

SOIL SURVEY OF THE AUSTIN AREA, TEXAS.

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LOCATION AND BOUNDARIES OF THE AREA.

The Austin area comprises a rectangular section of 705 square miles. The greater part of Travis County and parts of Williamson,

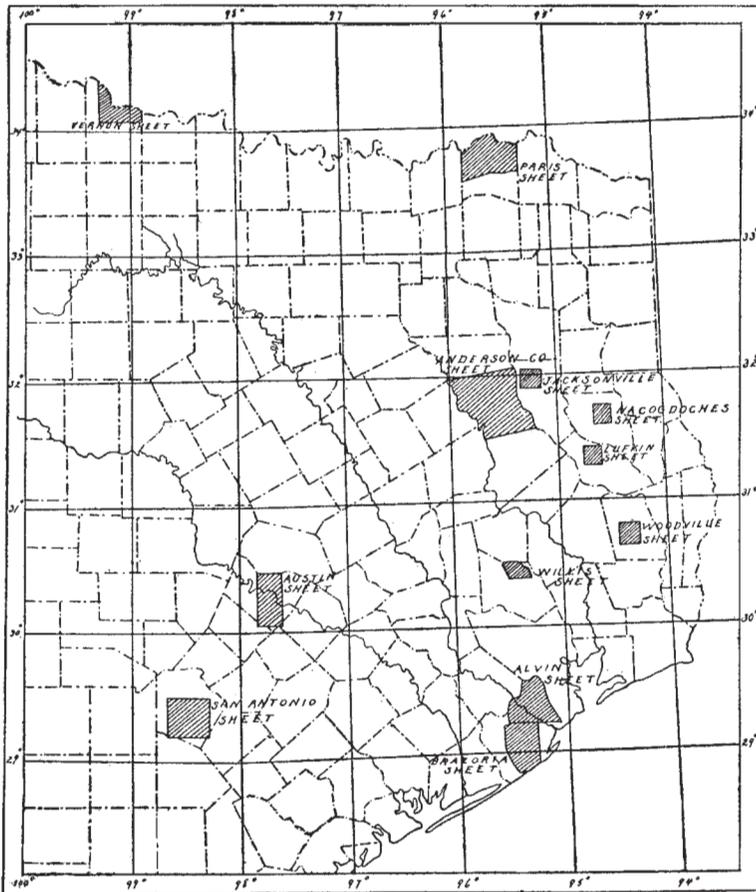


FIG. 17.—Sketch map showing location of the Austin area, Texas.

Bastrop, Caldwell, and Hays counties are included in the survey. The area is located southeast of the center of the State and embraces the eastern two-thirds of the Austin sheet, United States Geological

Survey. It is bounded by parallels 30° and $30^{\circ} 30'$ N. and meridians $97^{\circ} 30'$ and $97^{\circ} 50'$ W.

HISTORY OF SETTLEMENT AND AGRICULTURAL DEVELOPMENT.

The first settlement in the area was made about 1836 and was planted by a few pioneers who had pushed forward to the extreme frontier. In 1839 the Texan congress appointed five commissioners to select a site for the capital of the Republic of Texas. They chose the location of the present city of Austin, on the Colorado River. At that time this was the northwest frontier of that part of Texas settled by the whites, the country north and west being still in the possession of the Indians. The nearest settlements of any size were Bastrop on the east and San Antonio to the southwest.

The capital was thus located with a view to drawing at once to the frontier a population large enough to serve as a protection against probable attacks by the Indians. A large settlement was soon established, and the country in the immediate vicinity of Austin was rapidly occupied, small areas of land being put under cultivation. In 1850 the population numbered 2,336, but a comparatively small amount of land was cultivated, as those who were not connected with the affairs of government or had no business interest in the town were engaged chiefly in stock raising, the broad prairies, covered with native grasses, and the mild climate being well suited to this industry.

