

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

SOIL SURVEY OF ERATH COUNTY,
TEXAS.

BY

T. M. BUSHNELL, OF THE TEXAS AGRICULTURAL EXPERIMENT
STATION, IN CHARGE, AND H. W. HAWKER AND
D. B. PRATAPAS, OF THE U. S. DEPART-
MENT OF AGRICULTURE.

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



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1923.

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[PUBLIC RESOLUTION—No. 9.]

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

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

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

Approved, March 14, 1904.

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

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MAP.

Soil map, Erath County sheet, Texas.

SOIL SURVEY OF ERATH COUNTY, TEXAS.

By T. M. BUSHNELL, of the Texas Agricultural Experiment Station, In Charge, and H. W. HAWKER and D. B. PRATAPAS, of the U. S. Department of Agriculture.

DESCRIPTION OF THE AREA.

Erath County is situated slightly north of the center of the State of Texas and about 60 miles southwest of Fort Worth. The county line is formed by eight tangents inclosing an irregular area about 40 miles long by 30 miles wide. The county has an area of 1,083 square miles, or 693,120 acres.

Erath County belongs to that part of the Great Plains region of Texas which has been described as the Grand Prairie,¹ and includes part of the West Cross Timbers belt. Strips along the southwestern and northern borders belong to that section which physiographers have called the North Central Plains section.



FIG. 12.—Sketch map showing location of the Erath County area, Texas.

This country presents a very common Texan land form known as a "wold," which is formed by differential erosion from inclined sedimentary rocks, and is composed of a smooth plain, increasing gradually in elevation from south to north and a steep slope running east and west across the northern part of the county by which the plain is abruptly terminated and the general land surface drops rapidly from the highest part of the plain to a lowland or second plain about 300 feet lower than the highest part of the first. In technical physiographic literature a plain of this kind is designated as a dip plain or structural plain, and the steep slope by which it is terminated as a "bajada" or escarpment. The land form unit represented by the plain and escarpment constitutes a "cuesta." The smooth plain south of the escarpment covers two-thirds of the county. The escarpment itself, being narrow, covers a small belt of rough country and the lower plain north of the escarpment occupies the rest of the county, approximately a third. The northern part of the main plain, just south of the escarpment, is cut into a number of ridges and valleys by small streams draining northward and northeastward into the Brazos River. This forms what may be described as a ragged or frayed edge to the plain. It occupies a belt about 3 miles wide and constitutes a very hilly portion of a plain that is elsewhere smooth.

¹ Bulletin No. 44, University of Texas, pp. 19 and 20.

In the southeastern part of the county a range of flat-topped hills rises above or lies on the smooth plain, forming by contrast with it a prominent topographic feature. This range is a northern outlier or remnant of another plain lying south of this whose northern edge stands above the southern low margin of this plain in exactly the same way as this one stands above the southern low margin of the plain occupying the northern third of Erath County.

The northern plain of Erath County rises rather gradually northward and as it rises the streams draining it cut deeper and deeper valleys into it, and its surface is thus made more and more uneven. The extreme northern part of the county has a hilly topography because of this relationship.

Recapitulating, approximately the southern two-thirds of the county is occupied by a smooth southwardly sloping plain, with some flat-topped hills standing on it in the southeastern part of the county. The smooth plain is bordered on its northern edge by a narrow belt of hilly country formed by a series of narrow valleys cut into it and terminated by an abrupt drop to a lower plain. The rough belt including the abrupt drop is about 3 miles wide and runs east and west across the northern part of the county, turning southward along the eastern margin for several miles.

North of this rough belt is a parallel, smooth lowland belt, 3 to 5 miles wide, gradually rising northward and merging into a low hilly belt occupying the extreme northern part of the county.

The elevations in the central part range from 1,200 to 1,500 feet above sea level. The Dublin-Lingleville ridge lies above 1,500 feet and attains a maximum for the county of over 1,750 feet near the Cage Ranch. The Duffau Mountains rise about 100 feet above the surrounding plains. All the larger stream bottoms are below 1,000 feet at the county line, and Richardson Creek has a minimum elevation in the county of 850 feet above sea level.

Erath County lies astride the watershed between the Brazos and Leon Rivers, and all the run-off eventually reaches the Brazos. The main drainage divide passes from Smith Gap to Huckabay, Gatlin Hill, Pilot Knob, Bunker Hill, Lone Mountain, Martharl Gap, and Chalk Mountain. From it the drainage flows north to the Palo Pinto (in Palo Pinto County) and Paluxy Creeks and south to the Leon (in Comanche County) and Bosque Rivers. An offshoot of the main divide passes south from the Cage Ranch to Lingleville, Dublin, and Carlton, Hamilton County, between the basins of the Bosque and Leon. Another offshoot passing from Huckabay to Union Grove and Pleasant Ridge Schools and north of Brown Ranch separates the Paluxy Basin from the Palo Pinto and Kickapoo Basins.

The surface drainage of the county is in general well provided for by the network of small and large valleys. Since the land has been put under cultivation many streams said to have been formerly perennial go dry or become a series of pools and shallows in dry seasons. The run-off is very rapid, so that even small streams are too deep to ford during rains, but the flood stage passes in a few hours or, in the case of the larger streams, a few days. Paluxy Creek and some other streams are widening their channels and thus providing room for such large volumes of water as practically to prevent their first bottoms from overflowing.

Erath County was organized in 1856. The earliest permanent settlers were coming in slowly from more eastern States during the fifties, but the first large influx came after the Civil War. The population numbered 11,796 in 1880, 21,594 in 1890, 29,966 in 1900, 32,095 in 1910 and 28,385 in 1920. Seventy-five per cent of the population is classed as rural. The average density of rural population is 19.6 persons per square mile.

The county is most thickly settled in the central and southern agricultural sections and in the coal fields. The people are chiefly whites, although there are negroes in Dublin, Stephenville, and Thurber, and a few on farms near Stephenville. Thurber has a large foreign element, consisting chiefly of Mexicans, Italians, Poles, and Austrians.

Stephenville, with a population of 3,891, is the largest town and county seat. John Tarleton Agricultural College, belonging to the Texas system of agricultural and mechanical colleges, is located here. Dublin, with a population of 3,229, is a railroad center and distributing point for several wholesale houses. Thurber is a company-owned mining town, where coal is mined and brick is made. Bluff Dale, Alexander, Clairette, and Harbin are small railroad towns, and Morgan Mill, Lingleville, Huckabay, Duffau, Johnsville, Exray, Chalk Mountain, Sap oak, Victor, Purves, Edna Hill, and Patilo are small trading points. Lipan, Hico, Carlton, Desdemona, and Gordon are towns in neighboring counties, but near enough to be trading points for Erath County farmers.

The Missouri, Kansas & Texas Railway traverses the southern part of the county and connects with Waco and Cisco. It is intersected at Dublin by the Fort Worth & Rio Grande Railway (Frisco system), which crosses the county in a northeast-southwest direction. The St. Louis Southwestern Railway (Cotton Belt system) extends southward from Stephenville to Hamilton and Waco. The Wichita Falls, Ranger & Fort Worth Railroad has recently been built from Dublin to Desdemona and other oil-field towns. A branch of the Texas & Pacific Railway comes to Thurber and the coal mines of that vicinity.

The system of public roads extends to almost all the settled parts of the county. Many of the roads have been graded and a few miles have been surfaced. Most of the roads are in fair condition in dry weather, but after rains they become very "heavy" and almost impassable in spots. In places the soil material is a natural limestone gravel, which when graded up forms a good hard road under all weather conditions. This material occurs in practically all parts of the county, and if used for surfacing the poorer sections of the roads, would greatly improve the road system. A good highway across the county is under construction.

Telephone lines extend to many small towns and farms. Mail routes pass near most farmhouses.

There are over 115 rural schools in the county. The tendency is toward consolidation of schools and the erection of better buildings.

Local markets absorb much of the farm produce. Cream, eggs, poultry, hogs, and cattle are shipped to Fort Worth. Cotton goes to Fort Worth and more distant markets. Corn, oats, and hay are largely sold to farmers within the county.

CLIMATE.

The records of the United States Weather Bureau station at Dublin show a mean annual precipitation of 27.06 inches. As a rule, spring has the most rainfall, winter the least, and summer and fall a little less than spring. However, averages do not show true weather conditions, as the seasons vary extremely from year to year. In 1901 there was less than 14 inches of rain and in 1908 there was nearly 40 inches. It seems that often there are several years of good rainfall followed by several years of drought. The prevailing weather of this section approaches that of the semiarid regions. Snow has an average depth of only 2 inches per annum. Sleet is more common and is sometimes destructive to trees and telephone lines.

The mean temperature for the year is 64.4° F., for the summer 81.9° F., and for the winter 45.7° F. A maximum temperature of 111° F., and a minimum of -9° F. have been recorded. The characteristic weather cycle for the winter consists of a cold "norther," which may start with a cold rain, sleet, or snow, but blows clear and often cold enough to freeze. This is followed by a few days of calm, cold, clear weather, gradually becoming warmer, with winds growing stronger and bringing clouds from the southeast until the sky is overcast, when the cycle begins again with a sudden cold wave from the north. The northers gradually become less intense in the spring. Summer weather is more variable. Continued southeast winds are likely to be followed by rain. When rainy weather sets in it may last for a week or more. Sometimes hot, dry winds blow from the southwest until growing crops are scorched.

The average date of the last killing frost in the spring is March 18, and of the first in the fall November 10, giving a growing season of 247 days. The latest spring frost recorded occurred on April 5, and the earliest in fall on October 9. There is ample time for the maturing of all crops commonly grown in this county. Frosts are likely to damage fruit crops by killing buds which have been forced by a few warm days in early spring.

The following table gives the normal monthly, seasonal, and annual temperature and precipitation at Dublin:

Normal, monthly seasonal, and annual temperature and precipitation at Dublin.

(Elevation, 1,466 feet.)

| Month. | Temperature. | | | Precipitation. | | | |
|----------------|--------------|-------------------|-------------------|----------------|--|---|----------------------|
| | Mean. | Absolute maximum. | Absolute minimum. | Mean. | Total amount for the driest year (1901). | Total amount for the wettest year (1908). | Snow, average depth. |
| | ° F. | ° F. | ° F. | Inches. | Inches. | Inches. | Inches. |
| December..... | 45.7 | 84 | 6 | 1.94 | 0.90 | 0.00 | 1.0 |
| January..... | 45.5 | 84 | -1 | 1.09 | .00 | .53 | .8 |
| February..... | 46.1 | 92 | -9 | 1.24 | 1.00 | 1.24 | .1 |
| Winter..... | 45.7 | 92 | -9 | 4.28 | 1.90 | 1.77 | 1.9 |
| March..... | 57.2 | 97 | 19 | 1.55 | .80 | 2.47 | .2 |
| April..... | 63.5 | 98 | 24 | 3.30 | 2.10 | 12.78 | .0 |
| May..... | 71.8 | 103 | 34 | 3.71 | 3.13 | 6.96 | .0 |
| Spring..... | 64.1 | 103 | 19 | 8.56 | 6.03 | 22.21 | .2 |
| June..... | 79.8 | 108 | 50 | 2.71 | .00 | 1.15 | .0 |
| July..... | 82.4 | 111 | 54 | 2.36 | 1.18 | 2.44 | .0 |
| August..... | 83.5 | 106 | 46 | 2.10 | 1.03 | 2.25 | .0 |
| Summer..... | 81.9 | 111 | 46 | 7.17 | 2.21 | 5.84 | .0 |
| September..... | 76.7 | 104 | 40 | 2.45 | .70 | 3.37 | .0 |
| October..... | 65.3 | 97 | 29 | 2.64 | 1.45 | 4.21 | .0 |
| November..... | 55.4 | 88 | 12 | 1.96 | 1.40 | 2.10 | .0 |
| Fall..... | 65.8 | 104 | 12 | 7.05 | 3.55 | 9.68 | .0 |
| Year..... | 64.4 | 111 | -9 | 27.06 | 13.69 | 39.50 | 2.1 |

AGRICULTURE.

The agriculture of Erath County passed through the usual pioneer stages. The first lands to be cultivated were creek bottoms and post-oak land. This timbered land had to be cleared or deadened off, but it supplied fuel and material for building log cabins and fences. It was also easier to work than the heavy prairie lands, which were not generally taken up until the eighties, when barbed wire fences came into use. Cattle, horses, and hogs were grazed on the open range, where they subsisted on grasses, bushes, and acorns. The farmers had small patches of corn, wheat, cotton, and various other crops which helped to make each farm self-sustaining.

