U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS—MILTON WHITNEY, Chief.

SOIL SURVEY OF LUBBOCK COUNTY, TEXAS.

BY

J. O. VEATCH, IN CHARGE, AND H. G. LEWIS.

HUGH H. BENNETT, INSPECTOR, SOUTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1917.]

WASHINGTON:
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1920.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., June 24, 1919.

SIR: I have the honor to transmit herewith the manuscript report and map covering the survey of Lubbock County, Tex., and to recommend that they be published as advance sheets of field operations of the Bureau of Soils, 1917, as authorized by law.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

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Soil Map, Lubbock County sheet, Texas.

SOIL SURVEY OF LUBBOCK COUNTY, TEXAS.

By J. O. VEATCH, In Charge, and H. G. LEWIS.—Area Inspected by HUGH H. BENNETT.

DESCRIPTION OF THE AREA.

Lubbock County is situated in central-western Texas, its western boundary being about 60 miles from the New Mexico State line. Lubbock, the county seat, is, by rail, 377 miles west of Dallas. The county is bounded on the north by Hale County, on the east by Crosby County, on the south by Lynn County, and on the west by Hockley County. It has an area of 868 square miles, or 555,520 acres.

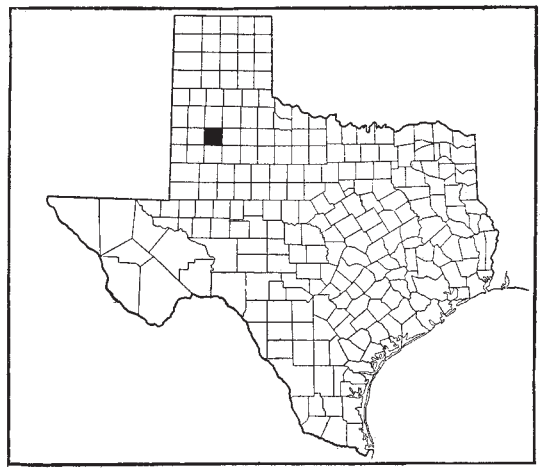

FIG. 1.—Sketch map showing location of the Lubbock County area, Texas.

Lubbock County is situated in the High Plains, in the division known as the Llano Estacado. It lies in the region locally known as the South Plains, as distinguished from the Panhandle or northern part of the High Plains of the State.

The topography in general is that of a nearly level, featureless plain. (Pl. I, fig. 1.) The altitude of the plain in the central part of the county is near 3,250 feet above sea level. The general slope is eastward and southward, the elevation being 3,350 or 3,400 feet in the extreme western and northwestern parts of the county and about 3,150 feet in the southeastern part.

The land surface is a plain of deposition, representing, with little modification, the original surface of a great sheet of sediment carried down by streams from the Cordilleran region to the west in late Tertiary and Pleistocene times. The land surface is therefore comparatively recent. In this area there has been scarcely any drainage way or stream development.

While the plain in general is flat and nearly featureless, there are local areas where broad, shallow depressions or swales and intervening areas of higher level give an undulating surface. Also, the plain is dotted with shallow basins containing small intermittent lakes known as playa lakes. These lake basins range in depth from 10 to 60 feet below the level of the surrounding surface. They are nearly circular, bowl shaped, have smooth slopes, and are from 5 to 400 acres in extent. The lakes themselves are nearly circular and range from 1 to 40 acres in extent. They are dry the greater part of the year, but contain water for short periods after heavy rainfall. More than 800 of these intermittent lakes were located during the progress of this survey. There are also a few low, isolated hillocks or knolls underlain by hard rock, as well as low ridges forming the rims of the lake basins, but these would not be noticeable features, except in a generally smooth and flat plain.

The drainage of the area is principally into the lake depressions, where the excess water stands until it is lost by evaporation. There is, however, very little run-off, on account of the nearly level topography.

Double Mountain Fork and its tributary, Yellowhouse Creek, headwater branches of the Brazos River, and the only streams in the county, flow across the county in a southeasterly direction. They have not developed any tributaries, and are small and unimportant streams in this county. Their upper courses are marked simply by shallow depressions in the plain. The stream bed is dry throughout the greater part of the year, and in places there is no definite channel. From the vicinity of Lubbock southeastward, Double Mountain Fork has cut a narrow, canyonlike valley 100 to 175 feet below the plain and maintains a small flow throughout the year.

The plain in its virgin condition is without tree growth, but is uniformly covered with a carpet of short grasses, grama and buffalo grasses being the predominating species. Some parts support a scattered, dwarf growth of mesquite, shin oak, and catclaw, the bushes reaching a height of 3 to 6 feet. A few stunted hackberry, cedar, and mesquite trees, together with polecat bush, algerita, and other shrubs, are found in the canyon of Double Mountain Fork.

There is no dependable source of surface water except along the lower part of Double Mountain Fork, but an abundant supply of water, suitable for general household purposes, is obtained from wells, at depths for the most part ranging between 50 and 130 feet. Windmills are in general use for pumping water.

Lubbock County was organized in 1891, at which time it had less than 300 inhabitants. In 1910 the population numbered 3,624. At present (1917) it is estimated at 9,000 to 10,000, about one-half of

which is classed as rural. This rapid increase in settlement has been due largely to an influx of farmers, attracted by the low price of land and the discovery that farming can be successfully carried on under the prevailing semiarid climate. The population is composed largely of native whites, principally settlers from the eastern and earlier settled parts of Texas, with a small proportion from Oklahoma and other Central Western States.

Lubbock is the principal town and the county seat. It has an estimated population (1917) of about 5,000. The only other important town is Slaton, in the southeastern part of the county, with a population of about 1,500.

Railway facilities are afforded by the Panhandle & Santa Fe Railway, a subsidiary of the Atchison, Topeka & Santa Fe. This road traverses the county from southeast to northwest, connecting with the main line to the west at Clovis, N. Mex. A branch passes through the north-central part of the county, making connections at Amarillo, and other branches extend eastward from Lubbock to Crosbyton, Crosby County, and southwestward from Lubbock to Brownfield, Terry County.

The public roads of the county are of ordinary earth construction, and generally follow land-section lines. Owing to the low rainfall and the nearly level topography the roads are generally in good condition for both wagon and automobile traffic.

Most of the rural districts have telephone service, and the county is provided with rural mail delivery.

Lubbock is the principal local market for all farm products. Fort Worth is the principal live-stock market.

CLIMATE.

Lubbock County is situated in the High Plains region, which is generally classed as semiarid. It is characterized by comparatively low rainfall, a moderately high mean temperature, a large percentage of clear days, a dry atmosphere, and a high rate of evaporation.

The mean annual precipitation is about 21 inches. The rainfall, however, is very irregular from year to year and is unequally distributed throughout the year. The lowest recorded rainfall in any year is 14.37 inches and the highest 40.46 inches. There is in general only a very light rainfall during the winter months, the heaviest precipitation occurring from April to October. The precipitation is mainly in the form of local showers, and during the summer months these are frequently torrential. Hailstorms are not infrequent, but they are rarely destructive over large areas. The snowfall is very light, and snow rarely stays on the ground for more than two or three days.

There is a rather wide range between the maximum summer temperature and the minimum winter temperature. The mean for the winter is about 40° F, but freezing temperatures are very common, and "northers"—strong north winds accompanied by sudden cold—are of frequent occurrence. The mean temperature for the summer is 77.5° F., and while hot days prevail during this season, the nights are cool. There is a normal growing season of about 205 days. The average date of the last killing frost in the spring is April 8, and that of the first in the fall October 30. When planted late, or in years when growth is delayed by drought, corn, kafir, and cotton often fail to mature. Fruit, especially peaches, is subject to injury from late spring freezes, and the quality and yield are also affected by the frequent prolonged summer droughts.

The region is characterized by winds of high velocity, especially during the spring months, and considerable damage is caused by the drifting of sandy soils. The prevailing winds are from the south and west.

The county lies in a region having approximately 3,250 hours of sunshine per year. The evaporation from a free water surface during the months from April to September, inclusive, according to observations covering an eight-year period at Amarillo, Tex., is 53.21 inches. This figure is probably applicable to this county.

No Weather Bureau observations covering an extended period have been made within Lubbock County, but the records of the station at Mount Blanco, Crosby County, a short distance to the east, probably represent local conditions. These observations cover a period of 30 years.

Records compiled by the Texas State experiment farm at Lubbock, covering the period from 1911 to 1916, show an average annual precipitation of 22.48 inches, with an average of 15.01 inches during the growing season.

