

SOIL SURVEY OF THE VERNON AREA, TEXAS.

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LOCATION AND BOUNDARIES OF THE AREA.

The Vernon area is within Wilbarger County, which lies upon the northern boundary of Texas and is separated from Oklahoma Territory by the Red River. Though geographically it is in about the middle of the State from east to west, the country is generally spoken of as Northwest Texas, or perhaps more commonly as the Panhandle country. (See fig. 9.)

Wilbarger County is bounded on the east by Wichita County, on the south by Baylor County, and on the west by Foard and Hardeman counties. It is in west longitude 99° and north latitude 34° , and comprises 947 square miles. The area surveyed lies wholly within the county and contains 277 square miles. Vernon lies a little south of the center of the area, which extends northward from that town a distance of 15 miles. The eastern boundary of the area lies 8 miles west of the eastern boundary of the county, which is formed by the 99th meridian. The southern and western boundaries of the area lie 6 and 7 miles, respectively, from Vernon. The Pease River flows through the area from west to east, cutting it into two nearly equal parts.

HISTORY OF SETTLEMENT AND AGRICULTURAL DEVELOPMENT.

Little was known of Wilbarger County previous to 1870, except by occasional hunters and explorers. Recognizing the natural advantages of the country, one or two ranchmen sought range for their cattle upon the rich grasses of the prairie in 1873 or 1874. The great National cattle trail, leading from central Texas to Dodge City, Kans., passing through Wilbarger County at the present site of Vernon, and crossing the Red River at Doans, was the scene in 1876 and subsequent years of great cattle drives, aggregating many thousand head annually. In 1885 there were driven through Vernon 300,000 head of cattle, 200,000 head of sheep, and 190,000 head of horses. Single herds in these drives sometimes numbered as high as 5,000 head. There were then herds of buffalo, antelope, and wild horses ranging the prairies of the county.

One of the first farmers to come to the county was the late Judge Doan, who settled near the Red River, at Doans, in 1877. At that time there were not half a dozen settlers in the county. Timber was not available in the vicinity, and nearly all the settlers then lived in dug-

outs, wooden houses not appearing until several years later. The county was organized in 1881, with only about 50 bona fide residents.

The Houston and Texas Central Railroad was granted one section of land for every 16 miles of railroad built and operated in the State. Choosing this section of the country as one from which to make their selection, they made the original survey of Wilbarger County, receiving half the lands, the alternate sections belonging to the State free-school fund. These school lands were thrown upon the market in 1883 at a price of \$1 per acre for unwatered land, and from \$2 to \$3 per acre for the sections bordering upon streams or having springs or living streams located upon them. The agricultural development of the county was very slow until about 1885, when the Fort Worth and Denver City Railway reached Harrold, in the eastern part of the county. It was continued on to Vernon the following year, then a little place of about 250 inhabitants, including transient cowboys, and in 1887 connections were made through to Colorado points.

The first settlements were made along Pease River and Paradise Creek. The early agricultural products of the county were principally wheat, oats, and corn. At first the heavy loam lands were thought to be the best fitted for general agriculture, and these were in greatest demand, but the experience has been that though naturally richer in plant food, these loams do not resist droughts well, and of late years the more drought-resistant sandy soils have been given the preference. Little cotton was grown in the county until three or four years ago, but it is now fast coming to be one of the staple crops.

CLIMATE.

The climate of the Vernon area is comparatively dry, and is characterized by high winds and light annual rainfall. The temperature through the summer months is generally pretty uniform, averaging about 80° for the months of June, July, and August, with few sudden changes. In the fall and winter months, however, considerable fluctuation is noticed. Cold winds of great severity sweep down from the north without warning, changing the temperature through many degrees in the space of a few hours and causing at times much suffering to men and animals exposed to their force. Accompanied by sleet and snow these "northers" are at times so fierce during the winter months as to cause considerable loss of life to cattle.

During the months of July and August the winds sometimes carry with them the other extreme of temperature, the hot blasts at times resulting in the course of a few hours, or a day, in the total destruction of a crop of corn, wheat, or cotton. The length of the growing season is such, however, that there is often a considerable subsequent growth of vegetation possible before the time of killing frosts. Corn puts forth a sucker growth from which a good forage crop is secured. Small grain is almost always harvested before the advent of these hot

winds. Cotton is blighted, but if rains fall subsequently a partial crop is secured. It must be understood, however, that hot winds of such destructiveness are not of annual occurrence. A small amount of damage is done by them nearly every year, but it is only once in four or five or more years that they do the greatest damage.