The table below shows the acreage and production of the leading field crops, as reported in the last five censuses:

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

| Crops. | 1879 | | 1889 | | 1899 | | 1909 | | 1919 | |
|-----------------------------------|-------------------------|----------------------------|-------------------------|----------------------------|-------------------------|------------------------------|-------------------------|---------------------------|-------------------------|----------------------------|
| | Area. | Production. | Area. | Production. | Area. | Production. | Area. | Production. | Area. | Production. |
| Corn..... | <i>Acres.</i> 19,702 | <i>Bushels.</i> 108,883 | <i>Acres.</i> 35,160 | <i>Bushels.</i> 936,596 | <i>Acres.</i> 55,324 | <i>Bushels.</i> 1,212,750 | <i>Acres.</i> 17,544 | <i>Bushels.</i> 67,579 | <i>Acres.</i> 42,957 | <i>Bushels.</i> 936,040 |
| Oats..... | 1,822 | 22,660 | 10,902 | 304,047 | 13,646 | 248,570 | 261 | 1,815 | 35,684 | 935,943 |
| Wheat..... | 5,832 | 28,397 | 9,205 | 101,807 | 6,698 | 58,380 | 38 | 154 | 19,228 | 251,124 |
| Grain sorghums..... | | | | | | | 854 | 10,715 | 2,455 | 46,271 |
| Hay and forage ¹ | 418 | <i>Tons.</i> 227 | 3,621 | <i>Tons.</i> 6,600 | 5,132 | <i>Tons.</i> 8,322 | 11,545 | <i>Tons.</i> 10,057 | 20,252 | 21,518 |
| Cotton..... | 14,220 | <i>Bales.</i> 2,857 | 41,989 | <i>Bales.</i> 17,390 | 93,350 | <i>Bales.</i> 25,478 | 127,005 | <i>Bales.</i> 21,268 | 63,865 | <i>Bales.</i> 19,738 |

¹ The figures for 1879 and 1889 are for hay alone.

The census figures in this table bring out a number of significant facts that indicate the general trend of agriculture in the county. The most prominent feature is the large acreage in cotton. Other significant features are the fluctuations in the acreage and yield of corn, oats, and wheat, the introduction of the grain sorghums in recent years, and the steadily increasing importance of the hay and forage crops. The year 1909 was very dry, and much cotton was planted to take the place of corn and small grains that were destroyed by drought. The year 1919 is considered one of the best all-round crop years in the history of the county, consequently the small grains are more prominent and the yields of all crops are good.

Cotton is the most important crop and the main cash crop. It is grown on nearly every farm, is planted on the best soil, and receives the best care. It is grown under all conditions, and in this respect it differs from other crops whose acreage is frequently governed by the weather and market conditions. The yield varies widely with the season; the average has ranged from 0.16 to 0.41 bale per acre.

Corn is the second crop in importance. In 1919 it was planted on 42,957 acres, and averaged 21.7 bushels per acre. The average yield has ranged from 3.7 to 28.4 bushels per acre. It is chiefly a subsistence crop, being fed to horses, mules, cattle, hogs, and poultry, or ground for cornmeal. Any surplus is bought by neighbors for the same use. A little is shipped out of the county when large yields are obtained. Corn tops are often cut and tied in bundles for forage and animals are pastured in the stalk fields.

Oats were sown on 35,684 acres in 1919, and averaged 26.2 bushels per acre. The average yields range from 7 to 28 bushels. Most of the grain is fed in the sheaf to the work animals.

Wheat was grown on 19,228 acres in 1919, with an average yield of 13 bushels per acre. The average yield reported in the four preceding censuses ranges from 4 to 11 bushels. Wheat is a cash crop, part of which is sold to local mills.

The grain sorghums, mainly kafir and milo, are becoming more important every year. In addition to constituting a very large part of the hay and forage produced, they were grown for grain in 1919 on 2,455 acres, with an average yield of 18.8 bushels per acre. In 1909 the grain sorghums yielded an average of 12.5 bushels per acre, or three times as much as corn in the same dry season.

The hay and forage crops have steadily increased in importance. Tame hay in 1919 occupied 4,725 acres and yielded 4,974 tons. The tame grasses consist mainly of Johnson grass, with considerable millet and some other grasses. Small grains were cut for hay from 2,096 acres, yielding 1,651 tons. Small acreages of prairie grass and annual legumes also supply some hay. Sorghums for forage occupied 11,836 acres, yielding 13,379 tons. These include sorgo (saccharine sorghum), kafir, milo, and feterita. In addition a small acreage of corn was harvested for forage and some silage crops were grown. The hay is baled and fed to work stock and cows. The sorgo may be baled or fed in bundles like the grain sorghums.

Peanuts yielded an average of 20.6 bushels per acre in 1919 on an area of 3,924 acres. The nuts are marketed and the hay from the vines is fed to stock.

In 1919 Erath County reported 69,645 peach trees of bearing age, with a production of 122,819 bushels, and 32,822 apple trees, with a

production of 56,202 bushels. Other fruits grown in a small way include grapes, pears, plums, dewberries and blackberries, figs, and Japanese persimmons. Several carloads of wild pecans were shipped from the county in 1920. Forest products were valued at \$56,472 in 1900. Firewood is now the principal product.

The census reports the number of domestic animals on farms on January 1, 1920, as follows: 8,476 horses, 5,549 mules, 83 asses and burros, 15,398 beef cattle, 14,087 dairy cattle, 3,326 sheep, 1,737 goats, 8,914 swine, and 147,356 chickens. The value of dairy products in 1919, exclusive of milk and cream used in the home, is reported as \$342,078, and the value of chickens and eggs produced as \$348,923.

Animals constituted 27.3 per cent of the total farm value in 1880 and 15 per cent in 1920. The apparent decline in importance is due to the relatively great increase in the value of buildings, equipment, and the land itself.

Less than 200,000 acres, considerably less than one-third the area of the county, are under cultivation, while more than 500,000 acres are used for pasture. Probably much of this latter always will be used for that purpose on account of its steep slopes or rough or rocky surface or the shallowness of the soil over the rock. The pasture land is found on almost every farm, and several large areas of it are in ranches. Thus topographic features, the abundance of stone, and the nearness of rock to the surface determine the agricultural value of much land of the county.

Soil differences, especially variations in the depth, texture, and structure of the surface material, combine with weather conditions to determine crop adaptation and yields. Sandy soils are adapted to peanuts and fruits. Heavy soils are better suited to small grains and produce corn and cotton well in favorable or wet seasons when the deeper sandy soils are too cold and moist.² If the spring is wet the crops start better on heavy land than on sandy land, but in case of subsequent summer drought they may fail on the heavy land but make a crop on the moisture stored in the sandy land. Since the average season in Erath County tends toward semiarid conditions, the sandy land is considered "surer" for crops. The sandy soils blow and drift more or less when the land is bare. This is especially true where the slope is exposed to the prevailing winds. Also crops on a southern slope are more subject to damage from hot winds than those on a northern slope in the lee of a hill. Cotton makes a heavier growth of stalks and is subject to more damage from the boll weevil on low, wet, and strong soils than on the higher, thinner lands. Frost comes earlier in the bottoms than on the hills.

The farmers of Erath County recognize the adaptation of various soils to the principal crops, as indicated above, and also the effect of varying seasonal conditions on different kinds of soil; but they usually plant corn and cotton every year on all kinds of land. The use of the sandy or heavy land for one crop or another depends more upon weather conditions up to planting time than upon the natural adaptation of the soil.

The plan followed by the average farmer is to plant as much cotton as he and his family can gather and enough corn, oats, and forage crops to feed his work stock and cows. On the black lands more small grains, including some wheat for sale, are grown.

² This is a peculiar condition produced by a high absorptive power in the upper sandy layer and the almost impervious nature of an underlying clay stratum.

The live-stock industry consists chiefly of the raising of beef cattle. Most of these are marketed at Fort Worth as feeders; some are fattened before marketing. About the only concentrate used is cottonseed meal. Cattle are wintered on pasture, supplemented with Johnson grass and sorgo hay and bundles of sorgo, kafir, milo, and feterita. Cattle are protected from cold weather by the rough topography of the range and by sheds on some ranches. Many of the smaller farms produce a few calves from dairy or beef cows each year; the larger ranches have herds of rather high grade Herefords, Shorthorns, Angus, and other breeds.

Dairying is carried on near the towns to supply whole milk and cream. On most farms a few cows are kept to supply home needs and produce butter for local markets. Cream is collected and shipped to creameries at Fort Worth. Cows are pastured, but are fed more or less hay, grain, bran, and meal. The predominant breed is the Jersey, although some Holsteins are being brought in. The dairy business promises to increase.

Poultry and eggs are by-products of most farms. The average flock is of mixed breeds, chiefly of the Mediterranean class, such as the Leghorn and Ancona. A number of fanciers maintain purebred flocks and hold an annual poultry show.

The quality of the hogs is probably higher than that of any other class of live stock in the county. The herds include some purebred Duroc-Jersey, Poland-China, and Chester White animals. A few hogs are found on most of the farms. Hogs are kept on natural pastures, where they have access to grasses and other plants, roots, nuts, and acorns. They also run in stalk fields. They are usually fattened in small pens, mainly on corn. Many are butchered for home consumption, and a few are shipped to the packers at Fort Worth.

Sheep and goats are adapted to the rough valleys where the cedar has tended to choke out the grasses and to lessen the value of the range for cattle. They eat the weeds and browse on the young shoots and tips of cedar branches. Sheep do better in the weedy pastures, but they are not so well adapted to the brushy lands as goats. The goats are mostly Angoras. They raise one or two kids a year and clip about 4 pounds of mohair. The land must be fenced with woven wire and the flocks need considerable attention, especially at kidding time. The grass matures and seeds in goat pastures, so that the range is improved for cattle and horses by grazing with goats.

The average farm has three to seven head of work animals, several hogs and milk cows, and a small flock of poultry. The barns are usually small and of open construction. There are few sheds to protect the machinery, consisting of wagons, moldboard and disk plows, harrows, disks, planters, and cultivators. The dwellings are usually unpainted frame houses of light construction. Some of the better farms have substantial and comfortable houses, adequate barns and sheds, good fences, and heavy machinery, including tractors.

The methods of cultivation in common use are based on the needs of the two principal classes of soil and on weather conditions. Sandy lands are usually listed deeply, which tends to leave the land rough and to protect it from blowing and also drains and dries out the surface earlier in the spring. Heavier soils not subject to destructive drifting that are to be seeded to small grains are flat broken, disked,

and harrowed. Where the land is very hard or stony a disk plow is preferred to a moldboard plow. Intertilled crops, such as cotton, corn, and the grain sorghums, are usually planted at the bottom of the water furrow or listed trench, where there is plenty of soil moisture to germinate the seed. The soil from the ridges between the rows is worked into the furrows around the young plants in subsequent cultivations, which are designed to smother the weeds and form a mulch of loose soil to conserve soil moisture. Weeds and grasses are hoed out by hand at chopping time. In actual practice cotton receives the best care, and corn and other crops are cultivated as often as time and the supply of labor allows.

The greater part of the corn crop is planted in March or early in April. It is believed that the grain sorghums yield best and are not blasted if they are planted like early corn, but usually they are put in late, like June corn, to utilize land which could not be prepared for cotton or early corn. Cotton is planted in May or later. Picking begins in September and lasts until January or later. Corn is usually mature enough to harvest in October.

Wheat is sown in the fall and oats in the fall or spring. The land is flat broken, disked, harrowed, and seeded with a drill. Stock is often pastured on the grain during the winter. Wheat is cut in May and oats a little later. Threshing follows soon after harvest. Johnson grass is cut about this time and baled after curing a few days in the field.

Definite rotations of crops are not commonly used, although it is a common practice to alternate cotton and corn, and occasionally sow a crop of oats. Cotton may be planted several years in succession on the same field, and oats are grown almost continuously on some fields of black land.

Commercial fertilizers have not been used in Erath County. Co-operative fertilizer experiments by the Texas Agricultural Experiment Station indicate that applications of phosphatic and nitrogenous fertilizers will increase yields of cotton and corn in ordinary seasons, although in case of drought phosphates may decrease the yield.³

Barnyard manure is sometimes applied to fields, and gives good results.

The labor on farms is chiefly white and of local supply. In addition to hired labor, there is more or less exchange of labor among neighbors. Many women and children work in the fields, especially during cotton chopping and picking. The supply of farm labor is inadequate and the pay at the time of the survey (1919) was high, as a result of this shortage and of the war.

According to the 1920 census there are 3,387 farms⁴ in the county, with an average size of 164.2 acres. The farms range in size from very small to very large, some of the ranches containing thousands of acres. About 80 per cent of the total area is included in farms, and 42 per cent of the farm land is classed as improved. In 1880 there were 1,668 farms, including 43 per cent of the total area. They had an average size of 179 acres, of which 22 per cent was improved. In 1900 and 1910 the number of farms was greater and the average size was smaller than at present.