Normal monthly, seasonal, and annual temperature and precipitation at Mount Blanco, Crosby County.

[Elevation, 2,750 feet.]

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1889).	Total amount for the wettest year (1905).	Snow, average depth.
	°F.	°F.	°F.	Inches.	Inches.	Inches.	Inches.
December	40.8	78	−6	.65	0.00	0.62	1.7
January	40.0	87	−10	.54	1.25	1.00	2.2
February	40.2	92	−14	.93	.60	1.60	2.5
Winter	40.3	92	−14	2.12	1.85	3.22	6.4

Normal monthly, seasonal, and annual temperature and precipitation at Mount Blanco, Crosby County—Continued.

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1889).	Total amount for the wettest year (1905).	Snow, average depth.
	°F.	°F.	°F.	*Inches.*	*Inches.*	*Inches.*	*Inches.*
March	51.3	96	11	.61	.00	4.90	1.0
April	59.9	98	17	1.86	1.25	5.30	.0
May	68.4	103	28	2.29	.82	3.90	.0
Spring	59.9	103	11	4.76	2.07	14.10	1.0
June	75.8	110	42	3.11	3.47	4.20	.0
July	78.7	104	48	3.04	1.39	6.90	.0
August	78.1	105	42	2.49	.00	3.00	.0
Summer	77.5	110	42	8.64	4.86	14.10	.0
September	71.9	102	33	2.14	1.50	4.20	.0
October	61.2	95	20	2.06	2.98	2.45	T.
November	49.3	85	5	1.33	1.11	2.39	.5
Fall	60.8	102	5	5.53	5.59	9.04	.5
Year	59.8	110	−14	21.05	14.37	40.46	7.9

AGRICULTURE.

The early agriculture of Lubbock County consisted almost entirely in the raising of cattle on the native pasturage. As late as 1900 the population numbered less than 300, and the county was divided into large ranches, individual holdings comprising thousands of acres. Some farming, however, has been done by ranchmen for the last 25 years in the production of feed for the ranch stock and fruits and vegetables for home use. During the past six or seven years there has been an influx of farmers following the building of railroads. Land values have increased rapidly, and the ranches are being subdivided gradually and disposed of as farm land.

Stock raising is the principal industry, but it is being rapidly displaced by general farming. At present 75 per cent or more of the area of the county is used for grazing. On the ranches, where cattle raising is the chief industry, some farming is carried on, consisting principally of the growing of forage crops for winter feed as a supplement to the native pasture. On the farms a system of general or diversified farming is followed. This includes the growing of several forage and feed crops in conjunction with the raising or feeding of live stock on a small scale. A majority of the farmers grow a small acreage of cotton as a cash crop and a few are engaged in dairying.

Milo, cotton, kafir, corn, sorghum (cane), and Sudan grass are the principal crops, probably ranking in acreage in the order named.

Milo occupies the largest acreage[1] and is the principal grain crop. It is generally regarded as one of the surest crops under the prevailing climatic conditions, and is perhaps the most suitable crop for sod or virgin land. The average yield on such land is close to 1 ton, or 40 bushels per acre, depending upon the preparation of the land and the distribution of the rainfall. The Dwarf Yellow is most commonly grown. Milo is used principally as feed for live stock, though a part of the crop is sold.

Cotton is the principal cash crop on the farms. The cotton acreage has greatly increased during the last three or four years, owing to the advent of large numbers of settlers from the eastern or cotton-growing sections of the State, and to the success which has attended the growing of this staple under semiarid conditions. The total acreage of cotton is probably almost as large as that of milo. The yields have varied widely from year to year, and with different conditions of soil and cultural methods, ranging from one-sixth to 1 bale per acre. Cotton growing has not been carried on for a sufficient length of time to make possible an accurate estimate of the average yield, but apparently it is about one-third bale per acre. Tests conducted at the State experiment farm with 36 different varieties during 1913 and 1914 showed yields ranging from 1,002 to 1,614 pounds of seed cotton per acre.[2] The county lies outside the zone of boll-weevil infestation.

Of the sorghums, kafir ranks next to milo in acreage. It is grown on practically all the farms and ranches. Most of the crop is consumed on the farms as forage, but it is used to some extent for silage. A comparatively small percentage of the crop is thrashed for the grain. The Dwarf Blackhull is the principal variety. The average yield of grain is about 25 or 30 bushels per acre.

Probably a majority of the farmers grow corn, although the climatic conditions are not very favorable for this crop. The yields have ranged from practically complete failure to as much as 60 bushels per acre. Frequently the growth of corn is seriously retarded by lack of moisture and the grain fails to mature properly. At the Texas agricultural experiment station near Lubbock the average yield of corn for the three-year period 1912 to 1914 was 11.61 bushels per acre.[2] The Mexican June seems to be the variety best adapted to local conditions. The corn grown is used almost entirely as feed for live stock.

[1] The estimated acreage in June, 1916, according to a survey conducted by the Lubbock Chamber of Commerce, was 11,112.

[2] Texas Agr. Expt. Sta., Rept. of Substation No. 8. By R. E. Karper.

Sorghum is one of the principal crops grown to supply roughage for the winter feeding of cattle, and it is also the principal crop for silage. A small part of the crop is thrashed for seed, the yield being about the same as in the case of the grain sorghums. The yield of dry forage is probably 3 to 5 tons per acre. The Sumac (Redtop) is the variety generally grown.

Sudan grass has become an important forage crop. Most of the farms have a small acreage of this grass, and on a few farms its cultivation receives special attention. It is grown principally as a hay crop, yielding two or three cuttings per year, with an average of a little more than 1 ton per acre at each cutting. Probably 25 per cent of the crop is grown for seed, which gives an average yield of about 500 pounds per acre. Sudan grass makes a good summer pasturage crop. It was first grown in the State in 1912 at the Texas State Experiment Farm, Substation No. 8, near Lubbock.

Wheat is an unimportant crop, though the acreage devoted to it is steadily increasing, especially on the heavier soils. It yields from 10 to 20 bushels per acre. Much of the crop is sown primarily for winter pasture. On the light sandy soils the crop is seriously damaged by drift during the winter and spring, and it has not proved as successful here as on the heavier types. Turkey is the principal variety grown.

Crops of minor importance include feterita, alfalfa, peanuts, cowpeas, millet, rye, and barley. Alfalfa has been grown in large fields under irrigation in two localities chiefly for hog pasture, and several small patches of dry-land alfalfa give promise of success.

A variety of tree fruits and vine and brush fruits can be grown. Small orchards of a few acres generally supply sufficient fruit for home use and frequently a surplus for sale on the local markets. Apples have proved to be a much more certain crop than peaches. Some varieties of grapes do especially well.

A varied list of garden vegetables can be grown under irrigation and good yields of watermelons and sweet potatoes have been obtained without irrigation.

Dairying, as an adjunct of general farming, has been carried on during the last two or three years by a number of farmers. Cream and butter are sold throughout the year, the skimmed milk being fed to hogs. Silos, especially the pit or underground silo, have been constructed where dairying is engaged in. Sorghum and kafir are the principal silage crops.

The raising of beef cattle is the most important branch of the livestock industry. Only a comparatively small number of cattle are finished for the market, most of them being sold as feeders. Plate I, figure 2, shows cattle gathered at a watering place. The cattle are

grazed on the native pasture, with supplementary feeding for four or five months during the winter and spring. Under this method the carrying capacity of the pastures is about 10 acres for a cow and calf. Most of the ranches are equipped with silos. Sorghum and kafir silage, kafir in bundles, and Sudan grass hay, together with a small amount of cottonseed cake or meal, constitute the cattle feeds. According to a recent estimate,[1] the beef cattle in the county number 23,975.

Sheep raising is carried on to a small extent in the northeastern part of the county. The native pasture is very closely grazed and is supplemented by feeding and the use of wheat for winter pasture.

Hogs are raised on most of the longer-established farms and pork production, as an adjunct to general farming, is rapidly increasing. It is a special industry on several farms. Milo and corn are the principal dry feeds, and alfalfa, wheat, rye, and barley are used for pasturage.