Little specific climatological data for Vernon and the immediate vicinity are obtainable, but the conditions obtaining there are thought to be fairly well represented by the figures given in the subjoined table. The annual precipitation is probably a little high, and it is thought that 25 inches would be nearer correct for Wilbarger County. At Amarillo the precipitation for the ten years ended 1901 averaged 21.56 inches.

In the Vernon area killing frosts often do not occur until December, the frosts of November being usually light. The seeding of small grain is in progress more or less continuously well on into December and sometimes throughout the whole of that month. Ice seldom forms of a thickness exceeding an inch or two at any time during the winter. The snowfall is light, rarely enough to make good sleighing.

Unlike the rainfall in the semiarid region of California, the greater part of the rainfall in this part of Texas occurs in the summer months. There is, therefore, notwithstanding a considerable precipitation, more uncertainty in grain production in the Vernon area than in parts of California areas with a normal rainfall of less than half as much. The dry weather of fall and winter, if but slightly accentuated, makes seeding difficult and often leaves the young plants in a condition unfavorable for enduring the winter season. The same conditions make the selection of suitable forage crops a difficult problem.

Average monthly and annual temperature and precipitation.^a

Month.	Haskell.		Henrietta.		Rhineland.		Forestburg.	
	Temperature.	Precipitation.	Temperature.	Precipitation.	Temperature.	Precipitation.	Temperature.	Precipitation.
	°F.	Inches.	°F.	Inches.	°F.	Inches.	°F.	Inches.
January	43.2	0.92	45.0	0.35	42.8	0.86	44.3	1.68
February	46.4	.79	43.6	1.45	43.0	.86	43.9	.66
March	51.0	1.28	54.9	1.46	53.7	2.06	54.6	4.44
April	68.1	1.93	61.8	2.62	63.6	2.54	64.8	3.65
May	73.8	2.61	72.8	3.49	73.5	4.18	71.0	6.92
June	84.3	3.05	80.9	3.11	81.1	3.03	77.1	4.16
July	85.8	2.63	84.7	2.62	84.1	5.08	82.1	5.79
August	84.0	1.57	85.2	2.66	85.3	1.39	78.9	1.62
September	77.8	1.33	78.1	1.78	77.0	2.67	76.2	1.48
October	66.5	.85	66.3	2.00	67.0	2.08	63.6	1.68
November	51.3	1.49	53.2	1.76	53.3	1.79	52.0	2.94
December	45.8	1.73	44.1	1.09	42.7	1.13	46.2	1.92
Year	65.6	19.73	64.2	24.39	65.1	27.59	62.9	35.92

^aThis table has been compiled from fragmentary records, covers different periods of time for different stations, and is not strictly comparable station or with tables of normals given for other areas covered by this report.

PHYSIOGRAPHY AND GEOLOGY.

The Vernon area lies upon the Permian Red Beds, which extend from the bluffs of the Llano Estacado or "Breaks of the Plains" on the west to the black prairie region of east-central Texas. The area is drained by Pease River, Beaver Creek, and Red River. The Red River, although bordering the county on the north for a distance of about 40 miles, receives comparatively little of the surface water except secondarily through the first-mentioned streams. Pease River rises at the edge of the Staked Plains, about 150 miles west, and reaches the Red River about 9 miles east of Vernon, passing in an easterly direction through the county a little north of its center. It drains the larger part of the area surveyed. Its principal tributary is Paradise Creek, rising to the southwest in the adjoining county and emptying into Pease River 2 miles below Vernon. Wild Cat Creek heads to the north of Tolbert and empties into Pease River opposite Vernon. Beaver Creek, a tributary of Wichita River, drains a small part of the southern edge of the area.

In physiography the country is what is generally termed a high, rolling prairie. The prairie billows are for the most part long and gently undulating, with intervening loam plains or plateaus having a nearly level surface. The level of these loam plains is often broken by eroded depressions or "breaks," the heads of incipient streams. These depressions consist of more or less circular areas, having flat floors composed of the basal red clay from which the overlying loam has been removed. Such areas are indicated on the soil map. These floors are usually bare, save for a few mesquite trees which occasionally obtain a foothold. The walls are nearly always precipitous and vary from 3 or 4 to 10 feet in height. The surface water and silty flood wash is transported from these areas by narrow, abruptly incised streamlets.

A prominent physiographic feature of the area surveyed is a high sand ridge extending across the northern part. The southern border of this ridge is about 6 miles north of Pease River, and trends in a direction approximately parallel to the river. From this line the ridge extends north as a broad belt 5 miles wide to the edge of the sheet, and for an undetermined distance beyond. The sand, though covered by grass, is loose textured and hilly, exhibiting a sand-dune structure. This sand ridge rises to a height of about 100 feet above the level of the surrounding prairie, and it is estimated that its elevation above the river at Vernon is about 220 feet.