³ Texas Agricultural Experiment Station Bulletins Nos. 184 and 235.

⁴ In the census each tenancy is enumerated as a farm.

According to the 1920 census, 49.6 per cent of the farms are operated by owners, 49.7 per cent by tenants, and 0.7 per cent by managers. The proportion of farms operated by tenants has increased steadily, but during the last 20 years the increase has not been rapid. Where the land is rented, the owner receives one-third of the corn and one-fourth of the cotton or peanuts. In a few cases the owner furnishes everything and receives half of the crops. Near Thurber a few farms belonging to the coal company are rented for cash.

The average value of farm land is reported in the 1920 census as \$25.57 an acre. Some of the rougher pasture land of the county is valued at about \$15 an acre. Improved and well-located farms range up to \$100 or more an acre.

SOILS.⁵

Erath County lies in the prairie region of the United States and not far east of the boundary between the prairies and the plains, assuming that these two are defined in terms of the differences in the character of the soils. The soils of the prairie region when mature are characterized by the features usually found in humid soils. On account of the heavy rainfall to which they have been subjected the readily soluble mineral compounds have been leached out of them, their carbonates have disappeared throughout the full thickness of the zone of complete weathering and the finer grained soil material has been removed from the upper part of the soil and carried either into the lower part or eliminated from the soil section entirely, producing a surface of lighter texture than the nature of the parent rock would lead one to expect, and a subsoil usually heavier than would be expected from a study of the parent rock alone. The deeper horizon of disintegrated material, derived directly from the parent rock, has suffered no noticeable change in the proportion of fine and coarse materials.

While this county lies in the prairie region it is one in which somewhat unusual conditions exist. These conditions have favored the growth of timber over a considerable part of the area. The prairie region of the United States, defined according to the character of its soil and in such a way as to differentiate it from that large treeless area in the western part of the United States known as the Great Plains, is one in which the treeless condition is thought to be temporary. It seems to be the region designated by Clements as the subclimax prairies, the climax prairies in his nomenclature corresponding to the region designated the Great Plains in the system of nomenclature here suggested. The treeless condition of the prairies or the subclimax prairies is due to a variety of causes, none of which are fundamental or permanent. The fundamental soil and climatic conditions are favorable to the growth of timber and when the local conditions tending to prevent the growth of trees fail to exercise a predominant influence timber growth takes place.

In many parts of the prairies the local factor influencing the growth of grass, when climatic conditions favor the growth of timber, are geological. They operate through the soil, but during the early stages of soil development only, and cease to operate when the soil has attained maturity of development.

⁵ The soils of Erath County do not join up with those of Eastland County in a number of places along the boundary. This is accounted for in part by the fact that new soil series have been established since Eastland County was surveyed, and in part by the fact that the soils were mapped in greater detail in Erath County than in Eastland County.

In Erath County the soils that have attained maturity of development and assumed the characteristics that must be considered permanent for the region as long as existing climatic conditions prevail—the characteristics described above as those of the mature soil of the region—are those of the Windthorst series. The Nimrod fine sand belongs in the same group, being merely a Windthorst soil developed to a more advanced stage than that attained by the Windthorst fine sandy loam, the typical mature soil of the region.

The soil material, the disintegrated product of the rock underlying the region of Windthorst soils, is a mixture of sand and clay. If the character of the parent rock were the predominant factor in determining the character of the soil at maturity of development, the surface soil would be a heavy sandy loam or sandy clay loam. This is not the case, however. The surface soil of the fine sandy loam, the prevailing type, is a fine sand, loamy fine sand, and only occasionally as heavy as a fine sandy loam. The processes of weathering have taken a large part of the fine material out of the soil, translocated it in part into the subsoil and in part removed it entirely. The result is a sandy surface soil and a heavy clay subsoil. Sandy soils, whatever the nature of the subsoil, do not favor the growth of grass. In the absence of grass, or in the presence of a poor grass cover, if any at all, a cover of trees will usually occupy a region with as heavy a rainfall as Erath County. The sandy nature of the surface soil, itself a product of weathering and primarily such, acting through a long period of time on a soil that is not rapidly removed by erosion and replaced by a new soil, has been unfavorable to the growth of grass and has favored, in this climate, the growth of trees.

The character of the soil profile has influenced the character of the tree growth also, the heavy clay subsoil tending to water-logging of the soil in wet weather and the dryness of the soil in dry weather has favored the growth of shallow-rooted trees so that instead of a heavy growth of elm, white oak, red oak, and other deep-rooted trees the trees are mainly post oak and blackjack oak.

The action of the arboreal vegetation and the lack of a grass cover has produced a light-colored soil. The smooth uplands of the region, therefore, where a mantle of soil material thick enough to allow the soil and subsoil to attain a stage of maturity of development are covered with a light-colored soil, usually or predominantly sandy in the surface soil and heavy in the subsoil.

The rest of the upland soils of the region differ widely from the Windthorst soils in character as well as in stage of development. The soils within a small area may vary widely in "age" or stage of development regardless of the fact that the forces producing those soil features, described above as those characteristic of a mature stage of development, are climatic and act uniformly over an area as large as Erath County. The rate of aging is determined in part by the texture of the parent material of the soil acted upon, its composition and by the topography. A sandy or sandy clay material on smooth topography attains maturity in a much shorter time than heavy clay or silty clay on any kind of topography.

The Denton and San Saba soils are dark in color; they are heavy in texture; they are, as a rule, thin or shallow, and the parent rock is limestone of varying degrees of purity and degree of induration. The former are dark brown to brown in color, predominantly dark

brown, while the latter are black. The Lewisville soils belong in this group of dark-colored soils also.

The detailed descriptions of these soils in the report show that they are shallow, or, in other words, the unweathered parent rock lies at less than 36 inches and often at but little more than a foot. The parent rock is, as already stated, calcareous.

The predominantly heavy texture of these soils has been favorable to the growth of grass and unfavorable to the growth of trees. The soils are wet in springtime during the growing season for the grass. By the time the usual dry weather and heat of midsummer has dried out the shallow soils and caused them to crack badly the growing season of the grass is over. The dry cracked soil of midsummer is not favorable to tree growth. These soil types are dark in color as a result of their development under a grass cover, though on account of the long hot summer, often with low rainfall after the middle of June, they are not so dark as the prairie soils of northern latitudes.

Although the surface soils in most cases do not contain a high percentage of carbonates, yet in all cases lime carbonate lies only a few inches beneath the surface.

The surface soils are not acid and the rise of capillary waters or the evaporation of seep waters from the surface tends to bring carbonates to the surface and prevent the soils from becoming acid. Through the presence of this lime in the soil and subsoil the organic matter left in the soil by the decay of grass roots is prevented from being leached. This will continue as long as the soils are so shallow that calcareous waters are brought to the surface. As the limestone decomposes to greater and greater depth, as the thickness of the soil increases to several feet over the rock, the amount of lime brought to the surface will progressively decrease, the soils will be leached by the heavy spring rains and will gradually lose their lime. Leaching will then remove the organic matter and they will become light in color. This stage, however, in Erath County can not happen in many thousands of years or even in hundreds of thousands, and may not happen at all. Erosion of the surface soil may take place as rapidly as the increase of the depth of weathering of the rock. The latter is more likely to happen and it is more probable that erosion will operate too rapidly, unless guarded by the farmers, and remove all the soil, leaving the rock bare. The dark color of these soils is due, therefore, in part to their development under the influence of a grass cover and in part to their high lime content. When looked at from the standpoint of the geologist or physiographer this high lime content is seen to be temporary, disappearing with increasing age, yet from the human standpoint, the standpoint of the individual or the race, it may be considered permanent.

Such soils are well known and widely distributed over the humid portion of the earth's surface, though they are not known to occur in large areas of hundreds or thousands of square miles like those of many other soil groups. They belong in the same general group with the black waxy lands of eastern Texas and the black lands of Alabama and Mississippi, differing from them in many respects of detail. They are well known in Europe, occurring in considerable areas in southern Poland, Transylvania, Czechoslovakia, and other

places. The Polish people long ago recognized their peculiar characteristics and gave them a name that is widely known throughout Europe. They are known as Rendzina soils.

The Lewisville and Erath soils of Erath County, derived from calcareous terrace deposits, belong in the Rendzina group also. They are differentiated from the others because of the different process by which the material out of which they have been made was accumulated.

The alluvial soils have been differentiated largely on the basis of the group of soils from which the materials of which they are composed have come. They need no special discussion.

A grouping of the soils of the county on the basis of the source of the soil material follows.

The rocks of the county comprise four principal strata of fairly uniform thickness and southeasterly dip. The first or upper stratum is calcareous and has three subdivisions: (1) A hard, grayish, chalky limestone (probably the Edwards limestone); (2) a grayish, highly fossiliferous limestone or "shell beds," which is weathered in places into gravelly fragments (probably Comanche Peak limestone); and (3) limy, variegated clays (the Walnut clays). The second main stratum (Paluxy sands) consists of noncalcareous, soft, grayish or brownish sandstone with a few very thin seams of limestone. The third main stratum (Glen Rose formation) consists of alternating beds of hard gray limestones, limy clays, and marls.⁶ Sometimes variegated, limy clays are found at the base of this formation. The fourth main stratum consists chiefly of hard, brown or red sandstone, with some pebbly conglomerate and shale, and is noncalcareous.

The rocks in the first or upper group and those in the third are those from which the Denton and San Saba soils have been developed. The second and fourth groups are those from which the Windthorst have originated.

On the basis of color, origin, and structural characteristics the soils are grouped in series; and the series are divided into types on the basis of difference in the texture of the surface soil.

On the basis of differences in the mode of accumulation of the soil material, the soils are grouped as residual and alluvial, the alluvial group being divided into terrace or old-alluvial soils and first-bottom or recent-alluvial soils.

The residual soils are those derived mainly through the weathering in place of the formations already described; in the case of some sandy soils the surface has been reworked and to some extent transported by wind. The residual soils occupy by far the greater part of the county. They are classed in the Windthorst, Nimrod, Denton, Erath, San Saba, and Brackett series.

The alluvial soils are derived from materials transported by streams and deposited during periods of overflow. The terrace soils are developed on the benches or second bottoms (old flood plains), and are classed in the Lewisville and Bastrop series. The first-bottom soils consist of the recent-alluvial material of the present flood plains, and are classed in the Frio and Trinity series.

⁶ According to Hill there is another geological formation, the "Basement sands," which includes some of the limy layers here considered as Glen Rose and some of the sandy conglomerate here regarded as the upper part of the Pennsylvanian Carboniferous, but this forms no distinctive soils, except, perhaps, the Erath clay.

The following table shows the scheme of classification of the soils of Erath County:

Scheme of classification of the soils of Erath County, Texas.

| Origin. | Lime content. | Soil. | Subsoil. | Series. | Vegetation. |
|--|---|-------------------------|--|-------------------------------------|--|
| Residual (partly eolian). | Noncalcareous (does not effervesce with HCl). | Brown..... | Red, mottled with yellow and gray. Stiff clay. | Windthorst... | Post oak and blackjack oak. |
| | | | Red, friable, lighter with depth. | Windthorst (friable subsoil phase). | |
| | | Grayish brown. | Yellow, or mottled yellow and gray, or yellow, red and gray, and rather stiff. | Nimrod..... | Blackjack oak and post oak. |
| Residual..... | Calcareous.... | Brown to dark brown. | Light brown, yellowish, or grayish brown. | Denton..... | Prairie, live oak, and mesquite. |
| | | Brown to light brown. | Heavy clays of variegated color. | Erath..... | |
| | | Black..... | Dark gray, brown, and yellow. | San Saba..... | |
| | | Light grayish brown. | Light gray and yellow. | Brackett..... | |
| Alluvial. { Recent alluvium. Old high terraces. Concrete substratum. | Calcareous.... | Brown..... | Brown..... | Frio..... | Pecan, elm, cottonwood, hackberry, and oaks. |
| | | Black..... | Brown and gray | Trinity..... | |
| | Calcareous.... | Brown..... | Light brown, yellowish brown. | Lewisville.... | Post oak, blackjack oak, and lowland trees. |
| | Upper part noncalcareous. | Brown or reddish brown. | Stiff red clay, mottled with yellow. | Bastrop..... | Post oak and blackjack oak. |

Rough stony land is Windthorst material.