In general, attention has been given to the selection of crops and varieties best adapted to the climatic conditions without regard to the different soil types, since it is believed that the amount and distribution of rainfall and other climatic conditions, rather than the differences in soils, are the controlling factors in yield. The sorghums have been selected as the most dependable crops and considerable attention has been given to determining the varities best suited to local conditions. Farming in this region is so new that the adaptation of the different soil types to special varieties of the staple crops has not been worked out. The differences in soils, so far as they affect the agriculture, have been taken into account mainly in their relation to tillage requirements. It is generally recognized that wheat and other small grains are best suited to the heavier soils or "tight land," on account of the tendency of the sandy soils to drift during the winter and spring months and that melons and peanuts give better results on the sandy soils as do also orchard fruits and small fruits.

In tillage especial attention is given to those practices which assist in the absorption of moisture, such as deep plowing and maintaining an effective soil mulch. All the farmers realize the necessity of working up a thin, dry, lumpy surface mulch, formed by deep plowing and subsequent shallow tillage. This is probably most essential on the heavier soils, as the sandy soils naturally absorb more moisture and suffer less loss from evaporation, so that the chief value of frequent shallow cultivation here is in keeping down weeds.

Plowing generally begins about the 1st of January and continues until the 1st of May. A large majority of the farmers prefer list-

[1] Survey made by the Lubbock Chamber of Commerce, June, 1916.

ing or bedding to flat breaking, and practically all the planting, except in the case of wheat and other small grains, is done with the lister planter. Seed-bed preparation very early in the fall is believed to be advantageous, but is generally impracticable, on account of the late maturing of crops.

Most of the sod land or virgin soil is broken with the "rod breaker," a plow having iron rods substituted for the moldboard, and so constructed that it cuts and practically inverts a slice of sod about 3 inches thick. (Pl. II.) Thorough preparation of the seed bed and efficient cultivation the first year are therefore very difficult. On such land planting is usually done with the two-row planter, which makes only a very shallow, narrow trench for the seed. When a tractor or the ordinary moldboard or disk plow is used in breaking the sod, and the plowing is followed by thorough harrowing, a good seed bed can be worked up the first year.

Irrigation is carried on only to a very small extent. Most farmers irrigate gardens and occasionally orchards, the water being obtained from wells equipped with windmills and stored in small earth reservoirs or galvanized-iron tanks. Extensive irrigation of field crops is practiced only on two farms, the water being pumped from deep wells by means of oil engines.

In harvesting milo, the crop is generally headed in the field by hand and hauled to the barn or feed lot for storage. It is subsequently either fed in the head or thrashed, the grain being crushed for feed as desired. Kafir is generally cut with a corn binder and shocked in the field in the same way as corn. It is later stacked in the open in the feed lots and fed in the bundle. When it is desired to thrash the grain it is usually headed in the bundle. Sorghum is handled in much the same way as kafir. Sudan grass is cut with a mower when grown for hay and with a grain binder when grown for seed. Usually a considerable part of the cotton crop is gathered in the boll and run through hull gins.

The small farms are usually equipped with one or two plows, a harrow, a lister planter, a mower, a corn binder, and four to six horses or mules. There are a number of tractors in use on the larger farms. The barns are small, as few of the crops grown require indoor storage. Silos have been constructed on most of the ranches and on those farms where dairying or cattle feeding is engaged in. An ordinary grade of work animal is used on the farm. The cattle consist of good grade stock, Hereford blood predominating in the beef cattle and Holstein and Jersey in the dairy herds. There are several breeders of registered stock in the county. Good grades of hogs are kept, the Duroc-Jersey predominating.

Very little attention has been given to the practice of definite systems of crop rotation or to other methods of maintaining the productiveness of the soils. On the older farms crops are changed, but without definite intervals or rotation. When the same crop is grown for more than one year in the same field in most instances there is simply a change in the location of the plant rows.

Farm laborers hired by the year receive from $30 to $35 a month and board. On the smaller farms very little labor is hired. The lack of cheap labor for picking cotton is one of the principal factors limiting the acreage in this crop. Mexicans are commonly employed for grubbing out mesquite and catclaw bushes in virgin land, receiving for such work $1.25 to $2 an acre.

The average size of farms, as given in the census of 1910, is 1,333 acres. It is probable that the average size at present is considerably less. Most of the recently established farms contain 160 acres; a smaller number contain 320 or 640 acres. The ranches upon which cattle raising is the principal industry, but on which some farming is also carried on, range in size from 2 or 3 to 15 or 20 square miles. The census of 1910 reports a total of 208 farms in the county, with an average of 132.5 acres of improved land per farm. It is estimated that the number of farms has since increased to about 600, with a little more than 100 acres per farm actually under cultivation. Most of the farms are operated by owners. Where farms are rented the share system prevails.

The selling price of improved farming land is ordinarily $35 to $45 an acre, and of unimproved land from $20 to $30 an acre, depending upon the location.

SOILS.

The soils of Lubbock County are almost entirely residual in origin and have been derived mainly from the geologically recent, sedimentary formations that directly underlie the High Plains. The surface formations of the Plains are in part late Tertiary and in part Pleistocene in age,[1] and are believed to be deposits of fluviatile or lacustrine origin, representing detritus washed down from the Rocky Mountain region to the west. The formation capping the plains in this county has a nearly uniform lithologic character and consists of a soft, whitish or greenish-gray silty and fine sandy clay, or chalky material containing a high percentage of calcium carbonate and therefore having the nature of marl. In some places the lime has been segregated near the surface, forming a hard marl or impure lime rock. The indurated marl reaches its greatest thickness, 10 to 20

[1] The geological map of Texas, published by the University of Texas, Bureau of Economic Geology and Technology, 1916, is taken as authority for the age of the geological formations in the county.

feet, in the bluffs or rim of the canyon of Yellowhouse Creek and Double Mountain Fork, while at a distance of 1 to 2 miles back from the stream it forms a layer ranging from only a few inches to 1 or 2 feet in thickness directly beneath the soil covering. In places throughout the county there is an entire absence of any hard rock directly beneath the soil.

Narrow strips of colluvial soils have been formed in the valley of Yellowhouse Creek and Double Mountain Fork, representing detritus washed down from the bluffs and adjacent plain. The total area of soil of this type, however, is only about 9 square miles.

There is little eolian or wind-formed soil in this county. In places there is a veneer, an inch or two thick, of silty soil which may be partly due to wind deposition, and a few small hummocky areas of loose loamy sand, attributed in part to wind action.

The soils covering 90 per cent or more of the county are characterized by a moderately friable or loose surface soil, a compact subsoil layer of clay or clay loam, a lower subsoil of dry, friable, granular, highly calcareous material, and a substratum of soft or indurated marl.

In surface characteristics, these soils do not appear to differ greatly from those in the more humid regions of the United States. The prevailing colors are dark brown, dark reddish brown, and rarely red. Most of the soils are fairly well supplied with organic matter to a depth of 6 to 8 inches, and do not carry an excess of lime. The subsoils, however, are more typical of semiarid regions, being characterized by the concentration of lime and by a dry, granular structure at about 3 feet, where the ordinary limit of the downward percolation of the rainfall is reached.

In the southeastern part of the county, Double Mountain Fork has cut through the Tertiary formation capping the plains and exposed the underlying beds, which in this part of the High Plains are believed to be of Triassic age. The formation here consists of red sands, red sandy clay, dark chocolate-red hard clay, greenish sandy clay, and a thin bed of limestone and calcareous conglomerate. The soils influenced by these Triassic beds lie on the slopes below the canyon walls of the valley and altogether cover little more than 3 per cent of the total area of the county. The soils are mainly reddish in color and similar in appearance to some of the red soils of the plain, but they differ in having a less compact and stiff subsoil, and in the absence of a marl substratum.

Soils of recent-alluvial origin cover only a very small proportion of the area of the county, being confined to the bottom lands of Yellowhouse Creek and Double Mountain Fork. In many places the line of separation between the alluvium, which forms a strip only a few hundred feet in width, and the colluvial soil of the valley slopes

is not sharply defined. In the upper part of the valley, which is dry practically throughout the year, the alluvium is similar to the valley-filling material characteristic of arid and semiarid regions.

In the county as a whole the fine sandy loam and clay loam types of soil predominate, the two groups being about equal in area and together covering about 90 per cent of the county. There is only a very small area of clay soils, very little deep sand, and a nearly complete absence of stony soils. It is estimated that about 97 per cent of the area of the county is tillable.

The soils in general are naturally productive. The nearly level topography favors a maximum absorption of the rainfall, and the subsoil structure is generally favorable for the retention of moisture.