The sand is underlain by a soft, calcareous sandstone of medium texture and grayish color. This is more or less interstratified with layers of red clay and red arenaceous shale. A few exposures are to be seen along the bluffs on Red River, in a few stream valleys in the neighborhood of Doans, and to the west of Tolbert, where a quite

abrupt escarpment appears. This sand is undoubtedly derived from the indurated material underlying it. Appearances would seem to indicate that a large river or body of water, as an estuary, at one time existed here, and that from its shores the winds drifted the sand inland and piled it up into low mounds and dunes. The disconnected counterpart of this range of sand hills is seen on the south side of Pease River. The ridge here is comparatively narrow, and is smoother in outline, possessing less of the dunelike structure seen upon the other side of the valley. South of Vernon a comparatively wide valley has been cut through this ridge by Paradise Creek.

Pease River, when compared with the physiography and drainage system of the county, is a very old stream, and has succeeded in eroding a relatively wide valley. Its northern bank is for the most part formed by a distinct bluff, in the area surveyed, and the river is at present cutting into it. A more or less terraced valley, having an average width of about a mile and a half, has been built up on the south side of the river. Immediately along the stream this is composed of loose, drifting sand, back of which is an older terrace of sandy loam, overlying in a few instances a small amount of stratified gravel.

The immediate beds of Pease and Red rivers are relatively very wide, the former measuring on an average one-fourth of a mile and the latter something over 1 mile. The beds consist of a body of loose, porous, light-yellow, and reddish sand, drifted to a considerable extent by the wind but having a generally level surface. Through this sand the river at normal stage winds in a comparatively narrow stream. In times of extreme drought the water fails altogether in Pease River, and above the North Fork the same is true of Red River. The water in both streams, but more especially in Pease River, is saline from the salt received from the gypsum beds through which it passes nearer its source.

The country lying between Pease River and the sand ridge to the north is covered mainly with a reddish-brown loam, and an extensive area of loam is also found in the southern part of the area surveyed. Covering the loam bluffs on the north bank of Pease River and extending for a few miles up Red River from its junction with the Pease is a sandy loam of much finer material than that seen to the south of Pease River. It is probable that this is a considerably older deposit. It is well developed at Red Bluff and upon the bluff at Doans Crossing, and is found only upon the highest elevations along the rivers. Underlying it at Red Bluff is a deposit of volcanic ash, the only exposure seen in the area. It is believed that this fine sandy loam is largely an æolian deposit, and is possibly more or less modified by the volcanic ash.

The only notable springs in the area are at Doans, in the northern

part of the sheet. This combined cluster of springs yields a stream about 6 inches wide, which persists throughout the year. The water from them does not reach the river as a surface stream, but sinks into the sands about a mile from its source.

With the exception of a few hackberry, China berry, elm, and stunted cottonwood trees growing along the more constant streams, the only forest growth in the county consists of mesquite trees, found usually upon the heavier loam and clay soils, where they appear generally in patches, sometimes covering a square mile or so, which from a distance look like fruit orchards.

SOILS.

The soils of the area have been classified into six different types, and are described in the following pages in the order of their areal importance.

Areas of different soils.

Soil.	Acres.	Percent.	Soil.	Acres.	Per cent.
Vernon loam	62,528	35.3	Vernon fine sandy loam....	5,248	3.0
Vernon sand	56,448	31.8	Vernon silt loam	2,880	1.6
Vernon sandy loam	30,592	17.3	Total	177,152
Vernon clay	19,456	11.0			

VERNON LOAM.

This soil to a depth of 12 inches is a fine-grained reddish-brown to dark-brown loam. It is mellow and friable, works up easily in the field, and does not clod. The subsoil, extending to a depth of 36 inches, is a light reddish-brown loam, considerably heavier in texture than the overlying soil. It at times contains lime in the form of concretions, and when this is present the subsoil is grayish in color and somewhat sticky in consistency. At from 3 to 6 feet it is underlain by red clay.

There is some variation in the surface soil of this type. About 2 miles northeast of Vernon, near the north bank of the Pease River, there is an area over which the soil is unusually dark in color and more clayey than in the typical section. This phase of the soil shows a tendency to clod to some extent and is not as easily worked as the true type. Farther down the river and lying adjacent to the Vernon fine sandy loam the soil grows decidedly lighter in color and is looser in structure, partaking somewhat of the qualities of the sandy loam.

The greater part of the area of this soil lies to the southeast and east of Vernon. A quite large extent of it is also to be seen to the north of Vernon, lying between Pease River and the areas of Vernon sandy loam.