Cotton was grown in small quantities very soon after the area was settled, but lack of transportation facilities and distance from markets prevented extensive cultivation, and only a very small acreage was devoted to its production. In 1858 the total white population was 8,386, an increase of 6,050 in eight years. Property values had also risen rapidly, improved lands being valued at from \$5 to \$100 and unimproved lands at from \$2 to \$25 an acre. Cotton and corn were the crops cultivated, with a small acreage of wheat and oats.

Although the number of cattle in the area increased in the eight years following 1850 only from 12,000 to 17,000, the rise in land values and the large increase of population indicate an increased area of cultivated land. Among the settlers were a few Swedes, who located on the black prairie lands east of Austin and are now among the most prosperous farmers in the area.

The cultivation of cotton soon began to receive more attention, and the acreage devoted to the crop gradually increased. In 1859 patent reapers were coming into general use in the harvesting of wheat and oats, and there was a demand for farm labor at good prices. As the cultivation of cotton and grain grew in importance the amount of land devoted to grazing purposes rapidly decreased, and the cattle

industry began to die out, the black prairie lands being too valuable agriculturally to be used as cattle ranges. However, the rough, hilly section west of Austin was still devoted exclusively to stock raising, as it was but poorly suited to cultivated crops.

In 1871 the Houston and Texas Central Railroad reached Austin, and five years later the International and Great Northern entered the city. In 1904 the Missouri, Kansas and Texas Railroad extended a branch line to Austin. The facilities furnished by the railroads for transporting products early made Austin a center of trade for the surrounding country. As the productiveness of the soil and the mildness of the climate became more widely known, large numbers of settlers and home seekers came to the area from the more northern and eastern States.

The area is purely an agricultural section, there being no manufacturing industries of importance. A dam constructed in 1893 across the Colorado River above Austin, for the purpose of furnishing water power for manufacturing, as well as to irrigate the level bottom lands along the river, was destroyed by flood in 1900.

The agricultural interests of the area have gradually become centered in the production of cotton, almost to the exclusion of all other crops, and although small areas cultivated to corn, wheat, oats, sorghum, Johnson grass, or vegetables are often seen, the conditions seem most favorable to the successful specialization of cotton.

CLIMATE.

The climate of the Austin area is mild and healthful. Warm weather begins early in March and lasts until November. The oppressiveness of the summer heat is to some extent counteracted by the south winds which prevail during most of the year. These serve to equalize the temperature, making the winters warmer and the summers cooler.

During January and February sudden changes of temperature are frequently experienced, caused by north or northwest winds, locally known as "northers." These come down across the Great Plains and often cause the temperature to fall many degrees in a very short time. The ground very seldom freezes at all, and then only on the surface. There is no season of the year at which conditions are such as to interfere with plowing.

There is usually sufficient rainfall for the production of the crops grown, although they often suffer greatly from droughts in the summer months. The normal monthly and annual temperature and precipitation, as observed at Austin and Duval, are shown in the table on the following page, taken from records of the Weather Bureau.

Normal monthly and annual temperature and precipitation.

Month.	Austin.		Duval.		Month.	Austin.		Duval.	
	Tem- pera- ture.	Precipi- tation.	Tem- pera- ture.	Precipi- tation.		Tem- pera- ture.	Precipi- tation.	Tem- pera- ture.	Precipi- tation.
	<i>° F.</i>	<i>Inches.</i>	<i>° F.</i>	<i>Inches.</i>		<i>° F.</i>	<i>Inches.</i>	<i>° F.</i>	<i>Inches.</i>
January	48.7	2.47	50.6	2.00	August	84.1	2.43	85.2	1.88
February	52.7	1.88	53.8	1.39	September	78.6	3.72	79.7	2.88
March	60.2	2.22	61.4	1.94	October	69.3	2.77	70.6	3.01
April	69.0	4.05	69.4	4.05	November	59.0	2.26	60.0	2.32
May	76.5	4.40	76.2	3.77	December	52.2	2.70	53.3	2.28
June	82.2	2.51	83.3	2.75	Year	68.1	33.71	69.1	30.17
July	85.1	2.30	85.9	1.90					

PHYSIOGRAPHY AND GEOLOGY.