In the study of the soils in relation to native vegetation, it is of ecologic interest to note that the densest cover of short grasses is on the heavy or compact soil, while "bunch grass" (mainly *Andropogon* sp.) and *Aristida* are most abundant on the sandy, lighter-textured soil. Likewise, the coarser herbaceous species—for example, *Gutierezzia sarothrae* and *Artemisia filifolia*—are most conspicuous on the more pervious or dry gravelly soil. The invasion of mesquite and shin oak on the plain is apparently beginning on the sandier types, while the tree growth and most of the woody shrubs in the area are found on the stony, gravelly, and sandy slopes in the canyon of Yellowhouse Creek and Double Mountain Fork.

For purposes of classification and mapping, the soils are divided into series on the basis of similarity in origin, color, and structure. The series are separated into types on the basis of texture, or the relative proportions of different-sized particles, such as sand, silt, and clay, which compose the soil material.

The reddish soils of the plain are classed in the Amarillo series. This series is characterized by dark brown or dark reddish brown surface soils and red, reddish-brown, or chocolate-colored subsoils. The subsoils are heavy and compact but become friable and highly calcareous with depth. A substratum of whitish lime rock or soft clay-marl appears at shallow depths. Three types, the Amarillo loamy fine sand, fine sandy loam, and clay loam, are mapped in this county.

The brown or very dark brown soils of the plains are included in the Richfield series. This series differs from the Amarillo chiefly in its darker color. Characteristically there is an absence of red in the 3-foot section. The color difference is due primarily to a slight difference in topography and apparently to the resultant poorer drainage, the Richfield soils occupying the flatter and lower situations where the two series are associated. Three types are mapped in this county—the Richfield fine sandy loam, loam, and clay loam.

FIG. 1.—CHARACTERISTIC FLAT PRAIRIE TOPOGRAPHY OF MUCH OF LUBBOCK COUNTY.

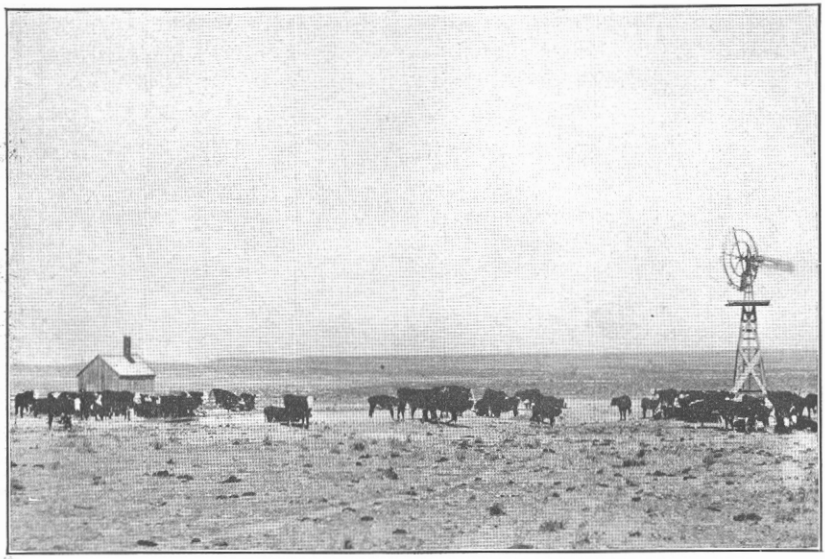

FIG. 2.—CATTLE AT WINDMILL WATERING PLACE ALONG YELLOWHOUSE CREEK, IN NORTHERN PART OF THE COUNTY.

BREAKING SOD LAND WITH A ROD-MOLDBOARD PLOW, TURNING A SHALLOW, 16-INCH FURROW SLICE.

The lighter-colored soils of the upland are classed in the Brackett series. This series is characterized by light-brown or grayish surface soils and grayish or white, friable, pervious subsoils. The soil layer is generally thin and highly calcareous. In this county the Brackett gravelly loam, fine sandy loam, and loam are mapped.

The surface soils of the Randall series are dark drab to black, and the subsoils somewhat lighter, usually drab or dark gray. The soils of this series consist of sediments washed from surrounding soils derived from unconsolidated Tertiary formations and deposited in shallow depressions occupied by temporary lakes or ponds. They are entirely without drainage and are subject to periodic submergence. The clay is the only type of this series developed in Lubbock County.

The alluvial soils are included in the Frio series. The surface soils of this series vary from very light brown or grayish to very dark brown or nearly black and overlie brownish subsoils. The subsoil is calcareous, usually heavier in texture than the surface soil. Only the loam type of this series is mapped in Lubbock County.

The following table gives the actual and relative extent of the different soil types:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Amarillo fine sandy loam	158,592	39.1	Richfield fine sandy loam	9,664	1.7
Heavy phase	58,496		Frio loam	9,664	1.7
Amarillo clay loam	161,344	29.1	Brackett gravelly loam	6,656	1.2
Richfield clay loam	97,664	17.6	Steep broken land	5,696	1.0
Richfield loam	19,456	3.5	Amarillo loamy fine sand	4,544	.8
Brackett loam	4,864	2.0	Brackett fine sandy loam	2,432	.4
Colluvial phase	6,208				
Randall clay	10,240	1.9	Total	555,520	

AMARILLO LOAMY FINE SAND.

The surface soil of the Amarillo loamy fine sand consists of a reddish-brown loamy fine sand, 8 to 15 inches deep. The subsoil is a red or reddish-brown, moderately compact, heavy fine sandy loam to fine sandy clay loam, changing at 2 to 3 feet into loose fine sandy loam or loamy fine sand. In some places the type as mapped does not differ essentially from the typical Amarillo fine sandy loam except in the looser structure of the surface soil, but generally there is a higher percentage of sand and the marl substratum lies at depths greater than 4 feet. Some deep soil occurs in small areas where the material from 18 to 30 inches is a light loamy fine sand, having a light-brown color at the surface, but gradually changing

to reddish brown and red with depth, the soil at the same time becoming more compact and heavier. Some included patches represent Amarillo fine sandy loam.

The Amarillo loamy fine sand occurs in very small, widely separated areas. The largest bodies lie a short distance south of Lubbock and about 6 miles northeast of Slaton. The type is developed principally on the more undulating and higher land on the plain and low hummocky ridges around the rims of the deeper lake basins. Narrow strips occur on the valley slopes along Double Mountain Fork north of Lubbock, the type here being in part made up of loose sand washed from the adjacent higher slopes of Amarillo fine sandy loam. In some of the areas the soil accumulation and the topography seem to be due in part to wind action.

This soil absorbs the rainfall readily, and is retentive of moisture. It has proved productive under cultivation. It is, however, more subject to blowing than the heavier soils during the high winds of the spring months, and is difficult to handle on this account.

In its virgin condition there is a more abundant growth of bear grass, catclaw, and mesquite on this soil than on the heavier types, and in the area northeast of Slaton there is a growth of shin oak *Quercus undulata*, from 10 inches to 3 feet in height. There is also a thicker growth of coarse bunch grass, a species of Andropogon, than on the heavier soils.

AMARILLO FINE SANDY LOAM.

The Amarillo fine sandy loam typically consists of a dark reddish-brown fine sandy loam about 8 inches deep, passing downward through reddish-brown or dark-red sandy clay loam into the subsoil proper, which begins at depths of 10 to 15 inches, and consists of dull-reddish, compact, and moderately stiff fine sandy clay. At 20 to 30 inches the subsoil color changes to salmon or yellowish red, and the material becomes more friable or granular and lighter in texture, although it remains somewhat compact. At about 2 feet whitish marly material frequently appears, and a substratum of soft, whitish marl or impure lime rock is commonly encountered at depths ranging from 2½ to 4 feet. Where the underlying rock is hard, there is commonly a sharp plane of separation between the subsoil and the substratum. The surface soil appears to be fairly well supplied with organic matter to a depth of 6 or 8 inches. It is not highly calcareous, but beginning at about 2 feet the material effervesces with acid, and it becomes increasingly calcareous with depth. Around old prairie-dog and badger holes there is a small amount of gravelly fragments of marl.

The type is fairly uniform throughout the county, but in some places the marl substratum is not encountered above 6 feet. In

places the substratum is a soft, greenish-gray, calcareous clay. On the lower slopes of the lake basins the soil is much darker than typical, grading into Richfield fine sandy loam.