The Vernon loam occupies the more level and slightly rolling portions of the prairie upland. The contour is always smooth and even

and presents no abrupt outlines. At the margins of the areas, where contact is made with the Vernon clay, however, there is sometimes seen an abrupt scarp or "break" where the upper 6 to 10 feet of surface has been eroded away, leaving exposed the underlying clay. The streams of the newly forming drainage systems on this type have steep-cut banks and exhibit the arroyo form of erosion so often seen in arid countries. In elevation this type occupies a position next above the Vernon sandy loam and lower than the upland phase of the Vernon sand.

For the most part this soil needs no artificial drainage, though occasional flat or slightly depressed spots are found where drainage would prove of great benefit.

The soil is derived, as are all the soils of the county, from the weathering of the Red Beds of the Permian formation.

Corn, wheat, oats, Kafir corn, and sorghum are the principal crops grown upon the Vernon loam. It is essentially a wheat soil, and is so recognized. When the rainfall is sufficient the yield is from 25 to 40 bushels to the acre, the former being about the average. Comparatively little cotton is grown upon this type of soil.

The Vernon loam seems to be better adapted to the production of wheat than to any other crop so far tried. The uncertainty of securing seasonable rain in the spring, however, makes even this speculative. Several experiments with macaroni wheat are being made in the area, and if as good results are secured in these trials as have met the introduction of this drought-resisting grain in other semiarid regions there is promise of the development of a profitable industry in the Panhandle section of Texas.

The following table gives mechanical analyses of typical samples of this soil:

Mechanical analyses of Vernon loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
7743	3½ miles NW. of Vernon.	Fine dark-brown loam, 0 to 10 inches.	1.54	0.02	0.34	0.76	2.12	12.78	74.78	9.20
7745	3¼ miles SE. of Vernon.	Friable, fine brown loam, 0 to 14 inches.	1.23	.12	1.98	2.16	4.84	16.64	64.34	9.70
7746	Subsoil of 7745.....	Fine reddish-brown to yellow loam, 14 to 36 inches.	.78	.32	1.78	1.76	4.18	14.46	64.82	12.22
7744	Subsoil of 7743.....	Heavy loam containing much clay, 10 to 24 inches.	1.00	.06	.32	.84	2.50	11.08	71.24	13.96

VERNON SAND.

The Vernon sand consists of a loose, incoherent sand of medium texture and a depth of about 18 inches. The river-flat phase sometimes contains a little silty material. The upland phase is at times slightly sticky, probably from the presence of lime carbonate. The grains of this sand are all pretty well rounded. No gravel is present. In color it ranges from a yellow in its least typical phase to a reddish brown, where on the upland it contains some organic matter. The subsoil of the river-flat phase is usually somewhat looser and coarser than the soil, at a depth of 3 feet becoming quite incoherent, while in the case of the upland phase it is generally considerably finer in texture and not uncommonly contains sufficient lime carbonate to make it somewhat plastic and grayish in color. The lime seldom takes the form of concretions.

The most extensive development of the upland phase of the type is found in the northern part of the area, where it occurs as a high ridge 8 miles long by 5 miles wide. To the west and north it continues out of the area to an undetermined distance. South of Pease River a corresponding ridge of Vernon sand extends nearly throughout the area in a line parallel to the river, though the continuity of its eastern extremity is broken.

The lowland or river-flat phase of the type is found bordering both Pease and Red rivers throughout nearly their whole length. Along the Pease it has an average width of about one-half mile on each side, while along the Red River, near Doans, it reaches a width of $2\frac{1}{2}$ miles and extends in one unbroken strip from that point south for a distance of about 9 miles to Red Bluff.

The upland phase occurs as a high, rather abrupt ridge or table-land, and the contour is, especially at the northern part of the sheet, generally hummocky and dunelike. It here occupies the highest elevation in the county. The ridge lying south of Pease River is smoother in outline, but is still more hilly and wavy than the loam soils of the prairie upland. The river-flat phase occupies a position usually from 3 to 6 feet above the rivers, and is level, save for the low dunes which have been piled up on its surface by the winds. These range from 2 to 10 feet in height and are generally covered with a scanty growth of grasses.

The upland areas of this soil are always well drained. That part of the type which occurs at the river level is sometimes, though not often, flooded, but the water table is rather too near the surface for most crops. Local spots in this phase have had enough silt deposited upon them at times of high water to constitute a different soil type, though with a subsoil similar to that of the Vernon sand. Not much of this low-lying phase can be artificially drained.

