonate.	Type and sample number.	Calcium carbonate.
Wilson clay loam:	*Per cent.*	Durant clay:	*Per cent.*
23608	2.27	23619	17.31
Ellis clay:		23620	27.75
23609	3.50	23621	9.38
23610	2.39	23622	12.06
23611	14.68	Trinity clay:	
23612	16.47	23633	4.09
Durant very fine sandy loam:		23634	3.97
23613	12.95	23635	13.22
23614	18.59	23636	12.36
Houston black clay:			
23617	5.59		
23618	9.31		

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