The Amarillo fine sandy loam is widely distributed throughout the county. The largest and most uniform areas are encountered in the central, eastern, and southeastern parts. Most of the areas are very irregular in outline, since the type is closely associated with the other types of the Amarillo series and the Richfield soils, and its occurrence conforms closely to variations in the topography of the plain. Numerous small oval areas or circular bands occur around the rims of the deeper lake basins. The surface of the larger areas is nearly level, but not as smooth or flat as that of the clay loam soils. Where the type is associated with the heavier soils, it generally occupies the higher and more undulating land.

This is one of the more extensive soil types, occupying about 39 per cent of the total area of the county. All of the land is tillable and the soil is adapted to a wide variety of crops. From 15 to 20 per cent of the type is under cultivation, probably a higher percentage than of any other type. The virgin soil supports a good growth of grama and buffalo grass, but the type is slightly inferior to the clay loams in grazing value. Coarse bunch grasses, mainly species of Andropogon are more common than on the heavier types. There is a scattered growth of dwarf mesquite (*Prosopis* sp.), catclaw (*Acacia* sp.), and bear grass (*Yucca angustifolia.*)

Where this type is cultivated general farming is carried on, with sorghums, corn, and cotton as the principal crops. The soil gives good yields under favorable moisture conditions, but only a very small percentage of it has been farmed for a sufficient length of time to make possible reliable estimates of yields. The acreage yields obtained thus far are: Cotton, one-third to one-half bale; corn, 10 to 20 bushels; milo, 35 to 40 bushels; kafir, 25 to 30 bushels; and Sudan grass, 3 to 4 tons. The soil does not seem to be adapted to wheat and other small grains. Sweet potatoes, cowpeas, peanuts, and melons have been grown in small patches with some success. Various fruits, especially grapes, do well.

This soil is easily plowed and cultivated. It is highly retentive of moisture, and after being well saturated withstands prolonged droughts. In preparing the seed bed most farmers prefer bedding or listing to flat breaking. Practically all the crops on old land are put in with the lister planter. The soil is likely to drift during the winter and spring months, unless special methods of prevention are adopted.

The cost of clearing the virgin land of mesquite or other troublesome roots ranges from $1.50 to $2.50 an acre. The selling price of

the land at present is $20 to $30 an acre for unimproved areas, and $30 to $45 for improved areas.

Amarillo fine sandy loam, heavy phase.—The heavy phase of the Amarillo fine sandy loam consists of a dark reddish brown or chocolate-brown, heavy fine sandy loam, or fine sandy loam, passing at 3 to 5 inches into reddish-brown or chocolate-brown, heavy fine sandy loam, which at 6 to 10 inches rests upon reddish-brown or chocolate-brown sandy clay loam. This passes at depths between 20 and 30 inches into light-reddish, salmon-colored calcareous clay, usually containing whitish, chalky lime material in the lower subsoil, although there are places where little or none is encountered within the 3-foot section. A substratum of impure lime rock or white marl lies at depths of 2½ to 4 feet.

This phase differs from the typical soil in its slightly darker surface color, in the shallower depths to clay loam or clay, and in being generally more friable or granular in the subsoil. Much of the phase adjacent to the Yellowhouse Creek canyon is yellowish brown in the subsoil, or brown with only a suggestion of red, the soil here being intermediate between typical Amarillo and typical Richfield. The hard marl substratum here generally lies not more than 3 feet from the surface. Small spots of Richfield loam and fine sandy loam and Amarillo fine sandy loam and clay loam are included with the phase on account of the difficulty of accurately mapping small variations where there is little or no difference in topography. Some of the phase in association with the Amarillo clay loam is a loam in texture, and does not differ in subsoil character from the clay loam type.

The principal areas of the Amarillo fine sandy loam, heavy phase, occur as long, narrow strips on both sides of the canyon along Yellowhouse Creek and Double Mountain Fork, beginning a few miles north of Lubbock. Smaller areas are widely distributed throughout the county.

The surface in general is nearly level and a little flatter or lower than that of associated areas of the typical Amarillo fine sandy loam. The areas paralleling the canyon occupy flat, benchlike situations, slightly lower than the level of the plain 1 to 2 miles back. Many of the smaller areas occur on the rims of lake basins or occupy the steeper slopes.

Probably about 10 per cent of the phase is under cultivation. The staple farm crops are grown, and the same farming methods are practiced as on the typical Amarillo fine sandy loam. No material difference in yields has thus far been observed. The soil in the virgin condition is slightly more compact than that of the typical Amarillo fine sandy loam, and requires a little greater draft in plowing. It is less susceptible to blowing.

The native vegetation consists principally of a scattered growth of dwarf mesquite and catclaw, with a good growth of the native pasture grasses. Broom weed (*Gutierezzia sarothrae*) is apparently more abundant than on the typical Amarillo fine sandy loam.

AMARILLO CLAY LOAM.

The soil of the Amarillo clay loam is a dark reddish-brown to dark-red sandy clay loam, or a brown to reddish-brown fine sandy loam or loam, passing quickly into reddish clay loam. Beginning at a depth of 8 to 12 inches the subsoil is a stiff, dark reddish or reddish-brown clay. Below 24 to 36 inches it is lighter red or salmon colored and more calcareous. The structure of the subsoil changes at about 3 feet, the material below this depth becoming drier and more friable and granular. A substratum of whitish, soft, impure lime rock or greenish-gray, calcareous clay is encountered at depths of 3 to 5 feet. The surface soil generally is not highly calcareous, but the subsoil at 20 to 30 inches contains sufficient lime to cause free effervescence with acid, and the lower subsoil, at 36 to 40 inches, generally is highly calcareous. When dry the immediate surface soil may have a brown color.

Some of the soil included with this type has a covering of 4 to 6 inches of heavy fine sandy loam over clay, but the mixture of the two layers when found to a depth of 8 to 10 inches constitutes a fine sandy clay loam. The soil here generally has a more pronounced reddish color than typical. Such areas are encountered principally in the central part of the county. It is not everywhere possible to draw accurate lines of division between the Amarillo clay loam and Richfield clay loam, since there is little difference in topography in many places, and no material difference in the color of the top soil. Small spots of Richfield clay loam are included in the larger areas of the Amarillo type.

The Amarillo clay loam is widely distributed. The largest and most uniform areas occur in the northern and western parts of the county. The surface is generally level. Where the type is associated with the Amarillo fine sandy loam it occurs in the flatter and less undulating situations. Where associated with the Richfield clay loam it generally occupies slightly higher elevations than that type. There is very little run-off, but the land is rarely too wet for successful cultivation.

The Amarillo clay loam is one of the more extensive types in the county. Probably not more than 10 per cent of it is under cultivation. As in the case of other types, this is due to the thinly settled condition of the county rather than to the unsuitableness of the type for farming. The virgin soil supports a thick cover of grasses, grama

grass (*Bouteloua oligostachyia*) and buffalo grass (*Bulbilis dactyloides*) predominating. There are large tracts quite free from the coarser vegetation, such as bear grass and catclaw, which is found on the sandy soils. The land has a high grazing value.

All the staple crops of the county are grown. Ordinary yields are from 30 to 40 bushels of milo per acre, 25 to 30 bushels of kafir, and about one-third bale of cotton. It is the general opinion that in a year of favorable rainfall the yields are at least as good as on the fine sandy loam type, but that they are smaller in a droughty season. Wheat, rye, oats, and barley, whether sown for grain or pasture, do better than on the more sandy soils.

This is one of the types locally known as "tight land." The expense of cultivation is slightly higher than on the sandy soils, heavier teams being necessary in plowing, but the tilth improves under cultivation. The type has the advantage of being coherent, or slightly cloddy, and resists blowing. The expense of clearing the land of brush and roots is less than in the case of the sandy soils, since this type is nearly free from any growth larger than the grasses and weeds.

The selling price of unimproved land of the Amarillo clay loam ranges from $20 to $30 an acre and of improved land from $30 to $45 an acre.

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

Mechanical analyses of Amarillo clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
445036, 445048...	Soil.....	0.0	0.7	2.0	25.5	30.9	21.7	18.8
445037, 445049...	Subsoil.....	.0	.6	2.1	24.7	26.0	23.5	22.7
445038.....	Lower subsoil.	.0	.6	1.3	24.3	33.4	19.5	20.8

The following sample contained more than one-half of 1 per cent calcium carbonate ($CaCO^3$): No. 445038, 3.84 per cent.

RICHFIELD FINE SANDY LOAM.