The soil of the upland phase was probably formed before the rivers

had reached their present levels and at a time when a very wide river or estuary covered what now exists as the loam upland. The disintegrated material derived from the underlying sand rock was washed up along the shores and carried inland by the winds. In the same manner the Vernon sand lying contiguous to the present rivers is being left behind by the recession of the streams, and is being constantly drifted and piled into dunes by the wind.

Upon the upland phase nearly all the ordinary farm crops are grown, though the principal ones are Kafir corn, sorghum, and cotton. Under the most favorable conditions cotton produces as high as 1½ bales to the acre, though, owing to uncertain seasons, one-half bale is much nearer the average. Excellent stands of corn and Kafir corn are seen growing upon this type, even in quite dry seasons. Some wheat is grown, but the quantity is comparatively insignificant. Apples, peaches, and melons do well on this soil. The greater proportion of the type is used for pasture land, and is covered with a growth of native grasses. The lowland phase of the type is used for little else than pasturage, and is for the most part not adapted to agricultural purposes.

The upland phase of the Vernon sand is well adapted to the culture of cotton and fruit, and during seasons of sufficient rainfall should prove an excellent soil for early truck crops, melons, etc.

The following table gives mechanical analyses of typical samples of this soil:

Mechanical analyses of Vernon sand.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.06 mm.	Silt, 0.06 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
				P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
7755	1 mile E. of Doans.	Loose, incoherent, medium to fine yellow sand, 0 to 18 inches.	.23	0.00	0.90	8.50	57.70	26.82	4.18	1.30
7753	6 miles SW. of Vernon.	Loose, incoherent, medium reddish yellow sand, 0 to 22 inches.	.45	.02	7.38	24.96	45.26	13.44	5.36	3.58
7751	7½ miles SW. of Doans.	Loose, incoherent, medium yellowish red sand, 0 to 26 inches.	.69	.32	5.50	13.40	35.58	23.60	14.42	7.18
7756	Subsoil of 7755.....	Loose, incoherent fine sand, 18 to 36 inches.	.16	.00	.84	7.40	60.30	27.66	1.88	1.26
7752	Subsoil of 7751.....	Medium to fine yellowish red sand, 26 to 40 inches.	.40	.10	4.48	11.16	30.08	24.88	21.16	8.14
7754	Subsoil of 7753.....	Sticky, medium reddish yellow sand, 22 to 36 inches.	.42	.20	5.76	18.98	46.78	12.92	10.60	9.76

VERNON SANDY LOAM.

The Vernon sandy loam is a dark red to reddish brown sandy loam, having a depth varying from 12 to 18 inches. While the mechanical analyses show it to be rather fine in texture, the presence of a considerable number of quite coarse quartz grains makes the soil appear coarser in texture than is actually the case. The soil is mellow, friable, and easily worked. The subsoil down to a depth of 36 inches grows gradually heavier in texture. The color varies from a red to a brown, and at times is slightly gray at 36 inches. This grayish color is probably due to the presence of a small amount of lime carbonate, which also gives the subsoil a sticky consistency. At a depth of 6 feet a small amount of waterworn gravel is sometimes seen. This is not always present, and the stratum is so thin and the gravel so much scattered that it exerts little influence upon the water-carrying capacity of the soil. The soil, taken as a whole, is quite retentive of moisture, and crops grown upon it withstand drought well.

The Vernon sandy loam reaches its highest development along the south side of Pease River, where it forms a continuous strip entirely across the area surveyed. Little of this type is seen on the immediate north bank of the river, though a considerable area of it is found bordering the upland sand hills farther north. If the sand hills be sloping, the Vernon sand and Vernon sandy loam are often found to grade imperceptibly into each other, forming a zone half a mile or so wide over which the soil partakes somewhat of the characteristics of both types. A few areas of the Vernon sandy loam occur in isolated patches in depressions on the sand hills to the south of the river.

In the Pease Valley the soil is found at an elevation intermediate between the river level and the prairie upland, and the greater proportion of that part of it which lies along the river to the east of Vernon occupies a pretty well defined bench or terrace, though at one or two places the type encroaches upon the lower level. The area of the soil found in the northern part of the survey occupies a higher elevation, resting upon the loam upland just below the sand hills.

The soil is generally well drained, lying in a sloping position, as a rule, and having few depressions in it. The subsoil is more or less porous and allows of the ready percolation of the excess surface water. Artificial drainage is seldom necessary.

In the Pease River Valley the soil was formed when the river was much wider than at present, and is probably largely alluvial in origin, the sands being deposited along the river's edge and drifted inland by the wind and there mixed with the heavier Vernon loam. In other parts of the area it was formed, and is still being formed, by the washing of the Vernon sand down over the lower-lying loam, resulting in the intermixture of the materials of different texture.