In the virgin state the types of the Windthorst soils have brown to grayish-brown surface soils, with an average depth of about 10 inches, passing abruptly into a subsoil of stiff red clay, which becomes heavier with depth and is mottled with yellow and gray below 20 inches. Under cultivation the soils often become reddish brown in color, particularly on thin eroded slopes. The substratum consists of yellow, gray, and red stiff clays, or unweathered brown and grayish sandstone, from which the series is derived. In better drained situations the red color extends to greater depths, and in flats or depressions the subsoil in places is mottled throughout. The material is generally noncalcareous—that is, it does not effervesce with hydrochloric acid. The characteristic vegetation is post oak. The stony fine sandy loam, fine sandy loam, with four phases, and the clay loam are mapped in Erath County.

The Nimrod series includes types with light grayish brown surface soils and a light-brown or yellow subsoil, showing some gray mottling in wet places. The material is noncalcareous and similar to that of the Windthorst soils. It is partly residual in origin, but apparently the surface has been drifted by winds. Underdrainage is poor. It is forested with blackjack oak and some post oak. The fine sand is mapped in this county.

The Denton series comprises types with surface soils of several shades of brown, underlain by a light-brown, yellowish-brown, or

grayish-brown, chalky subsoil. This soil occupies prairie land, but occasional clumps of live oak and a scattered growth of mesquite occur on it. It is residual from limestone, clay beds, and marl deposits, and is calcareous in both the soil and subsoil. Surface drainage is adequate. The clay and its shallow phase, stony clay and a rough phase, clay loam, loam, and fine sandy loam types are mapped in this county.

The types of the San Saba series are characterized by black surface soils and a dark-gray or brown to lighter grayish or yellowish-brown subsoil. The vegetation consists chiefly of prairie grasses with a few scattering live oak or mesquite trees. The surface drainage is fair to good. The material is residual from limestone, which in most places lies within 3 feet of the surface. The San Saba clay is mapped.

The types of the Brackett⁷ series are light brown or gray in the surface soil, and very light grayish brown or yellowish brown to almost white in the subsoil. The typical vegetation is a rather scanty growth of grasses, mesquite, and cactus. The soils contain considerable lime in both soil and subsoil. Surface drainage is good. The silty clay loam and gravelly loam types are mapped.

The Erath series includes types with brown to light-brown surface soils and extremely heavy and variegated clay subsoil and substratum. Some of the colors are red, maroon, purple, gray, brown, and bright yellow. It is residual from the Walnut formation and similar marly clays, comprising probably part of the Basement sands, and is calcareous. The surface drainage is good. Vegetation consists of grasses and a few live oak and mesquite trees. The clay type is mapped.

The Lewisville series consists of types with brown to dark-brown surface soils and a light-brown or yellowish-brown, well-oxidized subsoil. This is calcareous material occurring on old high terraces as old alluvium or outwash or valley-filling material, which is underlain by gravel cemented with calcium carbonate. In places most of the limestone gravel has decayed, giving rise to soft calcareous beds. In other places an underlying limestone hardpan may exist. These soils are above overflow and are well drained. The original forest growth was a mixture of oaks and other hardwoods. The clay loam type is mapped.

The Bastrop series consists of types having brown to reddish-brown surface soils and a red heavy subsoil more or less mottled with yellow. The soils correspond in origin and material to the Lewisville soils, but are better oxidized and a little better drained. The material frequently effervesces freely with hydrochloric acid, especially in the surface soil, and is underlain by lime hardpan, or "mortar-bed" material. The fine sandy loam of the series is developed in Erath County.

The Frio series comprises types with brown surface soils and subsoils. These soils are derived from recent alluvium. They are subject to overflow, but are otherwise generally well drained. They are moderately to highly calcareous. The vegetation consists of pecan, cottonwood, elm, hackberry, and various oaks. The silty clay loam, colluvial phase, loam, very fine sandy loam, and the fine sandy loam with a colluvial phase are mapped in Erath County.

⁷ In some of the earlier soil surveys of Texas some Denton material was included with the Brackett, the Denton series not having been established.

The Trinity series differs from the Frio chiefly in the darker color of the soil and subsoil and in having a greater proportion of the sediments washed directly from areas of dark-colored limestone upland soils. The typical soil is calcareous. The Trinity clay is mapped in the present survey.

The following table gives the actual and relative extent of the various soils occurring in Erath County. The distribution of the soils is shown on the accompanying map.

Areas of different soils.

| Soil. | Acres. | Per cent. | Soil. | Acres. | Per cent. |
|---------------------------------------|---------|-----------|--|---------|-----------|
| Windthorst fine sandy loam..... | 172,672 | 29.5 | Frio loam..... | 14,464 | 2.1 |
| Shallow-surface phase..... | 23,040 | | Trinity clay..... | 14,400 | 2.1 |
| Shallow phase..... | 4,480 | | Rough stony land..... | 13,504 | 1.9 |
| Colluvial phase..... | 4,352 | | San Saba clay..... | 9,664 | 1.4 |
| Friable-subsoil phase..... | 832 | 18.7 | Nimrod fine sand..... | 9,344 | 1.3 |
| Denton stony clay..... | 56,704 | | Frio very fine sandy loam..... | 8,256 | 1.2 |
| Rough phase..... | 72,448 | | Erath clay..... | 6,784 | 1.0 |
| Denton clay..... | 19,136 | | Windthorst clay loam..... | 5,376 | .8 |
| Shallow phase..... | 66,240 | 12.4 | Bastrop fine sandy loam..... | 4,672 | .7 |
| Frio fine sandy loam..... | 31,040 | | Frio silty clay loam, colluvial phase..... | 4,352 | .6 |
| Colluvial phase..... | 8,512 | 5.1 | Brackett silty clay loam..... | 2,944 | .4 |
| Denton fine sandy loam..... | 35,520 | | Lewisville clay loam..... | 2,176 | .3 |
| Denton clay loam..... | 35,072 | 3.9 | Total..... | 693,120 | |
| Denton loam..... | 26,752 | | | | |
| Brackett gravelly loam..... | 21,568 | 3.1 | | | |
| Windthorst stony fine sandy loam..... | 18,816 | 2.7 | | | |

WINDTHORST STONY FINE SANDY LOAM.

The Windthorst stony fine sandy loam consists of reddish-brown to brown loamy fine sand to fine sandy loam, about 4 to 8 inches deep, underlain by red or brownish-red fine sandy clay to stiff clay with little mottling but with lenses of yellowish sandy material. It usually grades into partly weathered sandstone, underlain by solid sandstone, within 3 feet of the surface. Angular fragments of the reddish or brownish rock are present on the surface and in the soil. In places they cover the ground thickly, and elsewhere are thinly scattered. They range in size from gravel to large slabs. The type as mapped includes small areas in which the soil texture is a loam or clay loam.

The type is developed in large areas in the Palo Pinto basin. The sandstone from which it is derived is of Carboniferous age. It is hard and resistant to weathering.

The topography of the areas of this soil is generally moderately sloping in the more southern occurrences but becomes steeper and rougher toward the north where it approaches in places the character of Rough stony land. The surface drainage is good.

The type supports a rather heavy growth of post oak, with some grass and mesquite where the soil is heaviest. The names "red rock land" and "mesquite glade land" are applied to it locally. Practically none of it is cleared or cultivated. The main use is for firewood and pasture. However, it is situated far from wood markets or railroads and the growth of grasses is scant, so that it is not especially valuable for either of these purposes.

The value of the type for farming is low, but parts of it are high priced because of the existence of veins of coal and on account of the gas and oil prospects of this section.

WINDTHORST FINE SANDY LOAM.

In a virgin condition the Windthorst fine sandy loam consists of brown to grayish-brown loamy fine sand to fine sandy loam, underlain at an average depth of about 10 inches by stiff red clay or fine sandy clay, slightly mottled with yellow, becoming more conspicuously mottled with yellow with increase in depth, and showing gray mottling below about 20 inches. The degree of mottling in the upper subsoil varies with the condition of drainage, being almost entirely wanting in the better drained situations. The substratum, which is like the lower subsoil, is underlain by brownish, yellowish, or grayish sandstone. Occasional thin seams of limestone or marly clay are present in the parent rock, but they do not give rise to noticeable soil differences. The parent rock, substratum, and soil are non-calcareous. Some included areas have calcareous material in the subsoil.

This soil has several variations, both in its natural and its cultivated state, which are of considerable agricultural importance, but they are of such irregular and local occurrence as to preclude their separation on a soil map. Some differences are due to topography and the resultant degree of erosion which has taken place. Very slight changes in slope may determine whether a field will wash badly or not. On some of the upper slopes adjacent to divides the cleared parts have eroded down to the clay subsoil and have become relatively unproductive. The same is true in places along dry draws. Most cultivated fields show some red eroded spots where the soil would plow up as a clay loam, or clay, and they also contain spots where materials washed from above have accumulated in deep, productive patches of "made land." Another variation presents an unusually deep, loose surface soil somewhat like a shallow phase of the Nimrod fine sand. The soil in this variation is subject to drifting and is more productive in dry than in very wet seasons. Where the sandy surface averages only about 6 inches in depth the land usually gives better results in wet than in dry seasons. Old cultivated fields are deficient in humus, have lighter colored soils, and are less productive than new ground. Where this type is derived from the Paluxy sands it has a smooth texture and is stone free. Where it is derived from the hard, Carboniferous sandstones it contains more or less medium and coarse sands, hard pebbles, and rock fragments. Some areas of this kind are indicated on the map by gravel symbols.

The Windthorst fine sandy loam is widely distributed over the county. Most of it is in large, continuous areas extending almost the length of the county, although there are some small isolated areas. The topography ranges from nearly flat and gently undulating or sloping to rather steeply sloping and gullied.

The surface drainage is effected by numerous streams and draws which reach back to almost all areas. There are only a few undrained ponds. The subsoil is impervious and rather unfavorable to underdrainage and aeration. In the shallower areas the land will not hold much moisture and is droughty, while in the deeper areas the rainfall is absorbed and stored so that the soil is cold and wet during continued rainy weather, but is quite resistant to drought. Small ditches aid in draining fields.

This is the most extensive and probably the most important soil type in this county. This is partly because it is physically suited to growing crops under the prevailing climatic conditions, and is easy to cultivate. It was originally in post oak and blackjack forest, the latter being dominant where the sand is deeper and looser. Smilax vines, grape vines, and bushes comprised the undergrowth. Probably 80 to 90 per cent of this type is cleared and under cultivation. The remainder is largely in woods pasture, and part of this probably will not and should not be cleared, as it is generally so sloping that it would erode badly if the forest were removed.

Cotton is the principal crop, and corn is second in importance on this type. Some years peanuts are extensively planted. The acreage devoted to the grain sorghums is increasing, while oats are not grown as much as formerly. Johnson grass is a volunteer pasture and hay crop, especially on that variation where colluvial material has accumulated. Many other crops are grown for home and local consumption, including sweet and Irish potatoes, peas, early truck, melons, squash, and berries. On a few farms grapes, pecans, Japanese persimmons, and figs have been successfully grown.

This type, along with its friable-subsoil phase, is probably the best orchard land in this section of Texas. All of the large orchards are located on it. The peach has been the extensively planted fruit, but the orchards are dying out through lack of proper care. Production is rendered uncertain by late spring frosts, and when good crops are obtained the market conditions are not always satisfactory. The Elberta variety is most common. Apples of the Jonathan, Winesap, Ralls, Delicious, Black Ben Davis, Mammoth Blacktwig, and other kinds are successfully grown, although they receive little attention. Pears and plums do very well.

Each farm carries a few hogs and a flock of poultry, and pastures a few work animals, dairy cows, and other stock, but animal husbandry is relatively unimportant on this type of soil.

Yields are largely determined by the weather. Cotton returns from one-sixth to one bale per acre, and probably averages one-fourth to one-third bale. Corn ranges from total failure in droughty years up to 40 bushels or more per acre in favorable seasons, averaging about 20 to 25 bushels. Yields of oats vary widely; the average is 25 or 30 bushels per acre. Peanuts average about 30 bushels of nuts and 30 bales of hay per acre. Johnson grass yields more than a ton of hay per acre in the low swales.

Oats are sown in the fall unless wet weather intervenes, when sowing may be delayed until spring. The land may be broken or merely disked and seeded with a grain drill. The crop is cut in June and threshed in July. When mixed with Johnson grass it is sometimes cut for hay.

Corn land is usually bedded, and the seed is planted in the furrows. The ground may be well prepared, or, when wet weather delays the work, corn may be planted with a lister planter in unbroken ground, and a double shovel used later between the rows. Walking or riding cultivators are used to kill weeds and work the soil into the furrows around the growing corn. Ordinarily corn is cultivated three to five times before it is laid by. When necessary the weeds in the drilled rows are hoed out. Corn is usually planted in March and matures in August, but some June corn is planted, which may mature before frosts.