The Richfield fine sandy loam consists of brown to dark-brown fine sandy loam, underlain at 8 to 14 inches by brown sandy clay loam to compact clay. This at about 2 feet changes to lighter brown, more sandy and friable, but compact calcareous clay. The lower subsoil and substratum have the salient characteristics of the series; the subsoil becomes grayish and highly calcareous at 24 to 36 inches, and grades into whitish marl at 3 to 4 feet. There are included some shallow areas where the rock is closer to the surface and the heavy clay subsoil is lacking. The surface soil apparently contains more

organic matter than that of the Amarillo fine sandy loam, and is more calcareous.

This type is widely distributed over the county, but it occurs mainly in small areas. The largest and most uniform developments lie east of Lubbock. It generally occupies slightly lower or flatter situations than the associated Amarillo fine sandy loam. A large proportion of the type as mapped lies on the lower slopes of lake basins, surrounded mainly by the Amarillo fine sandy loam. There is a circular strip of the type around practically each lake in the county where the adjacent plain is sandy, but in many instances because of narrowness of these strips they can not be shown on the map.

A considerable percentage of the type is under cultivation, and it has proved productive. So far as can be ascertained it gives fully as good yields as the Amarillo fine sandy loam. It is adapted to the sorghums, corn, cotton, and a variety of other crops. Wheat, rye, and oats do not succeed as well as on the heavier types of the series.

The native vegetation, in addition to the grasses, consists of a scattered growth of catclaw, scrub mesquite, and bear grass. There is not quite as thick a growth of grama and buffalo grass as on the heavier soils, and the pasturage value is slightly less. The soil is easily plowed and maintained in good tilth. The deeper areas are retentive of moisture, but unless carefully handled the soil is likely to drift.

RICHFIELD LOAM.

The Richfield loam consists of a dark to very dark brown, friable loam, 8 to 12 inches deep, overlying a brown, dark-brown, or chocolate-brown, compact clay loam or clay. At 20 to 30 inches the subsoil changes to a lighter-colored or light-brown, calcareous clay, in many places containing whitish, chalky lime material. The subsoil becomes more friable in the lower part of the 3-foot section, but is quite compact or tough in places when dry. The soil section is very similar to that of the clay loam type, except in the texture of the surface soil. This is generally a loam, but a considerable part of the soil as mapped consists of a heavy fine sandy loam, underlain at 3 or 4 inches by loam or clay loam.

A variation of small extent, associated with the areas of Brackett loam, and intermediate between typical Richfield and typical Brackett, consists of a brown silty loam over light-brownish clay loam, which changes to pale-yellowish or grayish, granular loam at 15 to 20 inches. Shallow areas of the type, having a more friable and pervious subsoil and characterized by a marl or rock substratum at depths of 18 to 24 inches, are also included.

The Richfield loam is rather widely distributed over the county, but it occurs principally in small areas. The surface in general is

nearly flat. Where the loam occurs in association with the clay loam it generally occupies slightly higher land. It is developed in the broad, shallow depressions of the plain and in small, roughly circular areas around the dry lakes.

Probably 10 per cent of the type is under cultivation. All the staple crops are grown and the yields obtained are about the average for the county. The virgin soil supports a thick growth of the common pasture grasses and has a high grazing value.

This type is intermediate in tillage requirements between the Richfield clay loam and fine sandy loam. It can be maintained in good tilth with a little less labor than the clay loam and is not as likely to drift as the fine sandy loam. Blue weed is probably a little more abundant at present than on the lighter-textured soil.

RICHFIELD CLAY LOAM.

The Richfield clay loam consists of a dark to very dark brown sandy clay loam or loam to fine sandy loam, underlain at 2 to 5 inches by brown or dark-brown clay loam, and at 7 or 8 inches by chocolate-brown to dark-brown clay, which in turn passes at 24 to 30 inches into light-brown or yellowish-brown, calcareous clay. This in the lower part of the 3-foot section often contains whitish, chalky material. In places chocolate-brown spots are closely associated with the dark-brown soil, giving some fields a spotted appearance. Whitish, soft, impure lime rock or soft, grayish clay is encountered at depths of 3 to 4 feet. There is generally an absence of reddish color in the 3-foot section, but on much of the flat, higher-lying land a chocolate color or very dark reddish brown shade appears in the subsoil.

Part of the type as mapped consists of 3 to 5 inches of brown, heavy fine sandy loam, underlain by brown, heavy clay loam or clay. The soil here works up into a fine sandy clay loam. In some of these areas the lower subsoil is yellowish brown, lacking the typical light-brown or grayish color.

The largest uniform areas of this type lie in the northeastern part of the county. They are very irregular in outline, owing to their intimate association with other types of the Richfield and Amarillo series, and there is probably not a single section of land composed entirely of this type. Small bodies, usually roughly circular or oval tracts surrounding lakes or areas of Randall clay, are widely distributed over the county.

The surface on the whole is more nearly level than that of other types of the Richfield or Amarillo series. The Richfield clay loam has been found in two slightly different topographic positions, viz., on the flatter land on the higher parts of the plain, in which situation there is very little difference in topography from the Amarillo

clay loam; and on the level land in the numerous lake basins and shallow depressions which dot the plain. There is only a very light run-off, but the land is rarely too wet for successful cultivation.

The Richfield clay loam is an extensive soil, but only a very small percentage of it is under cultivation. The soil in its virgin condition supports a thick growth of the more nutritious pasture grasses of the region, such as grama and buffalo grass, and large areas are entirely free from the coarser vegetation which characterizes the lighter textured soils. The pasturage value is probably higher than that of any other type.

This soil is productive when properly handled. Sorghums, corn, and cotton are the principal crops. Wheat is better adapted to this soil than to the sandy types, and yields of 10 to 20 bushels per acre have been obtained. Milo yields about 40 bushels per acre, kafir 25 to 30 bushels, and cotton one-third to one-half bale. The yields in years of favorable rainfall appear to be higher than on the sandy soils, but somewhat lower in very dry seasons.

This type is locally known as "black tight land." The virgin soil is compact and difficult to plow, but becomes more tractable with cultivation. Where tillage is neglected the top soil becomes hard and puddles after rains. Deep plowing and frequent shallow cultivation to conserve moisture are probably more essential than on the sandy soils.

This type has about the same land value at present as the other extensive soils of the county, namely, $20 to $30 an acre for unimproved and $30 to $40 an acre for improved land.

BRACKETT GRAVELLY LOAM.

The soil of the Brackett gravelly loam consists of a light-brown or brown loam to fine sandy loam, underlain at shallow depths—1 to 6 inches—by lighter brown or grayish to pale-yellow calcareous loam to silty clay loam. This passes into whitish, impure limestone or indurated marl at 5 to 24 inches. A small percentage of angular fragments of limestone are distributed through the soil, giving it an open structure. This soil is very similar to the Richfield soils in color and is derived from the same rock, but it lacks the heavy subsoil layer which is characteristic of the Richfield series.

The soil is not altogether uniform in texture, and there are minor color variations. A considerable part of the type as mapped is a gravelly fine sandy loam rather than a loam, and small spots of Richfield loam are included. In places the soil material is uniform in color and texture to the bedrock, with a sharp plane of separation between the two. Along the brink of the Yellowhouse Creek Canyon and in the more eroded spots the soil is grayish or white in color.

Small areas in which the surface soil is light brown and the underlying soil or marl has a salmon or pale-reddish color are also included.

The principal occurrence of the Brackett gravelly loam is in narrow, elongated strips adjacent to the canyon along Yellowhouse Creek and Double Mountain Fork from points a few miles north and northwest of Lubbock southeastward to the county line. Isolated areas, a few acres in extent, occur elsewhere throughout the county. In most places the surface is nearly level or but slightly uneven. The smaller, isolated areas occur on low swells or hillocks 10 to 30 feet above the surrounding level and on eroded slopes. The type occupies situations where the hard rock has been brought near the surface by water or wind erosion.

The Brackett gravelly loam covers about 10 square miles. Only a very small proportion of it has been placed under cultivation. The pervious structure and thinness of the soil do not favor the retention of moisture during droughts. Small areas of the deeper soil have given fair yields of the staple crops, and the soil would doubtless be productive under irrigation. The type is used principally for grazing.

The native vegetation on this soil is rather characteristic. There is an abundant growth of the broom weed (*Gutierezzia sarothrae*) and other weeds with woody bases and a scattering of catclaw and scrub mesquite. The stand of grass is thin, and there is a smaller proportion of grama and buffalo than on the Richfield and Amarillo soils.

BRACKETT FINE SANDY LOAM.