While the yield per acre of wheat does not amount to as much on

this type as on the heavier Vernon loam, yet with the uncertain seasons the crop is surer. Corn, Kafir corn, and cotton yield well, and with sufficient rainfall the latter will reach a bale to the acre in some cases. Oats are very successfully grown upon this type, yields of 65 to 80 bushels having been secured, though 40 bushels is about an average crop under good conditions.

This type of soil is generally considered to be very drought resistant and is adapted to the growth of almost any of the ordinary farm crops. It is also a good soil for potatoes and other vegetables and for melons. There should be little trouble in growing alfalfa successfully.

The following table gives mechanical analyses of typical samples of this soil:

Mechanical analyses of Vernon sandy loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
7757	3½ miles SW. of Doans.	Medium reddish-brown sandy loam, 0 to 15 inches.	0.77	0.24	8.84	17.78	25.38	22.56	13.22	11.20
7759	5¼ miles NE. of Vernon.	Fine sandy loam, 0 to 24 inches.	.60	.10	1.26	3.04	10.64	53.14	20.46	11.20
7760	Subsoil of 7759.....	Fine red sandy loam, 24 to 36 inches.	.22	.00	1.24	3.04	12.10	41.92	28.32	12.86
7758	Subsoil of 7757.....	Medium to fine, sticky sandy loam, 15 to 36 inches.	.27	.40	7.70	15.30	22.90	19.30	16.38	17.40

VERNON CLAY.

The surface soil of the Vernon clay is a red clay or heavy clay loam with a depth of about 9 inches, in some localities containing a small percentage of rounded quartz gravel. In the eroded depressions the soil contains little organic matter, as with every rain it is subjected to the flood wash of the underlying basal clay, and can hardly be considered a soil in the ordinary sense of the term. The subsoil is a heavy, sticky red clay, extending to an undetermined depth. It often contains waterworn gravel in which a precipitate of gypsum is not uncommonly found. The gravel varies in size up to 3 or 4 inches in diameter, and mixed with this are occasional pieces of silicified wood. Interstratified with the red clay underlying this type of soil are occasional bands of red arenaceous shale.

The largest and most continuous body of this type found during the present survey is in the southeastern part of the area. North of Pease River and to the south of Tolbert a quite extensive area of it also occurs.

The type is best represented in the first-mentioned locality, where it occurs as broken and eroded depressions in the prairie, with intervening long sloping hillsides covered with a growth of mesquite trees and curly mesquite grass. At this place it occupies a position just to the south of the divide between Beaver Creek and Pease River, and at the headwaters of the tributaries of the former stream. In other parts of the area it occupies erosion depressions at the sources and along the margins of newly forming stream courses. The landward margins of these depressions are irregular and varied in form, the faces of the walls are abrupt, from 3 to 10 feet high, and bare of vegetation, and the floors, which are usually flat, support a straggling growth of mesquite. The depressions are drained by narrow, deeply incised streamlets, carrying large quantities of the red clayey material down to the larger streams, and becoming dry in a few days after a rain. The barest portions of these areas, upon which no soil exists nor can exist, owing to the frequent washings which they receive from rains, are indicated upon the soil map by diagonal cross lines.

While the floors of these eroded areas are nearly level, they are so hard and smooth that the surface water runs off freely.

The Vernon clay is the underlying basal clay of the Vernon loam, and the soil type results for the most part from a denudation of the Vernon loam. Primarily the soil is derived from the Permian Red Beds.

The soil is very little used for anything except pasture, and because of the comparatively scanty vegetation a larger acreage per head of stock is required for range purposes than in the case of the Vernon loam.

In parts of the area where vegetation has secured some foothold, and there is in the soil sufficient organic matter, wheat might be grown advantageously in seasons of normal rainfall.

The following table gives mechanical analyses of typical samples of this soil:

Mechanical analyses of Vernon clay.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
7741	6½ miles SE. of Vernon.	Silty clay, 0 to 10 inches.	1.53	0.00	0.36	0.24	1.20	17.88	67.76	12.56
7742	Subsoil of 7741	Fine yellowish-red clay, 10 to 28 inches.	.69	.00	.64	.30	.84	8.50	72.20	17.10

VERNON FINE SANDY LOAM.

To a depth of about 22 inches the Vernon fine sandy loam is a fine brownish-red sand, carrying considerable silt. The individual particles appear much rounded, and in structure the soil is loose and mellow. It works up nicely in the field, and does not form clods nor bake. The subsoil is substantially the same as the soil, except that the color is usually a little lighter in the lower depths. Sometimes, however, the subsoil is somewhat darker and more loamy than the soil until a depth of 3 or 4 feet is reached. At depths of from 4 to 6 feet the material is generally a fine yellowish-red sand.