There is a great topographic difference between the northwestern portion of the area and the eastern four-fifths. The latter section lies wholly in the black prairie belt, except for a small area in the southeastern corner which is crossed by the east Texas timber belt. A hilly region extends across the area just west of Austin, following a northeast and southwest direction. This section presents a rough and broken topography, the hills rising in a series of terraces, in places almost bare of soil or vegetation, to an elevation of 900 to 1,000 feet above sea level. Small streams which are dry part of the year have eroded deep, canyonlike erosions in the valleys between the hills. The hills are quite uniform as to height, and are flat or gently rounded on the summit of the last terrace. Cedar, with a few small areas of scrub oak, is the principal growth of this section. To the northeast and southwest of the hills are two small plateaus of a less rugged character. They have an elevation of about 800 feet above sea level, and are cut by numerous deep canyons. The hill-sides are steep and rocky, but are covered with a thick growth of post oak, scrub oak, and cedar.

Beginning abruptly at the foot of the hilly region the black prairie belt stretches to the eastward. This consists of a gently rolling prairie with low, rounded hills, having the general appearance of a level plain. The valleys are wide and shallow, except along the course of the larger creeks, which in many places have cut deep gorges with perpendicular bluffs of limestone or calcareous clays that often rise to a height of 30 or 40 feet above stream level. The average elevation of the prairie is about 600 feet above sea level, a few ridges in the northeastern and southwestern portions rising to 700 feet, while the lowest point, where the Colorado River leaves the area, is 375 feet above tide level. The entire area, with the exception

of small portions along the northern and southern boundaries, is drained by the Colorado River, which flows through it in a southeasterly direction. Onion Creek, its main tributary within the area, drains almost the entire southwestern portion, while Cedar, Walnut, and Gilleland creeks serve to carry the excess water of the remainder of the area to the Colorado River. These streams, unlike the river, have very small areas of bottom lands along their courses. They generally flow between steep, perpendicular limestone or marl clay bluffs, which seldom widen out sufficiently to permit alluvial deposition to any great extent. The bottom lands along the river are wide and level, extending some distance from each bank, and are among the most productive lands of the area.

The geological formations which underlie the greater proportion of the area, and which form, by their disintegration, a number of the soil types, belong to the Montana, Colorado, Fredericksburg, and Trinity divisions of the Cretaceous period. The hilly region west of Austin is composed of alternate layers of hard and soft limestone, together with layers of a shaly formation containing many fossils and alternating with a marly material. The difference in the weathering of the hard and soft material causes the terraced appearance of the hills. These belong to the Glenrose formation of the Trinity division. The topography of the area covered by this formation is so steep and rugged as to render it unfit for agricultural purposes. Only a thin layer of soil is present on the more level ridges, and this is of a very stony character.

The small plateaus northeast and southwest of the hills are underlain by the Edwards limestone of the Fredericksburg division, which consists of a series of beds of hard white limestone and flint. The surface has a large amount of flint and limestone fragments scattered over it. The latter are known as honeycombed rocks, as the limestone, originally composed of both hard and soft material, upon the dissolution of the soft spots presents a honeycombed appearance. Iron is present in small amounts, giving a reddish tinge to the soils formed by its disintegration. The limestone burned at the limekilns near McNeil is also derived from this formation.

East of the Glenrose and Edwards formations and extending both north and south of the city of Austin is a wide belt of country formed from a soft, chalky fossiliferous limestone lying in horizontal layers of varying thickness. This is known as the Austin chalk formation, and is included in the Colorado division of the Gulf series of the Upper Cretaceous. It weathers into a soft, chalky mass that lies at a slight depth below a shallow covering of soil, and is frequently exposed at the tops of the rounded hills and along their steeper slopes.