Cotton land is usually well prepared by double bedding early in the spring and is left rough to prevent drifting during the period of high spring winds. Planting begins in April and may continue until June. Cotton is cultivated much like corn and is kept clean of weeds and grass. Some fields are worked with a hoe until late in August. Picking begins the last of September and may continue until spring.

Peanuts are planted in much the same way as cotton, but require less cultivation. With good seed and season they are very productive on this soil, but are in disfavor with many farmers because the land is left bare after the crop is removed and may be damaged by drifting.

A little barnyard manure is applied to this land, but commercial fertilizers are not generally used and little attention is paid to building up the land.

The Windthorst fine sandy loam sells at the present time (1920) for \$25 to \$100 or more an acre, depending on location, improvements, condition of the soil with respect to erosion, and productiveness of the land.

There are several ways in which this type of soil and the methods of handling it should be improved. Only a small part of it is terraced, but all of the slopes gentle enough to plow ought to be protected in this way from the erosion which has already ruined many fields. This land is well adapted to a more diversified type of agriculture, the benefits of which are well known. Every farm could profitably keep more hogs, dairy cows, and poultry, and have plenty of apples, peaches, pears, plums, pecans, dewberries, figs, melons, and vegetables for home use and a surplus for sale. Peanuts for pasture probably would make the raising of hogs more profitable, and at the same time build up the land. The cotton acreage should be decreased, and corn probably could be displaced in part by the grain sorghums, which yield better over a series of years. Judicious use of phosphatic fertilizers possibly would be profitable. A few farmers are already demonstrating what can be done with this land by improved methods.

Windthorst fine sandy loam, shallow-surface phase.—The shallow-surface phase of the Windthorst fine sandy loam consists of brown to slightly reddish brown fine sandy loam to loamy fine sand, passing abruptly at an average depth of 4 or 5 inches into stiff red or brownish-red clay, which becomes lighter red below and mottled in varying degrees with yellow and gray in the lower subsoil. In places the subsoil contains lenses of bright-yellow sandy material from partly decomposed sandstone, which may occur as bedrock within 3 feet or less of the surface. The surface soil locally contains some of the coarser sands, hard, smooth gravel, and fragments of brown sandstone. Erosion has bared the subsoil in spots and caused the surface soil of some patches to be deeper than in other places, owing to accumulated wash from higher positions. There are some included patches with yellow and whitish calcareous materials in the subsoil derived from limestone, such areas representing a soil having Windthorst material in the upper part and Denton or Brackett material below.

This phase is mapped in the Palo Pinto, Kickapoo, and North Paluxy basins on slopes and also on the flattish tops of "mountains."

The surface is gently to steeply sloping, but most of it is suitable for cultivation. The run-off is rapid, so that the soil is well drained and fairly well oxidized in spite of the impervious subsoil and substratum.

The shallow-surface phase is not very extensive in the county, but is rather important locally, as it occurs in sections where other types are generally too rough to cultivate. The original timber has largely been removed. This soil is known locally as "tight post-oak land."

About the same crops are grown as on the typical Windthorst fine sandy loam. Crop yields equal those on the typical soil in good seasons, but they average less in dry seasons. This phase is handled according to the ordinary farm methods practiced in this section. No fertilizers are used.

Land values are comparatively low because much of this soil is situated in rough country some distance from towns and railroads.

This land should be terraced, as the soil is shallow and the slopes are usually steep enough to wash when cultivated. Less cotton and more subsistence crops should be grown.

Windthorst fine sandy loam, colluvial phase.—The colluvial phase of the Windthorst fine sandy loam is variable in color and texture. In general it consists of brown fine sandy loam passing at about 6 inches into dark-brown or almost black heavy fine sandy loam to loam, underlain at about 12 to 15 inches by red or dull-red stiff clay, which becomes lighter colored and mottled with yellow and gray with increase in depth. In places the subsoil is a friable fine sandy loam to fine sandy clay, which is yellowish red to yellow in color, with some whitish material at about 30 inches. The material is residual and colluvial from Carboniferous sandstone and Paluxy sand (Cretaceous), and is generally noncalcareous. Parts of this phase are somewhat like a shallow phase of Nimrod fine sand.

This soil occurs in scattered areas throughout the sandy lands south of the main divide through the county. It is found on bench-like or gently sloping positions adjacent to small streams and in upland flats or depressions as in the large areas south of Stephenville and north of Highland. The surface is depressed, flattish, or gently sloping. Rainfall drains into the areas, but does not run off readily. The material, at least much of that of the surface soil, represents wash from adjacent slopes. The impervious subsoil seems to keep much of the soil in a seepy condition in wet seasons.

The colluvial phase is not extensive. Approximately 75 per cent of its area is cleared and cultivated. Cotton, corn, and peanuts are the principal crops grown. When the season is not too wet the average yields per acre are about one-third bale of cotton, 25 bushels of corn, and 30 bushels of peanuts.

This land is handled like all the sandy land of the county, and no commercial fertilizers are used. It is valued at \$25 to \$75 an acre, according to location and improvements.

This phase needs artificial drainage. Terracing would be beneficial, though it is not so essential as on more sloping land.

Windthorst fine sandy loam, shallow phase.—The shallow phase of Windthorst fine sandy loam consists of brown to reddish-brown loamy fine sand to fine sandy loam, ranging from about 4 to 10 inches in depth, underlain by red stiff clay, passing into lighter red clay mottled more or less with yellow. At about 15 to 30 inches yellowish and whitish calcareous chalky clay loam and hard limestone or marly material is reached. Included with this phase are a few spots of Windthorst loam, which consists of dark-brown loam,

passing through dark-brown, brown, and reddish clay, into yellowish, calcareous material at 26 to 30 inches. The soil of the loam consists partly of colluvial material. This shallow phase is entirely different from the shallow-surface phase. Here the shallowness refers to shallow depth to the underlying limy material, while the shallowness of the shallow-surface phase refers to the depth of the surface soil.

The principal areas of this phase are mapped around Huckabay. It really exists in narrow areas all along the line of contact between the Paluxy sands and the Glen Rose formations, with the former comprising the surface soil and the latter the deep subsoil, but it is usually of such small extent that it was included in mapping either in areas of the typical Windthorst fine sandy loam or in the Denton fine sandy loam.

The larger areas are quite gently sloping, but the narrower belts are usually on steeper slopes. Both surface and internal drainage are fairly good. Although this phase is small in extent, it includes some of the most productive land around Huckabay, and nearly all of it is cleared and cultivated. Originally it supported a forest of post oak, with a little live oak and mesquite in places.

Cotton, corn, oats, peanuts, and sorghums are the principal crops, and the average yields are equal to or slightly greater than those on the typical Windthorst fine sandy loam. Methods of handling this land are the same as for all sandy land.

Land of this type is valued at \$30 to \$75 an acre.

Like most soils of this county, this phase can be improved by terracing to prevent erosion and by diversified cropping and other methods of maintaining and increasing soil fertility.

Windthorst fine sandy loam, friable-subsoil phase.—Owing to the small extent of this soil it is included under the Windthorst series as a phase, although it is recognized as a member of a new distinct series (the Stephenville series). It consists of grayish-brown to light-brown fine sand or loamy fine sand to reddish-brown fine sandy loam, passing at depths of 6 or 8 inches into heavier reddish-brown fine sandy loam, which grades quickly, at 10 to 14 inches, into deep-red to bright-red fine sandy clay. The subsoil below 18 or 20 inches usually consists of a friable red or yellowish-red fine sandy clay loam, which becomes more friable and lighter textured with depth, the lower subsoil often ranging as light as fine sandy loam and in places loamy fine sand. Mottlings are almost entirely absent, except for some slight reddish-yellow mottling here and there in the lower part of the 3-foot section. In places the soil may be darker and deeper. In some areas the subsoil is a red clay that changes little in texture with increase in depth. Under cultivation fields of this phase have developed as the result of erosion spots where the soil is shallow and consists of reddish sandy clay loam or clay loam. The friable-subsoil phase is derived from the deep weathering of the sandstones of the geological formation styled the Paluxy sands. This lighter colored soil resembles the Orangeburg soils, which are of such extensive occurrence in the Coastal Plains region.

This phase is mapped in a number of places in the west-central part of the county. It occurs also in numerous narrow strips or spots too small to map. It is developed along the line of contact between the Paluxy sands and the overlying calcareous deposits.

It lies on the upper slopes of the hills and of small knolls or rises lower down. This sloping topography insures very good surface drainage, and the friable, porous subsoil insures unusually good underdrainage and aeration.

The friable-subsoil phase, though small in area, is nearly all cleared and cultivated, and is used for the same crops as are grown on the typical Windthorst fine sandy loam. It seems to be even more highly regarded by farmers, as it is warmer and produces well. However, its productiveness depends largely upon the depth of surface soil, the weather, and the way the land has been eroded. No fertilizers are used. The value varies like that of the typical Windthorst fine sandy loam.

The slopes should be terraced to check destructive erosion. The situation of the phase on hillsides and its friable subsoil make it well adapted to orcharding—the growing of peaches in particular.

The table below gives the results of mechanical analyses of samples of the soil, subsurface, and subsoil of the typical Windthorst fine sandy loam:

Mechanical analyses of Windthorst fine sandy loam.

| Number. | Description. | Fine gravel. | Coarse sand. | Medium sand. | Fine sand. | Very fine sand. | Silt. | Clay. |
|-------------|-----------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| | | <i>Per cent.</i> |
| 445516..... | Soil..... | 0.2 | 0.5 | 1.0 | 41.4 | 37.6 | 14.4 | 4.5 |
| 445517..... | Subsurface..... | .0 | 5.7 | 2.4 | 28.2 | 17.1 | 12.3 | 33.8 |
| 445518..... | Subsoil..... | .1 | .1 | .2 | 17.4 | 37.2 | 16.7 | 28.7 |

WINDTHORST CLAY LOAM.

The Windthorst clay loam is a reddish-brown clay loam to brown sandy clay loam, passing at about 4 to 8 inches into red or brownish-red heavy clay, which in places is mottled with yellow and gray in the lower depths. The clay subsoil is usually quite stiff. The surface may show some rock fragments and pebbles of a hard crystalline rock. Included with this type are a few small spots where the soil is somewhat darker colored and the subsoil is calcareous, such areas representing a variation corresponding to the shallow phase of the Windthorst fine sandy loam in having limestone material in the 3-foot section instead of sandstone material as in the typical soil. There are also eroded patches where the subsoil clay has been exposed. The typical soil material does not effervesce with hydrochloric acid.

A number of areas of Windthorst clay loam are in the Palo Pinto and Kickapoo basins, and others lie north of Morgan Mill. They occur on rather gentle slopes and in some cases at the foot of slopes. The surface drainage is good.

This type is small in extent, and little of it is cultivated. Its principal use is for pasture. The native growth includes a little grass, and mesquite, cactus, and other thorny plants.

The Windthorst clay loam is too compact and dense for crops to do well in dry seasons, although small grains and the grain sorghums could be grown. Improvement probably could be effected by growing humus-supplying crops, like cowpeas, by the addition of manure, and by the construction of terraces to retard erosion.

Parts of this type are underlain by coal and are leased for oil and gas rights.

With the Windthorst clay loam there have been included, on account of their small extent, several areas of Crawford clay loam. This consists of a dark-brown or chocolate-brown heavy clay loam passing at about 6 or 8 inches into red to dark-red, very heavy, rather tough, dense clay, which at 15 to 24 inches becomes slightly mottled with yellow and whitish limy material, and rests upon hard limestone rock. The soil material is derived from the upper strata of the Glen Rose formation. In some places there may be some admixture of material coming from the overlying Paluxy sands, which would account for a slightly lighter texture and a slightly mottled appearance of the soil. Spots of this Crawford soil occur near Stephenville. The topography is generally smooth, or gently sloping with a few steep and stony slopes. Outcropping ledges of rock are present in places.

This included clay loam is extremely small in extent and unimportant in the county. It is well drained and oxidized. About half of it is cultivated to cotton, corn, oats, Johnson grass, and sorghums, and the remainder bears grasses and large but scattered live oak, post oak, and mesquite trees. Crop yields in favorable seasons approach those on the Denton clay loam, but are very low during droughts. The land values are relatively high, partly because of the favorable location.

NIMROD FINE SAND.

The surface soil of the Nimrod fine sand is a gray or light grayish brown, loose fine sand about 6 or 8 inches deep. The subsoil is a very light yellowish or grayish-yellow, incoherent fine sand. In virgin areas the surface soil may be slightly darker and loamy. It is usually uniform in texture. This type may be residual from the Paluxy sands and the Basement sands or Carboniferous rocks, but some of it, at least, has the appearance of sand which has accumulated through wind action, somewhat as dry sand accumulates along the weedy roadsides. A substratum consisting of mottled red, yellow, and gray impervious clay is present everywhere, usually below 36 inches, but comes within the 3-foot section in a few places.