The type is found bordering the Red and Pease rivers, near their confluence, and extends inland from them for a distance of about half a mile. It occupies the bluffs along the rivers, and is rarely found below an elevation of 40 or 50 feet above their beds. At Doans a small area of it extends from the bluff down onto the bench lying just above the river flat. As a rule the surface is slightly rolling, allowing free drainage.

The soil is believed to be mainly æolian in origin, formed from the sands blown inland from the rivers during some period when their beds occupied a relatively higher position than at present.

Not much of this type is under cultivation, it being used principally for pasturage. This is one of the best soils of the area for wheat, corn, oats, cotton, and other farm crops. Fruit and vegetables would also do well upon it.

The following table gives mechanical analyses of typical samples of this soil:

Mechanical analyses of Vernon fine sandy loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.							
				Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.		
7737	6 miles NE. of Vernon.	Fine sandy loam, 0 to 24 inches.	P. ct. 0.79	P. ct. 0.00	P. ct. 0.68	P. ct. 0.50	P. ct. 2.64	P. ct. 46.74	P. ct. 42.14	P. ct. 6.72	
7739	2½ miles N. of Vernon.	Fine, mellow red sandy loam, 0 to 18 inches.	.71	.00	.22	.30	1.18	24.98	66.44	6.88	
7740	Subsoil of 7739.....	Finedark-redsandy loam, 18 to 36 inches.	.70	.00	.34	.42	1.84	25.21	64.40	7.64	
7738	Subsoil of 7737.....	Fine sandy loam, 24 to 36 inches.	.61	.30	.60	.40	2.48	44.14	41.78	9.82	

VERNON SILT LOAM.

The soil, as well as the subsoil, of the Vernon silt loam varies greatly, and ranges from a loose sandy loam to a loam of nearly the character

of clay. The most of the type, however, is a silt loam to a depth of about 10 inches, underlain by loose yellow sand. At irregular intervals through this sand are encountered thin, sticky bands of silt and clay.

The Vernon silt loam occurs along the Pease and Red rivers and forms but a small percentage of the total soil area mapped. It is found on the river flats, usually near the bluff line, and occupies depressions in the river-flat phase of the Vernon sand.

Owing to their position the drainage of the areas of the heavier phase of this soil would be difficult if attempted. They are wet for some time following rains, the surface being often too impervious to allow free percolation of water through it into the underlying sand.

This soil type is formed from the recently deposited river sediments dropped upon the older Vernon sand. The soil is covered by a rather scanty growth of coarse grasses, and is used only for pasturage. It has little agricultural value except, perhaps, in the case of the more sandy areas occurring near its contact with the Vernon sandy loam. These areas might be drained and made to produce corn and vegetables, and possibly alfalfa, in some localities.

The following table gives mechanical analyses of typical samples of this soil:

Mechanical analyses of Vernon silt loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.		Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.06 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
7749	5½ miles NE. of Vernon.	Fine sand to silt, 0 to 10 inches.	0.87	0.06	0.08	0.04	0.28	16.40	72.20	10.72	
7747	2 miles NW. of Vernon.	Rather sticky brown sandy loam, 0 to 10 inches.	1.63	.02	.48	1.82	8.10	37.70	40.46	11.32	
7748	Subsoil of 7747.....	Brown sandy loam to yellow sand, 10 to 36 inches.	.38	.00	.24	.76	4.40	45.44	40.36	8.26	
7750	Subsoil of 7749.....	Clay, silt, and sand, 10 to 20 inches.	.78	.06	1.14	3.18	11.10	14.92	53.46	16.06	

AGRICULTURAL METHODS.

Rotation of crops is not practiced to any great extent in the Vernon area, the desirability of systematic cropping not as yet having appealed to the farmer. Because of the fact that the rainfall and the attendant leaching away of plant food is so much less than in humid climates, rotation is perhaps not so essential, though to a certain extent it is

always desirable. The farms are easily cultivated, there being no stones or stumps and comparatively few soil washes, and seeding and harvesting are usually done upon a large scale, allowing the employment of the most improved and efficient labor-saving machinery. A great deal of wheat is drilled into stubble fields without previous plowing, harrowing, or other preparation of the soil. With the price of land ranging from \$5 to \$15 per acre, this method at present brings, perhaps, the largest returns for time and labor expended, but it is not to be commended, and as the country becomes more thickly settled and land dearer more intensive methods must prevail.

The greatest need of the country is irrigation, but water for that purpose, except on a very small scale, does not seem to be available. Underground water seems abundant and can be pumped from depths of from 20 to 40 feet. Small reservoirs might be built to catch the run-off from the hills, but the streams are dry during a considerable part of the year and would furnish an insufficient supply for irrigation purposes.