The level black prairie belt which extends across the eastern part of the area is derived from the Webberville and Taylor marl formations. They belong to the Montana division of the Upper Cretaceous, are composed of beds of calcareous clays and clay marls, and weather into a heavy black soil, very easily eroded. These formations are of great thickness, being estimated to be over 500 feet deep.

In the extreme southeastern corner of the area the sandstone, sand, and laminated red and brown clays, formed from the Lytton formation of the Eocene period, are found. The sandstone occurs in thin layers, and usually takes a reddish tinge when in a state of decomposition.

The higher ridges in the black prairie belt are often capped by a gravel deposit, which in many cases is deep enough to interfere with the agricultural value of the land. These are remnants of the Uvalde gravel deposits, which once covered a much larger territory. This formation is of the Neocene period. The gravel is rounded, and varies in size from small pebbles to cobbles several inches in diameter. Where this gravel deposit has worn down to the underlying clay formation the land is often very successfully cultivated, although the layer of gravel on the surface makes the soil very gravelly. The gravel is usually deepest on the summits of the ridges, often making them less suitable for cultivation than for pasture.

The gravelly areas on the bluffs and rounded hills in the vicinity of the river are composed of material of still more recent time, which was deposited by the river as terraces. Southeast of Austin, in the midst of the black prairie lands, are the remains of an ancient volcano. It rises a hundred feet or more above the surrounding plain, and is covered with fragments of basalt of various sizes, scattered over the surface and imbedded in a stiff, reddish-brown clay soil.

Very few of the above formations have at present any economic value. Some of the harder varieties of limestone are being extensively used for building purposes, but few of them are of a durable character. The fine alluvial deposits along the Colorado River are being used in the manufacture of brick. Although a number of borings for oil and asphaltum have been made in the northern part of the area with varying results, nothing has been obtained in paying quantities up to the present time.

SOILS.

Nine types of soil were mapped in the area. Three are alluvial, the other six being formed directly from the underlying rock formations. The table following gives the extent of each type.

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Houston black clay	190,400	42.2	Lufkin fine sandy loam	24,640	5.5
Austin clay	61,440	13.6	Travis gravelly loam.....	13,312	3.0
Colton stony clay	56,256	12.5	Yazoo clay	11,840	2.6
Houston gravelly clay	36,672	8.1	Yakima stony clay.....	896	.2
Yazoo sandy loam.....	30,336	6.7	Total	451,200	-----
Rock outcrop	25,408	5.5			

HOUSTON BLACK CLAY.

The Houston black clay is the typical black prairie soil of the Austin area. Its gently rolling topography, natural productiveness, excellent drainage, and general adaptability to all crops grown make it the most important soil type recognized in the area. The soil to a depth of 12 inches is a dark-brown to black clay, containing a large amount of organic matter. When it has been continuously cultivated for some years the soil becomes loose and friable, but when wet it is very stiff and tenacious. The subsoil from 12 to 36 inches is a stiff, tenacious light-brown clay. This becomes stiffer and slightly lighter in color as the depth increases. When in a dry condition large cracks are frequently seen in the soil, and if plowed when wet it bakes into very hard clods.

The Houston black clay extends in a southwesterly direction from the northeastern corner to the extreme southwestern part of the area, and this belt is only broken by the alluvial deposits of the Colorado River, which crosses near its center. It also occurs in smaller areas in all sections of the area surveyed east of the hilly portion.

The topography of the country embraced by this soil type is gently rolling. The hills are low and rounded, with wide, shallow valleys between them. The average elevation of this prairie section is about 600 feet above sea level, the highest ridges having an altitude of 675 to 700 feet. Many small streams flow through this prairie, furnishing excellent drainage for the rolling uplands. The small streams in this formation differ from those in other sections of the area in having gently sloping banks instead of flowing in deep, canyonlike gorges between perpendicular limestone walls. Very few, however, are perennial, the majority being dry most of the year.