The Nimrod fine sand is mapped in a number of scattered areas in association with the Windthorst fine sandy loam. It occurs on flat-tish divides, swales, and hillsides with very gentle to rather steep slopes. Most of the rainfall is absorbed by the deep porous soil, and is retained by the impervious clay subsoil, so that the soil remains cold and wet or "sobby" late in the spring. In places there are seeps where the subsoil has been bleached or changed to a whitish color by being long saturated with water.

The Nimrod fine sand is relatively unimportant because of its small extent and its natural deficiencies. This land was originally heavily forested with blackjack oak and some post oak, with a tangled undergrowth of vines and bushes, and on many farms it is left in that condition. Probably 30 to 40 per cent is cleared and cultivated.

The principal crops are cotton, corn, and peanuts. In wet seasons the crops do poorly, but in case of drought they usually do better than on the Windthorst fine sandy loam, because of the larger amount of moisture stored in the subsoil. Peanuts do very well on this land, but

in harvesting this crop the tendency of the soil to drift, which is especially great with such loose soils, is increased.

Most of the Nimrod fine sand is valued at \$20 to \$50 an acre.

More advantage should be taken of the special adaptation of this soil to peanuts. Instead of removing the peanut vines and leaving the land bare, the crop could be harvested by hogs. In this way the soil would be protected to some extent against drifting. By this practice the land could be built up to greater productiveness by increasing its supply of organic matter.

DENTON STONY CLAY.

The Denton stony clay consists predominantly of dark-brown clay underlain by grayish or yellowish-brown, friable, calcareous clay resting on marl or limestone at depths varying from about 10 to 30 inches. The average depth to rock is probably not as much as 15 inches. In small areas the surface soil is brown, but such areas are not true to type. Limestone fragments are scattered over the surface and through the soil and subsoil. This type is derived from alternating beds of limestone and marly clay. It comprises a succession of strips, benches, or steps of almost stone-free Denton clay, Denton clay, shallow phase, and very stony shallow Denton clay with large and small limestone rocks scattered over the ground. In places the texture is a clay loam, and some areas include the lighter colored Brackett stony clay. The type grades into the shallow phase of Denton clay in such a way that sharp boundaries can not be uniformly placed. The principal differences between this soil and the shallow phase of the Denton clay is the more steeply sloping surface and the greater abundance of stone fragments in the former.

This type has been mapped in the lower parts of the Leon and Bosque Basins, and also north of Bluff Dale.

The topography is flattish or undulating on the divides, and sloping to rolling and dissected on the hillsides, where most of it occurs. The surface is very well drained, but in wet weather there are numerous seeps where underground waters form temporary springs.

Practically none of this type is cultivated because of its rolling topography and very stony nature. A few fields are found within areas mapped as Denton stony clay, but most of these are actually on small included areas of other less stony types. Most of the type is in the virgin condition, and supports a growth of prairie grasses and weeds, with a few scattered live oak and mesquite trees.

The type is devoted to pasturing work stock and beef and dairy cattle. Ordinarily a section will carry about 60 head of cattle, and with a rainfall above the normal it will do much better. Very few sheep are kept on this land. Water for stock is supplied by streams, "tanks," and windmills.

The value of this type depends upon its location and association with other types in farms. The price ranges from about \$20 to \$60 an acre, depending on whether it is sold alone or with better grades of land.

There is more opportunity to improve the stock than the pasturage on this land.

Denton stony clay, rough phase.—The rough phase of the Denton stony clay is similar to the typical soil, except in having a rougher surface. As mapped it includes patches of Denton clay, shallow phase,

Brackett stony soils, and colluvial material about the heads of small draws. The soil is derived chiefly from the Glen Rose formation, but near the Cage Ranch it includes material from all the strata above the Carboniferous beds.

It occurs chiefly in one large continuous belt comprising the breaks north of the main divide. A few small areas are associated with the large bodies of typical Denton stony clay.

The surface is rolling to very rough or precipitous, and a steplike topography is characteristic. The advisability of classifying this land as Steep broken land or as Rough stony land was considered, but it was decided that it represents a better grade of grazing land than either of these classifications. There are some benchlike positions of Denton soil which are not so rough or stony, but these are rather narrow strips. Although some patches of Rough stony land are included, the average degree of stoniness is considerably less than on Rough stony land proper.

The run-off over much of the land is very rapid. Water for stock is supplied from streams, "tanks," and wells operated by windmills.

This land is devoted to pasturing stock, both on cattle ranches and farms. In its natural condition it is prairie land. In places it is bare and eroded. There are some mesquite trees, especially in the northern areas, and some small oaks south of Bluff Dale. These trees have been spreading in recent years, but they do not materially injure the range. In the valleys of Richardson, Pony, and Sycamore Creeks cedars have been rapidly spreading until in places they form dense thickets. They tend to crowd out grasses and to injure the range for cattle. In this section it has been found profitable to raise sheep and Angora goats. The sheep do well in more open, weedy country, and the goats are better adapted to the brush, where they browse on the young cedars, mesquite, and live oak. One or two acres will carry a sheep or goat, while 15 acres or more are required for a cow. Where goats are grazed the range is improved for cattle and horses, because the cedars are kept down and the growth of grasses is permitted to increase.

In this section some income is derived from the sale of cedar posts, which bring about 10 cents in the pastures or about 40 cents each at Stephenville. In thick brakes 200 to 300 posts may be cut from an acre. Judicious selection insures a continuous crop of posts. A few men also burn cedar for charcoal, which brings a good price.

This phase also comprises much of the range of the larger cattle ranches which produce both feeders and fat cattle. There is plenty of protection from cold winter weather in the many valleys.

Land of this phase is held at \$4 to \$8 an acre, and where well fenced at double these figures or more.

In 1919 this and other pasture land of the section was "taken" by broom weed. In such seasons it seems poorly adapted for grazing cattle and much better suited to sheep and goats.

DENTON FINE SANDY LOAM.

The Denton fine sandy loam consists of brown to dark-brown, friable, fine sandy loam, 6 or 8 inches deep, underlain by lighter brown or yellowish-brown friable clay loam to clay, becoming yellower or grayer, through admixture of limy material, at about 15 or 20 inches. The surface material, especially the sandy part, is

derived in part from Paluxy sands material, which gives rise to the adjoining Windthorst soils and which probably formerly covered the areas of Denton soils. The subsoil is derived from the Glen Rose formation. The substratum consists of marl and limestone. There are small included areas of the shallow phase of the Windthorst fine sandy loam and some spots of Denton loam.

The Denton fine sandy loam occurs in many areas scattered through the central and southern parts of the county. It is characteristically developed along the line of contact between the Paluxy sands and the Glen Rose formation, although this transitional zone is too narrow to map in many places.

It has a gently sloping to moderately sloping topography, and is well suited to farming operations. Good surface drainage is provided by numerous draws and streams.

This type is sometimes called "mixed land." It is considered good soil, and the greater part is cultivated. Part of it is in the native pasture grasses. The original growth also included some live oak, mesquite, and a few post oak trees.

Cotton, corn, oats, the grain sorghums, and Johnson grass are grown on this type, and dairy cows and other stock are run on the pastures. This soil produces very well in average seasons, but crops do not succeed on it so well in dry seasons as on the Windthorst fine sandy loam.

The value of Denton fine sandy loam depends upon its location, improvements, and the associated types of soil. Present prices range from about \$25 to \$75 or more an acre.

This soil would be benefited by terracing to prevent erosion and by more diversified cropping.

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

Mechanical analyses of Denton fine sandy loam.

| Number. | Description. | Fine gravel. | Coarse sand. | Medium sand. | Fine sand. | Very fine sand. | Silt. | Clay. |
|-------------|-----------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| | | <i>Per cent.</i> |
| 445573..... | Soil..... | 0.0 | 0.4 | 0.5 | 23.1 | 45.5 | 21.6 | 8.9 |
| 445574..... | Subsurface..... | .3 | 1.0 | .9 | 20.0 | 46.6 | 20.4 | 11.0 |
| 445575..... | Subsoil..... | 1.2 | 2.7 | 1.6 | 25.6 | 39.6 | 18.2 | 11.2 |

DENTON LOAM.

There are two rather distinct variations of Denton loam, which were not separated on the soil map, but which can easily be distinguished by their location with reference to streams and other types. One consists of a brown to dark-brown friable loam passing at about 8 inches into lighter brown or yellowish-brown friable silty clay loam or clay which contains some whitish limy material below depths of about 20 inches. This is more or less colluvial in origin and corresponds to most of the Denton clay loam in every detail except texture. It lies on slopes lower than adjacent areas of Denton stony clay and nearer to stream bottoms. The other variation lies above areas of Denton stony clay and farther from the stream bottoms, although some short draws head in it. It consists of a brown to dark-brown friable loam passing at 5 to 8 inches into lighter brown to yellowish

or grayish-brown clay loam to clay, which is highly calcareous and contains lime fragments and gravel in the lower part. In places this variation is quite shallow, resting on rock at 15 to 24 inches, and in a few places rocks occur on the surface. There are small included areas of Denton fine sandy loam, clay loam, or stony clay. This is prairie land, but a few live oak and mesquite trees appear in the vegetation. Relatively little of it is under cultivation. Its principal use is for pasture. Crop yields on this variation are somewhat lower than on the colluvial areas and correspond to those on the Denton clay, shallow phase.

The Denton loam is included in farms having an average value of about \$35 or \$40 an acre.

DENTON CLAY LOAM.

The Denton clay loam is a brown to dark-brown friable clay loam, in places ranging to nearly black, underlain at about 8 to 10 inches by a light-brown or yellowish-brown friable clay loam or clay, with more or less whitish limy material in the lower depths. As mapped, much of this type is a deep colluvial soil, but in some areas marl or limestone is found within the 3-foot section. There is a slight variation in texture of surface soil, and in places a few rocks are scattered over the land. The material is calcareous, and is derived from the Comanche Peak, Walnut, Glen Rose, and Basement sands formations.

This type is widely distributed over the county in areas occurring along the lower slopes of the two main calcareous formations. The surface is gently to moderately sloping, and seldom gullied. Some water comes to this soil from above, but it drains quickly to adjacent streams.

Although this type is not extensive, it is important because it occurs on many farms where it is better suited to cultivation than the associated rougher and stony types. It was originally prairie land, and a small part is still used for pasture, but most of it is planted to cotton, corn, oats, and the grain sorghums. The average yields are about the same as on the Denton clay. This soil is rather droughty, and it is most productive in seasons of good rainfall.

The land is handled about like the Denton clay, but because of its more sloping topography and irregular fields it is not so well adapted to heavy farm machinery. Farms containing Denton clay loam are valued at \$25 to \$75 an acre.

Some areas of this type need ditches to prevent water from the higher lands washing over them, and terraces to protect the slopes from erosion.

DENTON CLAY.

The Denton clay is a brown to dark-brown clay passing ordinarily at 5 or 6 inches into lighter clay and at about 8 to 12 inches into yellowish-brown friable clay, which contains whitish and pale-yellowish soft to partly indurated limy material below depths of 15 to 20 inches, the proportion of such material being greater in the lower part of the subsoil. The underlying marls and limestone occur in places within the 3-foot section. Parts of this type resemble the San Saba clay and Crawford clay in color. It is residual from the Comanche Peak limestone, and is calcareous.

This type occurs most extensively in the prairies from Selden to Chalk Mountain, and scatteringly on the high divides, as at Dublin and Purves. Near Edna Hill there are a few areas derived from the Glen Rose strata. It is developed in flats, slight depressions, and basins about the heads of drainage ways, where the surface is level or very gently sloping. The surface drainage is fairly adequate as the depressions have outlets. The underdrainage is not so thorough, yet the land is well enough drained to allow the successful growing of field crops.

The Denton clay is a strong, productive soil. Practically all of it is cultivated, although a few acres remain in the original prairie condition. The principal crops grown are cotton, corn, oats, wheat, sorghums, and Johnson grass. There is relatively little trucking on such land, and orchard trees do not thrive very well.

The yields on this and other heavy clay types in this region are very dependent upon the rainfall. Almost total failure may be expected in dry years, in which the more sandy soils yield fairly well. It gives better yields of corn and cotton than the sandy soils, either when the rainfall is adequate and well distributed or when it is excessive. In the better seasons cotton averages about one-third to 1 bale per acre in the best fields. Corn averages 25 to 30 bushels per acre under similar conditions. Wheat yields about 15 bushels, and oats 30 bushels per acre. Where Johnson grass has obtained a good foothold more than a ton of hay is often cut from an acre.