The Brackett fine sandy loam consists of 6 to 10 inches of gray or dark-gray, loose, fine sandy loam, underlain by friable, gray loam or heavy, fine sandy loam. A soft, grayish, friable clay-marl stratum is encountered at depths of 15 inches to 3 feet. The type is similar to the Brackett loam in color, structure, and topography, and considerable loam soil is included in some of the areas mapped.

The Brackett fine sandy loam is usually associated with the loam, and occurs in small, widely separated areas, 5 to 60 acres in extent. It occupies the higher parts or crests of low ridges or swells in the plain, the land in places being barren as a result of the action of wind or water.

A total area of about 5 square miles of Brackett fine sandy loam is mapped. Only two or three small fields are under cultivation. The soil apparently is droughty.

The native vegetation is characteristic. There is a scattered growth of bear grass (*Yucca*) with occasional catclaw, and a characteristic yellow-flowered weed of the Compositae. There is only a

thin stand of grass, and bunch grass, mainly species of Andropogon, is more common than on the heavier soils of the county.

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

Mechanical analyses of Brackett fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
445005	Soil	0.0	0.5	1.7	59.5	20.6	13.2	4.1
445006	Subsoil	.1	.6	2.3	53.3	20.0	15.0	8.2

These samples contained more than one-half of 1 per cent calcium carbonate ($CaCO_3$): No. 445005, 15 per cent, and No. 445006, 21.02 per cent.

BRACKETT LOAM.

The Brackett loam consists of a light-brown to ashy-gray friable loam which grades at 6 to 10 inches into gray or pale-yellowish loam to clay loam. This passes into whitish or pale-yellowish, rather chalky, highly calcareous material. Whitish marl or greenish-gray calcareous clay is frequently reached at 10 to 20 inches, with the hard marl in many places lying but a few inches below the chalky material. The surface soil is apparently lower in organic matter than that of the Richfield and Amarillo types, and the subsoil is more friable. The soil is highly calcareous throughout the 3-foot section. The type as mapped includes much soil which is a silt loam in texture. The distinction between the two classes in this county is not regarded as important.

The Brackett loam occurs in small, widely separated bodies of 10 to 60 acres. It is developed principally on low ridges forming the rims of the deeper lake basins and on the smooth slopes adjacent. It is also encountered on the rim of the basinlike valley of Yellowhouse Creek in the vicinity of Shallowater and westward.

The type occupies only a small total area and is of minor importance. Only a few small patches have been placed under cultivation. The soil apparently does not retain moisture as well as the lighter textured soils of the Amarillo and Richfield series. The grass growth is not as thick as on associated soils, but the smoother land affords fair grazing.

Brackett loam, colluvial phase.—The Brackett loam, colluvial phase, is predominantly a light-brown friable loam, generally containing some fragments of white, impure lime rock. There is little distinction between soil and subsoil, the material simply becoming light yellowish brown or grayish with depth, with little change in structure or texture in the 3-foot section. The soil, however, is not everywhere typical, varying from grayish to dark brown in color,

and in many places to fine sandy loam in texture. The phase occurs in narrow strips on the slopes below the bluffs or canyon walls along Double Mountain Fork, and represents soil material washed mainly from the adjacent bluffs. The colluvial accumulations range in thickness from 3 to 15 feet. The whitish marl which forms the upper part of the bluffs is the principal source of the soil material, but in several places wash from the Amarillo soils on the adjacent plain and from the reddish sands and clays underlying the white marl have contributed in its formation, so that the type may have a pale-reddish or reddish-brown color. The material is calcareous from the surface downward.

The surface of this soil slopes gently toward the stream channel, and the colluvial material grades into the alluvial soil without any sharp line of separation.

The total area of this phase is very small, and little of it is under cultivation. The topography is unfavorable for extensive dry-land farming, although the soil is productive. The type has less value as pasture than most of the upland. There is a thin growth of grama grass, with a more extensive growth of coarse bunch grass (*Andropogon* sp.), and a scattered growth of mesquite, bear grass, and sage (*Artemisia filifolia*). The situation is favorable for the irrigation of small fields from wells on the higher slopes or on the adjacent plain. The soil is suited to alfalfa and small fields might be successfully grown under irrigation, the crop to be used in connection with hog raising.

In the southeastern part of the county the Brackett loam, colluvial phase, as mapped includes soil similar in origin and topography, but which has a predominating reddish color. This included type consists of a light-reddish brown fine sandy loam overlying a light-reddish or salmon-colored fine sandy loam or friable fine sandy clay loam. Generally there is very little difference in color or texture to a depth of 3 feet or more, but in most places the material becomes a little heavier at a depth of 10 to 15 inches. This type occurs on the valley slopes below the more precipitous bluffs along the lower part of Double Mountain Fork. It includes some narrow strips of loose pinkish sand along tributary ravines, representing recent wash, and also mounds of moderately gravelly soil representing alluvial fan material. Some of the soil is residual in origin, being formed in situ from the underlying Triassic beds. In such instances there is a shallow substratum of chocolate-red clay, gray clay, or calcareous conglomerate. Much of the soil contains waterworn gravel derived from the conglomerate bed. The topography is gently sloping and undulating, with numerous low hills. The land is used at present entirely for pasture, but most of it could be farmed, and part is favorably situated for irrigation from wells on the higher land. In

places there is a good growth of grass, but the pasturage value on the whole is less than that of the soils on the plain. There is a scattered growth of mesquite and a few chaparral bushes. Sage (*Artemisia filifolia*) is common on the loose, dry soil.

RANDALL CLAY.

The Randall clay varies from a mottled brown and rusty-brown clay to a brown or dark-brown, drab or ash-gray clay. Frequently there is a shallow surface covering of fine sandy loam or silt loam. Greenish-gray, friable, calcareous clay is encountered at depths of 3 to 6 feet. The soil generally contains sufficient lime to effervesce with acid at 20 to 30 inches, and in a number of places it is calcareous at the surface, though for the most part the surface soil does not show effervescence. The surface material dries out to an ashy-gray color. In some of the shallow areas surrounded by Amarillo fine sandy loam a brownish-yellow mottling appears in the subsoil, and there is a substratum of yellowish sandy clay.

The Randall clay has been formed in the beds of the numerous intermittent lakes which dot the plain, and is widely distributed throughout the county. Over 800 areas, ranging from 2 or 3 to 40 acres, are shown on the soil map. The lake beds lie from a few feet to 50 or 60 feet below the surrounding plain, and receive the drainage of the adjacent slopes, the water being held until lost by evaporation. Many of the lakes dry up within a month after rains. These are known as playas.

The soil in the very shallow basins can be cultivated, but drainage of the lakes in the larger and deeper basins is impracticable. The soil generally becomes very hard and cracks when dry, but in some of the lakes there is a loose, ashy surface layer which is subject to blowing. When wet the soil is sticky and difficult to plow.

Most of this type supports a growth of several species of grasses and herbaceous plants, and the land has some value as pasture even when covered with water. A certain species is so much relished that horses graze it even though it is under water. It is a common opinion that the Randall clay areas are the original habitat of the blue weed (*Helianthus ciliaris*), which has become a serious weed pest in cultivated areas.

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

Mechanical analyses of Randall clay.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
445011, 445046...	Soil.....	0.0	0.4	1.2	14.8	23.9	21.5	38.0
445012, 445047...	Subsoil.....	.2	.3	1.5	16.1	25.2	19.8	36.5

FRIO LOAM.

The Frio loam consists of a brown to dark-brown, friable loam, underlain at 5 to 12 inches either by (1) brown clay to clay loam, passing into lighter-brown clay loam to clay, with considerable whitish, calcareous material, or (2) by light-brown to pale-yellowish clay loam to loam, passing into grayish, highly calcareous material. In places sandy loam or gravelly material is reached at depths ranging from about 2½ to 4 feet.

This type includes the narrow strip of alluvium along Yellowhouse Creek and Double Mountain Fork. It is calcareous in the subsoil and generally shows an efflorescence of white alkali salts in ditches and exposures along the channel of the stream. It includes a number of variations, depending upon drainage conditions and source of the soil material. As the total area is very small and the soil as a whole is of minor importance, the different variations are not mapped separately. In places the texture of the soil ranges to a silty clay loam, as in the area near Lubbock and in the strip along Double Mountatin Fork about 10 miles north of Lubbock. There are some included patches of fine sandy loam along Double Mountain Fork near Lubbock. Much of the soil, particularly on the banks of the stream, is a light-brown or grayish loose fine sandy loam. Some areas are a silt loam in texture. In the spots where water stands for short periods the soil is a dark-gray clay loam with a stiff, plastic clay subsoil. In the southeastern part of the county, where there has been considerable influence from the reddish sands and clays underlying the Tertiary marl, the subsoil is a stiff, chocolate-red and salmon-colored clay. In places there is a thin covering of pale-reddish sand, representing recent wash over the older and darker-colored loam or clay loam soil.