The Houston black clay is a residual soil, and is derived from a series of calcareous clays and marls, which underlie the type to a great depth. These clay deposits are known as the Webberville and Taylor marl formations, and are light brown in color before weathering into a stiff, black prairie soil.

In many places small areas are encountered which have small, rounded gravel, one-eighth of an inch to 3 inches in diameter, scattered over the surface. These are the remains of an old gravel bed which once overlay a large proportion of this clay formation, but the areas are too few and the amount of gravel too small to affect the value of the sections where they exist.

Other small areas, known locally as "gall spots," occur at intervals in the area covered by this type. Cotton and fruit trees are the plants affected by these spots, and these suffer more during a wet than a dry season. These areas are never of great extent, and are not due to the presence of alkali, as is generally supposed.

Under ordinary conditions large yields of all the crops cultivated in the area are obtained from this soil. Cotton averages about one-half to three-fourths of a bale per acre when free from the boll weevil, but during the present season an average yield of about one-fourth of a bale per acre was realized. When well cultivated, much larger yields per acre have frequently been obtained. Corn produces on an average from 20 to 25 bushels per acre, much larger yields being obtained during a wet season, when the crop is not affected by the usual summer drought. Sorghum cane is extensively cultivated, and crops of 2 to 3 tons per acre are usually obtained, 1 to 3 cuttings each season being made. Oats are not extensively grown, and are seldom thrashed out, being produced mainly for feeding purposes, but 25 to 30 bushels per acre is considered a fair estimate of the yield of this crop.

With an average amount of rainfall during the spring months, good yields of all the crops grown are obtained on this soil, the stiff clay subsoil enabling it to withstand the hot, dry summers much better than any of the other upland types.

Potatoes and garden truck are extensively grown for home use, but no effort has been made to grow these crops on a large scale for the markets.

Limited experiments indicate that alfalfa can be grown on this soil as well as on the river bottoms, although more care is necessary in the beginning in order to get a stand.

The Houston black clay is valued at from \$35 to \$60 an acre, according to its location.

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

Mechanical analyses of Houston black clay.

No.	Locality.	Description.	Gravel, 2 to 1	Coarse sand, 1	Medium sand,	Fine sand, 0.25	Very fine sand,	Silt, 0.05 to 0.005	Clay, 0.005 to
			mm.	to 0.5 mm.	0.5 to 0.25 mm.	to 0.1 mm.	0.1 to 0.05 mm.	mm.	0.001 mm.
			P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
10437	½ mile E. of Creedmoor.	Stiff clay, 0 to 10 inches ..	0.7	0.8	0.7	2.7	4.7	52.2	38.1
10439	1 mile E. of Manor ..	Dark clay, 0 to 12 inches ..	.6	1.5	1.0	3.7	6.8	46.3	40.0
10441	½ mile N. of Delvalle.	Clay, 0 to 12 inches	1.2	2.7	2.3	5.0	7.5	40.4	40.7
10440	Subsoil of 10439	Brown stiff clay, 12 to 36 inches.	.9	1.4	.9	3.8	5.8	49.4	37.6
10438	Subsoil of 10437	Brown stiff clay, 10 to 36 inches.	.4	.6	.5	1.6	4.1	53.0	39.7
10442	Subsoil of 10441	Dark stiff clay, 12 to 36 inches.	1.2	3.5	3.1	5.1	8.7	33.3	45.0

The following samples contained more than one-half per cent of calcium carbonate (CaCO_3): No. 10437, 1.5 per cent; No. 10438, 3.7 per cent; No. 10439, 17.5 per cent; No. 10440, 28.7 per cent; No. 10441, 11.1 per cent; No. 10442, 14.6 per cent.

HOUSTON GRAVELLY CLAY.