Wheat is sown in the fall if the weather permits. Oats also usually are sown in the fall, though if the season is wet they may be sown in the spring. The spring-sown grain, however, yields less and is of poorer quality. This land may be flat broken for corn and cotton as well as for the small grains, as it does not drift like the sandy lands. It dries and warms up a little earlier in the spring, and crops may be planted a little sooner than on the deeper sands. Plowing is shallow and subsequent working with cultivators and hoes forms only a shallow mulch of loose soil. Cracks appear when the surface dries out. The soil contains enough lime to make it crumble as the clods dry out after rains. Tractors and other improved farm machinery are often used in tilling this land. Commercial fertilizers have not come into use.

The Denton clay composes parts of farms which are valued at \$30 to \$75 or more an acre, according to location, improvements, and the proportion of included eroded or stony land.

Probably the greatest need of this soil is deeper plowing. More of the drought-resistant grain sorghums should be planted.

Denton clay, shallow phase.—The Denton clay, shallow phase, consists of light-brown or brown to dark-brown friable clay, passing at depths of 2 to 6 or 8 inches into lighter brown, grayish-brown, or yellowish-brown friable clay, commonly containing whitish marly material or limestone fragments. In places the subsoil consists of yellowish, friable, marly clay or clay loam. Unweathered marl and limestone fragments are commonly encountered at depths of 10 to 15 inches. The limestone consists chiefly of shell beds, and it weathers into small angular fragments or separate shells which are strewn on the surface or are turned up by the plow. In some of the shallowest areas, and where this phase occurs in long, narrow strips, the soil is almost as light colored as the Brackett soils. Some areas have

been slightly modified by sand blown from adjacent bodies of Windthorst fine sandy loam. The phase is residual from Comanche Peak limestone. The soil material is highly calcareous from the surface down.

The shallow phase occurs in irregular but continuous areas on all of the highest divides of the county from the Cage Ranch south, and on a few isolated hills. The surface is undulating and slightly dissected by draws. The borders near sandy lands are marked by short, steep, rocky slopes. Surface drainage is good because of the elevated position, which allows rain to run rapidly into the draws or onto lower areas of soil.

This phase of the Denton clay was originally prairie, with a growth of mesquite and buffalo grasses, broom sedge, poverty grass, broom weed, and many varieties of flowering plants, with clumps of live oaks and scattered mesquite trees. It is estimated that 10 to 20 per cent of it has been put in cultivation in "squaring up" fields comprised chiefly of typical Denton clay or San Saba clay. The remainder is in its native condition, and is prized as pasture land. It is so distributed that it serves for grazing on many farms where other and deeper soils are cultivated.

The principal crops are cotton, corn, and small grains. This land is quick to dry out and crops suffer readily from drought, but in wet seasons it produces almost as well as the typical Denton clay.

The value of this land depends upon the nature and proportions of other types in the farms. Larger areas useful only for pasture are priced at \$20 to \$30 an acre.

This phase is best adapted to pasture, and in the better parts to small grains, which will "make" from the winter rains, or to the grain sorghums which do well on little rainfall and furnish both grain and forage.

SAN SABA CLAY.

The San Saba clay consists of black heavy clay, ranging from about 10 to 30 inches or more in depth, underlain by dark-brown clay, passing beneath into grayish or yellowish-brown friable clay containing white, soft, limy material. The subsoil rests upon limestone or marl which in places comes within the 3-foot section. The material is chiefly from the Comanche Peak formation, but near Edna Hill it is derived from the Glen Rose. Some areas are colluvial. The material is typically calcareous from the surface down, enough so to effervesce freely with hydrochloric acid.

Areas of San Saba clay occur about the head of Duffau Creek, along the western foot of the Duffau Mountains, and in the region lying between the Duffau and Chalk Mountains. It occurs in depressions and flats lying below areas of Denton clay, the boundaries between the two in some places being arbitrarily drawn, because of the gradual change from one to the other.

The topography is nearly flat, slightly sloping, or basinlike. Rainfall flows onto this type from higher types, but there are fair drainage outlets. The land does not become soft and miry, except in a few seepy or springy spots.

This is one of the most productive soils in the county and practically all of it is cultivated. A small part still bears the original wild

prairie grasses. The principal crops are cotton, corn, wheat, oats, Johnson grass, and grain sorghums. The farm gardens are small and orchard trees do not thrive.

Yields depend upon the rainfall. In dry years crops fail except in seepy spots. However, with well-distributed average precipitation the land yields about one-third bale of cotton, 25 to 30 bushels of corn, 15 bushels of wheat, and 35 bushels of oats, and, under more favorable conditions, yields of a bale or more of cotton, 40 to 60 bushels of corn, 25 bushels of wheat, and 50 to 60 bushels of oats have been obtained. Johnson grass is a volunteer crop which has become firmly established in some of the lower land, where it can be eradicated only with great difficulty; and yields 1 to 2 tons of hay per acre.

This land is often flat broken, sometimes with tractors and disk plows. It is cultivated and handled about like the Denton clay.

Land of the San Saba clay brings from \$40 to \$50 an acre.

This type is especially adapted to small grains, and the grain sorghums would be surer crops than corn because they are more resistant to drought.

On account of its small extent, the San Saba stony clay is mapped with the San Saba clay, the stony areas being shown on the map by symbols. The type consists of black, heavy clay, passing at depths of about 8 to 12 inches into dark-brown to dark ashy gray heavy clay. The subsoil is calcareous and passes into whitish limestone (Edwards limestone) at shallow depths. Large and small fragments of the rock cover the surface.

The San Saba stony clay is mapped only on the tops of the Duffau and Chalk Mountains. The surface is flattish to gently sloping. Drainage is complete, as the areas are narrow and flanked by steep land.

The type has a small extent and a low value for pasture, as it is overgrown with dense thickets of sumac, shin oak, and other low bush growths. It is too stony to have much value even if cleared. Areas of this soil are included in farms and ranches which are valued at about \$20 to \$50 an acre.

BRACKETT GRAVELLY LOAM.

The Brackett gravelly loam is a light-gray, grayish-brown, or brownish-gray friable gravelly loam or gravelly clay loam, about 3 to 7 inches deep, passing into grayish-yellow or cream-colored gravelly, marly clay or silty clay loam with some layers of gravelly clay loam. In places the subsoil has a faint pinkish or salmon tint. Spots of gravelly clay loam, loam, and fine sandy loam which are too small and too indefinite to warrant separation on the map are included with the type.

This type is mapped in numerous areas in all parts of the county, except the northwest corner. It occurs in long, very narrow strips in the transitional zones between limy strata and lower lying sandy lands. The Walnut clays and calcareous parts of the Basement sands are the source of much of the material.

The Brackett gravelly loam occupies gentle to rather steep slopes and in places is gullied. The surface drainage is adequate.

The type comprises a small total area and very little is cultivated except where included in the edges of fields composed of other soils.

It bears a little grass, live oak, mesquite, and in places some cedar.

The yields of cotton, corn, and other crops are distinctly lower than on the better soils in the same fields. Such land is best kept in pasture.

The value of this type depends on the surrounding soils and location in the county.

BRACKETT SILTY CLAY LOAM.

The Brackett silty clay loam consists of light-gray or pale-yellowish brown silt loam to silty clay loam, passing at about 1 to 5 inches into light-grayish or pale-yellowish silty clay to clay containing varying amounts of white limy material. Both soil and subsoil are usually calcareous and contain some small rock fragments and pebbles. Much of this type has an eroded "badlands" topography, the surface being gullied and strewn with fragments of limy and ferruginous rocks. Some of it is flat and smooth. There are included areas of Brackett clay loam and clay, together with some spots of Windthorst clay loam. The type is derived from shaly strata in the Carboniferous rocks, and in places from the Basement sands or Glen Rose formations.

Areas of this type are located near Thurber, Sims Valley Church, Russel Chapel, Sapoak, and in the Sycamore Creek Valley. It is well drained.

This type is not extensive, and is unimportant in the local agriculture, as it furnishes only poor pasturage. It has a thin stand of grasses and weeds and a few mesquite trees. There are many bare patches of ground. None of it is cultivated.

Its value is low, as much of it lies in rough and remote sections, but around Thurber it is valuable because it is underlain by coal and possibly by oil and gas, and the shale is used for making brick.

ERATH CLAY.

The Erath clay is a brown to light-brown clay, passing at 5 to 8 inches into heavy clay of various colors. In places this subsoil clay is in the upper part dark red mottled with purple and in the lower part gray or yellow; in other places the layers are reversed. Thus the upper subsoil may be a light-brown or yellowish-brown clay in the upper part, and red, purple or liver-colored, or dull red, below. The substratum consists of the same heavy calcareous clays, which show many bright colors where exposed by erosion. Locally the surface soil consists of clay loam several inches deep and is light gray or reddish in color. This soil is derived from the Walnut clays and from similar heavy, variegated clays that comprise the middle strata of the Basement sands formation.

This type has practically the same distribution in the county as the Brackett gravelly loam and occurs in the same way below the soils derived from the limy strata and above those coming from the sandy formations. The surface is gently sloping and eroded in places. The drainage is good.

This is a type of small area, and is seldom cultivated. Its principal use is for pasture. The natural vegetation consists of grasses, weeds, and live oak and mesquite trees.

Taken alone this type would have little value, but it sells with other soils at \$25 to \$75 an acre.

LEWISVILLE CLAY LOAM.

The Lewisville clay loam consists of brown to dark-brown clay loam to silty clay loam passing at 6 to 10 inches into brown clay, and this in turn into yellowish-brown friable clay to clay loam, containing particles and concretions of lime in the lower part. The substratum carries layers of lime-cemented waterworn gravel, sometimes called "concrete." The material is old alluvium derived from the various upland soils of the county. In places limestone gravel in the older beds of the substratum has decayed, giving a chalky lime material.

The type occurs chiefly along South Paluxy and Richardson Creeks. One area along Kickapoo Creek is not typical of the Lewisville series. The surface soil of this is somewhat variable in texture, and it may not have the "concrete" substratum. In some places a light-colored subsurface layer is encountered, but elsewhere the borings are fair Lewisville clay loam. This variation is flat. Another isolated area of Lewisville clay loam was mapped near Bays School. The type occurs on terraces or second bottoms not subject to overflow.

The topography is flattish to sloping. Some of the areas include colluvial slopes and are not sharply separated from the upland. Surface drainage is excellent, and the porous substratum provides good underdrainage and aeration.

This type is too small in extent to be of much importance, but is largely cleared of the original lowland timber and is used for cotton, corn, and small grains. It is handled much like the Denton clay loam and yields equally well. Such land is valued at about \$40 to \$50 an acre.

BASTROP FINE SANDY LOAM.

The Bastrop fine sandy loam consists of 6 or 8 inches of brown to reddish-brown fine sandy loam to loamy fine sand, underlain by red stiff clay which is slightly mottled with yellow in the upper part and strongly with yellow and gray in the lower part. Parts of the type are better drained and oxidized and have red clay subsoils resting upon lime gravel within 3 feet of the surface. This type is derived from old alluvium washed from the Paluxy and Glen Rose formations. It is underlain by "concrete."

This type is mapped in the Paluxy, Armstrong, and Bosque Valleys. It occurs on benches which are not subject to overflow. The surface is flattish or gently sloping from the upland to a sharp break at the edge of the first bottoms.

The rainfall drains easily from the surface, and the gravelly substratum insures good underdrainage in most areas, although the compact subsoil is impervious in places.

This type occupies only a small acreage. Most of it is under cultivation, although some is in woods pasture and sparsely forested with the original post oak trees. Cotton, corn, oats, Johnson grass and peanuts are grown. The yields are equal to those on the Windthorst fine sandy loam, which the Bastrop fine sandy loam resembles as regards color of material.

This type is valued at about \$30 to \$75 an acre. It seldom needs terracing, but would be benefited by practicing the methods recommended for the Windthorst fine sandy loam.

FRIO FINE SANDY LOAM.

The Frio fine sandy loam is a brown or grayish-brown to dark-brown friable fine sandy loam to loamy fine sand passing at about 8 inches into lighter brown fine sandy loam, which continues with variations to considerable depths. There are both darker and lighter colored layers, and incoherent sands or heavier strata in places. A rather distinct variation of this occurs along the upper branches of the Bosque River and its tributaries, where the alluvium is derived almost entirely from the Windthorst fine sandy loam. Here the soil is lighter colored and more incoherent, and some of it does not effervesce with acid, whereas the Frio soils are typically calcareous. In most places this soil has also received sediments from the Denton and other calcareous soils, as evidenced by its darker color and limy nature.

The largest areas of this type are mapped along the Bosque River but it is also found along most of the south-flowing and east-flowing creeks and in the narrow stretches of bottoms along Little and Big Sunday, Lost, Clear, and Bear Creeks.