AGRICULTURAL CONDITIONS.

The people of Wilbarger County, in common with others of north-west Texas, while perhaps not as thrifty and provident as in some sections of the United States, are nevertheless energetic, industrious, and hopeful, and uncomplainingly make the best of what nature has to give them.

The element of uncertainty is proportionally larger in agricultural pursuits in this part of the State than in more humid regions. This is due not only to the absence at times of sufficient and seasonable rains, but also to the occasional disastrous hot winds of the late summer, which sometimes in a few hours almost totally destroy the crops. If, however, sufficient rains follow these winds, a partial crop is often secured before the advent of killing frosts. The native of the Texas Panhandle, however, if overtaken by crop failure, gets along as best he can and hopefully awaits better times. One of the pleasant features of this part of the country is the commendable spirit of social equality existing between people of widely differing wealth. Little account is taken of dollars if a man shows himself to be honest, self-supporting, and independent, and it is no doubt these conditions which have much to do with the contentedness of the people in general and the farmers in particular.

The population of the county is mainly agricultural. Vernon, the county seat, contains but about 2,000 inhabitants out of a total population for the county of about 6,000, and in Vernon live the only people who follow other than agricultural vocations. The other towns of the county are very small, consisting usually of only a store or two and a half dozen houses. The prosperity of the farming class is rather above that usually found in semiarid countries.

The majority of the farms in the county are worked by their owners, although a few are rented for a crop or money rental. The crop rent received is one-third of the corn or one-fourth of the cotton, while the money rental will average about 50 cents per acre.

The greater part of the land of the county originally sold in lots of one or more sections. Some of the ranchmen of the county have large holdings. One individual owns several hundred thousand acres in the southern and eastern part of the county, and others engaged in cattle raising have ranges of several sections. The average size of farms at present is thought to be about 320 acres.

Farm laborers are fairly abundant and to be had at wages of \$1 a day, but during harvest time they receive more. In more permanent employment they receive \$20 a month, with board. Cowboys upon the ranches receive from \$35 to \$40 per month, with board.

While cattle raising is still carried on to a considerable extent, the price of land is becoming too high to make this a profitable industry under natural conditions, i. e., raising the cattle from the calf to maturity with little or no feed except that secured from the native prairie grasses. At present the majority of the farmers are engaged in general agriculture. Of the ordinary farm crops, small grain is found best adapted to the soils of the area, and is given the greatest acreage. In favorable years wheat and oats give large yields, and even in excessively dry seasons from 4 to 6 bushels of wheat are harvested from an acre, so that there is almost never a complete crop failure. Little corn is grown, though considerable Kafir corn and sorghum are sown for feed. Part of this is harvested with binders, and to a part of it the cattle are allowed to run at will, a difference of opinion prevailing as to the relative economy of the two methods of feeding.

Within the last three or four years cotton has begun to be cultivated in the county, and this crop is fast coming to be one of the staples. It does very well upon the sandier soils, giving a yield of from one-half to one bale or more to the acre. Watermelons and cantaloupes are grown very successfully in the area, and these products have a good reputation in the markets of the East.

It is generally recognized that the sandy soils are the more suitable for cotton culture, as well as for fruit, melons, etc., and that, given sufficient rain, wheat gives the largest yields upon the heavier loam.

Transportation facilities in the area are furnished by the Fort Worth and Denver City Railway, which passes through the northern part of the county, and by the Blackwell, Enid and Southwestern Railway, which connects Vernon with Oklahoma points. The former line affords direct connection with Fort Worth and southeast Texas in one direction and with Denver and important Colorado points in the other. Neither the Red River nor the Pease River is a navigable stream. The majority of the wagon roads of the county are good, though but little

is done to keep them in repair. Upon the sandy soils they are unavoidably soft, and upon the loam soils they are at times, during unusual rainfall, almost impassable. A little intelligent drainage would put many dollars in the pockets of the farmers who are compelled to haul loads over these roads. Pease River is so wide, the sands are so treacherous, and the currents so shifting, that a bridge is maintained only at great expense. Two iron structures have been washed out during the last few years, and at present the stream is forded during the greater part of the year, no travel from one side to the other being possible when the water is high. Red River is forded at different points in the same manner, greater stability being given to the dangerous quicksands of both rivers by the building and frequent renewal of straw roads across them.

The city of Vernon affords a limited market for such general farm produce, vegetables, etc., as is offered, while the more staple and largely grown products, cotton, cereals, beef, etc., reach the Eastern and Northern markets through Fort Worth, 163 miles distant by rail.

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