The alluvial area varies in width from 100 feet to one-fourth mile. It is not sharply separated from the colluvial soil of the valley slopes. From the vicinity of Lubbock southeastward, where the stream is perennial and has a definite channel, the bottom land lies only 5 to 15 feet above the stream bed, but is rarely overflowed.

From Lubbock southeastward none of the land is cultivated, largely because of unfavorable topographic situation. Some wet spots, a few alkali spots, and some land injured by loose sand washed from tributary gullies probably could not be farmed profitably, but most of the land doubtless could be cultivated in small fields in connection with the adjacent slopes. Beginning 2 to 4 miles north and west of Lubbock, where the streams are dry throughout the greater part of the year, the alluvial soil is cultivated in a number of places. The same crops are grown as on the upland, and about the same yields are obtained. The virgin soil supports a thick growth of several species of grasses and affords fair grazing.

STEEP BROKEN LAND.

Steep broken land includes the steep bluffs forming the canyon walls of Double Mountain Fork and the rough, broken land bordering the numerous short tributary canyons or gulches in the southeastern part of the county. The upper parts of the bluffs are composed of whitish, impure lime rock or indurated marl and are nearly or quite barren of soil. The slopes below the lime rock or "cap rock" are less precipitous, owing to the softer nature of the strata, but are broken by gullies and sharp ravines. The land has no value for farming and affords only scant grazing. There is a scattered growth of coarse bunch grass, a few mesquite trees, occasional algerita and chaparral bushes, and a few stunted hackberry trees. Steep broken land has an area of 5,696 acres, or 1 per cent of the total area of the county.

SUMMARY.

Lubbock County is situated in central-western Texas. It has an area of 868 square miles, or 555,520 acres.

The county is situated in the High Plains region of the State. The general elevation is about 3,100 to 3,300 feet above sea level. The surface is a nearly level treeless plain, having a gentle eastward and southward slope. There are only two small streams in the area, and most of the run-off flows into shallow basins, which contain small intermittent lakes.

An abundant water supply is obtained from wells at an average depth of about 100 feet.

The population in 1910 was 3,624. The present population is estimated at 9,000 to 10,000, about one-half being rural.

Railway lines traverse all parts of the county. The public roads are generally in good condition for both wagon and automobile traffic.

The climate is semiarid. It is characterized by a low rainfall—about 21 inches—a large percentage of clear days, and a high rate of evaporation. The greater part of the precipitation falls during the months of April to October. Prolonged droughts are of frequent occurrence. There is an average growing season of about 205 days.

Ranching and general farming are carried on. Cattle raising is the principal industry on the ranches. The sorghums are the principal crops grown, and the most dependable crops under the prevailing climatic conditions. Milo ranks first in acreage, followed by kafir, sorgo (cane), and Sudan grass. Corn occupies a small acreage on most farms, but the acreage yields are low. Cotton is the principal cash crop on most of the farms. The forage and grain crops are largely consumed on the farms and ranches where grown. Dairying in conjunction with general farming is carried on to a small extent.

A variety of tree fruits, bramble fruits, and grapes can be grown. Yields are uncertain on account of climatic conditions, but small orchards generally afford an ample supply of fruit for home use. It is necessary to irrigate gardens.

It is generally recognized that the amount and distribution of rainfall are the principal controlling factors in yields. The methods of seed-bed preparation and tillage are designed to favor the absorption of the greatest amount of rainfall and to prevent excessive loss of soil moisture.

It is estimated that less than 15 per cent of the total area of the county is under cultivation. Most of the farms range from 160 to 640 acres in extent.

The soils are mainly residual in origin and have been derived largely from greenish-gray highly calcareous clay or marl of late Tertiary age. Narrow strips of alluvial and colluvial soils occur along Yellowhouse Creek and Double Mountain Fork.

Fine sandy loams and clay loams predominate, the two classes of soil having about the same total area and together covering about 90 per cent of the county. It is estimated that 96 per cent of its total area is tillable. The soils have proved productive under favorable conditions of rainfall.

Over 90 per cent of the soils are embraced in two series, the Amarillo and the Richfield. The Amarillo series is characterized by a brown or reddish-brown surface soil; a reddish, stiff, compact subsoil, which becomes more friable and highly calcareous at 2 to 3 feet; and a substratum of whitish marl. The Richfield soils have the same structure as the Amarillo and differ mainly in color, having a brown or very dark-brown color at the surface and a brown to grayish color in the subsoil. The Amarillo and Richfield soils are productive, desirable types, adapted to a wide range of crops. The heavier members are somewhat difficult to cultivate, but their tilth improves with cultivation.

There is a small area of light-brown and grayish, highly calcareous soils, which are included in the Brackett series. The Brackett soils are farmed to only a very small extent. They appear to be droughty.

The poorly drained soil occupying the numerous lake basins scattered throughout the county is classed as the Randall clay. In the shallow basins this soil can be cultivated, but drainage in the larger and deeper depressions is impracticable.

The alluvial soil is brownish and calcareous, and is mapped collectively as the Frio loam. Much of this soil is not cultivable on account of unfavorable topography. The yields are about the same as those obtained on the upland soils.

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[PUBLIC RESOLUTION—No. 9.]

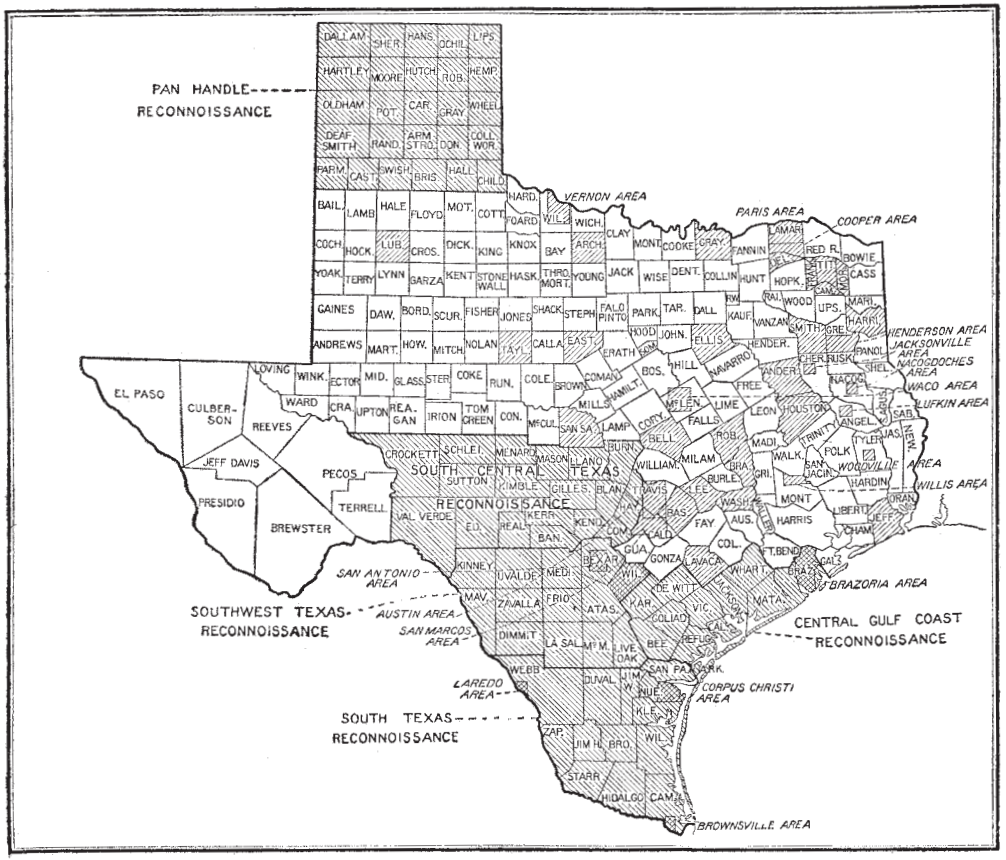
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

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.]



Areas surveyed in Texas.

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