The surface of this type is flattish, with occasional swales or abandoned stream channels. It has good surface and internal drainage.

This is the most extensive alluvial soil in the county, although its total area is not large. About 90 per cent of it is cleared and cultivated, and the remainder forms the forested belts along stream channels. It bears many large pecan trees, especially below the points where the bottoms reach the Glen Rose formation and are distinctly calcareous.

The common crops of the region are grown on the Frio fine sandy loam, and yields are about the same as on the Frio very fine sandy loam. In some years pecans from the wild trees are gathered in large quantities and bring good prices. Alfalfa probably would succeed.

The present value of this type is about \$30 to \$70 or more an acre, depending upon location and improvements.

Since this bottom soil is the natural habitat of the pecan, it would seem that it could be used to advantage for culture of budded varieties.

The type includes a dark variation, which consists of a dark-brown fine sandy loam grading at variable depths into brown or black fine sandy loam, loam or clay loam, underlain at about 10 to 30 inches by black, dark-brown, brown, or grayish-brown loam, fine sandy clay loam or clay. This variation is very intimately associated with the typical brown Frio fine sandy loam. In places it contains lighter colored and light-textured layers. It is often found near the stream banks, with the typical Frio occurring along the outer bottoms near the foot of the uplands.

This variation has about the same distribution as the Trinity clay, often occurring in the same stream bottoms, but usually farther downstream. Normally it is developed in narrow strips. The material is washed from both limy and nonlimy upland soils. The surface is flat, but the drainage is good, except during periods of overflow. Some of the situations in which the variation occurs are merely low flats in which drainage ways rise, and which are flooded during heavy rains by water from adjacent slopes. Here much of

the material is of colluvial origin. Some of the bottoms are relatively high and seldom overflowed.

This soil is not extensive, but it is good agricultural land. It originally supported a growth of lowland trees, which, with the exception of the pecans and other trees growing on the immediate banks of the streams, have been cleared away. Corn, cotton, and some oats are grown on this variation, and they yield well in most seasons. Cotton makes a rank growth and is more apt to be damaged by the boll weevil than on the upland soils.

The value of this land is about the same as that of Windthorst fine sandy loam.

Frio fine sandy loam, colluvial phase.—The colluvial phase is a brown to dark-brown fine sandy loam, underlain by brown fine sandy loam to loam, which passes into lighter brown, yellowish-brown, or grayish-brown friable loam, clay loam, or clay. The substratum consists of friable, porous, calcareous water-laid material. The soil and subsoil are moderately calcareous. This phase is derived from the sediments washed from the escarpment.

The colluvial phase is mapped only in the bottoms of creeks of the Palo Pinto Basin along their upper courses about where they issue from the escarpment. It occurs on high bottoms which are rarely, if ever, overflowed by the streams, whose channels here are rather deep.

The surface is flat to gently sloping and very favorable to farming. Surface drainage is good, but the porous subsoil makes this land droughty as compared with other bottom soils.

This phase has been cleared of the original forest growth and is planted to cotton, corn, and small grains. It produces about one-fourth to one-third bale of cotton, 25 bushels of corn, 10 or 15 bushels of wheat, and about 30 bushels of oats per acre under average conditions.

The value of this land, where not influenced by the prospect of oil, is around \$40 an acre. Much of it has been leased to oil men.

FRIO VERY FINE SANDY LOAM.

The Frio very fine sandy loam consists of brown to dark-brown, smooth, friable, very fine sandy loam, about 8 inches deep, passing into dark-brown loam to silty clay loam or silty clay, which grades at about 20 inches into lighter brown, grayish-brown, or yellowish-brown friable clay loam flecked with whitish limy material. In places the soil is almost as dark as the Trinity soils. The substratum consists of friable, porous, calcareous clay loam, loam, or fine sandy loam. The materials have been washed from the different residual soils of the county. There are some included small areas of fine sandy loam.

This type is mapped in the Paluxy, Armstrong, and Bosque bottoms, and is most extensive along the lower courses of these streams. It has a flat surface with slight inequalities along old stream courses, and has good surface and internal drainage. It is subject to overflow.

While the total area of the Frio very fine sandy loam is small, it is prized as good farming land, productive in all but extremely dry seasons. It was formerly heavily forested with lowland trees but is now cleared and in cultivation.

The crops commonly grown are cotton, corn, oats, and Johnson grass. All crops make a rank growth. Cotton tends to produce too much foliage, so that the weevils are more destructive and the bolls do not open so well as on upland soils. Under good conditions the yields average about one-third bale of cotton, 25 to 35 bushels of corn, 30 bushels of oats, and a ton or more of Johnson-grass hay per acre. Alfalfa possibly would prove successful on this type.

This land receives the usual cultivation for the different crops. In wet seasons much hoeing is necessary to keep down the grass and weeds.

Such land is priced, according to location and amount of other soils included with it in farms, at \$30 to \$75 an acre.

FRIO LOAM.

The Frio loam consists of brown to dark-brown loam passing at about 9 or 10 inches into light-brown or grayish-brown friable loam to silty clay loam, underlain at about 15 inches by light-gray or light yellowish brown, moderately calcareous loam to clay loam. In places the lower subsoil is lighter than clay loam in texture. This type is partly colluvial in origin and occupies high first bottoms, parts of which are seldom, if ever, subject to overflow.

The Frio loam is mapped in the Barton Creek bottoms, and along most of the other large streams rising in the breaks and flowing north or east. With the exception of a few small areas near Alexander and one near Highland, it does not occur south of the main divide. The surface is gently sloping or flat, and rarely cut by abandoned stream channels. Both surface drainage and underdrainage are excellent.

Although this type does not occupy a very large area, it is important as one of the best soils in the rougher sections of the county. The original growth of lowland trees has been cleared off, except for the pecans and a fringe of other trees along the stream channels.

Cotton, corn, and oats are the main crops. Cotton does well, the yield averaging about one-third bale per acre when not damaged by the weevil. Corn yields 30 bushels or more per acre in good seasons. Oats do equally well. Alfalfa should succeed.

The value of farms composed largely of this type and without too much rough pasture land is around \$50 an acre.

FRIO SILTY CLAY LOAM, COLLUVIAL PHASE.

The colluvial phase of the Frio silty clay loam consists of a brown to dark-brown friable silty clay loam or silt loam passing abruptly into brown silty clay loam, underlain by brown or dark-brown silty clay, which grades at about 12 to 15 inches into grayish-brown friable to slightly dense silty clay showing some whitish limy material. It consists partly of alluvium and partly of colluvial wash from adjacent limy hills.

Areas are found along most of the larger creeks which head in the "breaks." It occurs as first bottom and as slightly sloping colluvial strips lying between the foot of the uplands and the overflowed bottoms. The surface is flat or gently sloping toward the streams. The surface drainage is good. The land receives some water from the hills, but it is not overflowed by the creeks.

Part of this type still supports grasses and trees and is used for pasture, but the larger part is planted to cotton, corn, and oats. Johnson grass is a volunteer hay crop which yields over 1 ton per acre. Cotton yields one-fourth to one-third bale, and corn about 25 bushels per acre. Oats yield a little better than corn. Alfalfa probably would succeed.

This land is associated on many farms and ranches with large bodies of rough pasture land, which bring down the average value per acre, but in better farms it is held at \$40 or more an acre.

The type would in many cases be benefited by terracing and ditching to prevent erosion.

TRINITY CLAY.

The Trinity clay consists of very dark brown to black clay, about 8 to 12 inches deep, underlain by dark-brown, dark ashy gray, grayish-brown, or yellowish-brown calcareous clay. In places the material is black or nearly black to depths of 3 feet; in others it is dark brown at the surface and black in the subsoil. This type is derived from recent alluvium washed chiefly from soils of limestone origin. Lime nodules are present in the subsoil in places.

This type is found in the bottoms of streams in all parts of the county. It occurs along streams which head in areas of San Saba clay, Denton clay, and Denton clay loam. It is partly colluvial where it borders on these upland soils.

The surface of the Trinity clay is faintly sloping to flat. The drainage is fairly well established, but the land is subject to overflow by the streams and to the accumulation of rain water during heavy downpours, the areas receiving run-off from the adjacent highlands.

This type is not very extensive, but it is practically all under cultivation, and is regarded as one of the best soils in the county. The original growth of elm, cottonwood, hackberry, oaks, and other trees has been cleared, but the pecan trees have been left.

The principal crops grown are cotton, corn, oats, and Johnson grass. The yields vary with the seasons and correspond closely to those on the San Saba clay. Some years the pecans yield well. Alfalfa probably would succeed.

The soil is handled in much the same way as the San Saba clay, although the fields are usually too small and irregular for heavy machinery.

The price of Trinity clay ranges from about \$30 to \$75 an acre.

ROUGH STONY LAND.

Rough stony land comprises areas of the Windthorst stony fine sandy loam in which the topography is very steep and precipitous, and many of the stones are large bowlders or ledges of outcropping rock. It is mapped only in the Palo Pinto Basin. It is forested with post oak, which furnishes some firewood. None of it is cleared or cultivated. It is used chiefly for pasture, but the range is poor because there is little grass. It is valued for the coal, gas, and oil rights.

SUMMARY.

Erath County, Texas, comprises an area of 1,083 square miles lying near the center of the State and about 60 miles southwest of Fort Worth.

The area embraces an elevated, dissected plateau, two-thirds of which slopes gently southeast from the main divide, and one-third descends through abrupt "breaks" toward the north and east. Elevations range from 850 to 1,750 feet above sea level.

The drainage network is complete and all the run-off eventually reaches the Brazos River.

The population is chiefly native white. Seventy-five per cent of the population is classed as rural. Stephenville, Dublin, and Thurber are the largest towns.

The county is served by five railroads and has fair wagon roads.

Climatic conditions are variable, with a tendency toward the semiarid. Weather is the most important factor in the success of the crops.

The principal crops are cotton, corn, oats, peanuts, grain sorghums, Johnson grass, and coarse forage. Over two-thirds of the area is pasture land. The raising of cattle is an important industry on large ranches. Hogs are found on every farm. Sheep and goats are locally important. Poultry raising and dairying are side lines of growing importance on many farms.

The differences in sandy and clay soils and their respective relations to different climatic conditions are very important factors in farming in this section.

The average farm produces cotton for cash and subsistence crops for the stock. It is fairly well equipped with machinery, but has only fair barns, houses, and fences. Fields are usually as well tended as the weather permits.

No fertilizers are used. Labor is scarce and high priced. The average size of the farms is 164.2 acres, of which 42 per cent is improved land. About half of the farms are rented, the owner receiving one-third of the corn and one-fourth of the cotton.

Erath County lies within the Great Plains region. Most of the upland soils are residual, although a few areas have been reworked by the wind.

The nature and distribution of the various soils depends largely upon the four principal geological strata exposed in the county. There are two limestone and two sandstone formations, which give rise to calcareous heavy soils and noncalcareous sandy soils. The former have a growth of prairie grasses, live oak, and mesquite trees, while the latter bear post oak and blackjack oak.

The alluvial soils of the county include old, well-weathered deposits now above overflow, and more recent deposits which are more or less subject to overflow. All these soils are at least moderately calcareous and were originally in forest.

The soils are classified according to origin, color, and structural characteristics into 10 soil series.

The Windthorst series includes the most important and extensive agricultural types of the county. It is forested land with brown soils and reddish subsoils which are mottled and compact. It is represented in Erath County by three types and four phases.

The Nimrod fine sand is a deep sandy soil of a light-grayish or yellowish color. It was timbered land originally and is subject to blowing. It is well adapted to peanuts.

The Denton series includes prairie lands with brown to dark-brown soils and lighter brown or yellowish-brown subsoils which are

derived from calcareous deposits. It covers large areas in this county. Five types and two phases were mapped.

The San Saba clay resembles the Denton clay, but is very dark in color. With sufficient rainfall it is very productive.

The Brackett series includes very light colored, highly calcareous soils. Two unimportant types were recognized on the soil map.

The Erath clay comprises varicolored eroded clay land of low value.

The Lewisville clay loam consists of a brown surface soil and a lighter, well-oxidized subsoil, underlain by a lime hardpan, or "mortar bed" material.

The Bastrop fine sandy loam resembles the Windthorst soils, but occurs on old alluvial terraces and is underlain by a lime hardpan.

The Frio series includes first-bottom soils which are brown in color, moderately calcareous, and subject to overflow. Four types and one phase were mapped. They comprise some of the most productive land of the county.

The Trinity clay is a dark-brown to black soil with a dark-colored, calcareous clay subsoil. It is of small extent, but is considered one of the best soils in the county.



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