The Houston gravelly clay occupies a total area of about 55 square miles and occurs on the higher ridges of the rolling prairie, mostly in the southern portion of the area. The soil is a heavy dark-brown to black clay loam or clay, 0 to 12 inches deep, and contains a large amount of gravel and rounded, waterworn pebbles. These vary in size from one-eighth of an inch to 3 inches in diameter, and are scattered on the surface and embedded in the soil. The subsoil is a stiff clay of a light-brown color, which becomes stiffer as the depth increases. This contains a smaller percentage of the rounded gravel and pebbles. Occurring, as it does, only on the higher ridges, the soil is easily eroded, the clay loam being washed down into the valleys at times of heavy rainfall, leaving the gravel exposed on the surface.

The Houston gravelly clay is derived from the remains of an old gravel formation, which once rested above the clay formation underlying the rolling prairie lands. This gravel deposit has been almost entirely worn away, leaving a thin layer capping the higher ridges. This formation has become mixed with the underlying clay, forming a stiff, heavy clay loam, which contains a large percentage of gravel and rounded pebbles.

A comparatively large part of this type is under cultivation and is considered good farming land. Its worst feature is the damage necessarily incurred by farming machinery in cultivating it. A few of the highest ridges, where the gravel is deepest, are not cultivated at present. Here the soil has been eroded, leaving a deeper layer of gravel on the surface than occurs on the hillsides. These ridges are fenced off into pasture lands, and as they support a good growth of

mesquite and native grasses they are well suited for grazing purposes. The crops cultivated and the average yields are as follows: Cotton, with the usual amount of preparation of soil and cultivation of crop, yields one-fourth to one-third bale per acre. Where better methods have been used and a more thorough cultivation practiced, one-half to three-fourths bale per acre has been continuously obtained. Corn yields from 20 to 25 bushels per acre, and, as is the case with this crop on the other types, it produces larger yields in a wet season. Oats yield from 30 to 40 bushels per acre when not affected by "rust," which often does great damage to this crop. Only about one-half of the oats crop is thrashed, the remainder being used as hay. Wheat is not extensively cultivated, but is often used as pasturage for sheep during the winter months. It is then cut and fed to stock. Sorghum is extensively grown, and three cuttings are usually obtained. The crop averages about 2 tons per acre. Kafir corn is also cultivated for feeding purposes with good results.

This type of soil suffers no more from the summer droughts than the other upland types, the stiff clay subsoil enabling it to preserve enough moisture for the maturing of the crops grown, although its topography and the gravelly character of the soil cause it to be more thoroughly drained than the stiffer soils on the more level prairies.

The following table shows the results of mechanical analyses of the fine earth of both soil and subsoil of this type:

Mechanical analyses of Houston gravelly clay.

No.	Locality.	Description.	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>
10443	3 miles E. of Evelyn.	Black heavy loam, 0 to 12 inches.	0.3	0.4	0.5	2.3	8.5	48.2	39.6
10445	2 miles N. of Delvalle.	Heavy clay loam, 0 to 12 inches.	1.2	3.3	4.3	10.1	7.3	32.0	41.6
10446	Subsoil of 10445.....	Brown stiff clay, 12 to 36 inches.	2.1	3.8	4.0	8.4	8.9	35.1	37.7
10444	Subsoil of 10443.....	Dark stiff clay, 12 to 36 inches.	.7	.6	.4	2.0	7.6	48.4	40.4

The following samples contained more than one-half per cent of calcium carbonate (CaCO_3): No. 10444, 0.8 per cent; No. 10445, 0.8 per cent; No. 10446, 0.7 per cent.

AUSTIN CLAY.

Among the upland soils, the Austin clay ranks next to the Houston black clay in agricultural value. Having very similar topographic features, and being well drained and easily cultivated, it is often valued as highly as the stiffer clay soil. The soil to an average

depth of 10 inches is a dark-brown to black loam, containing a large percentage of silt and clay. When wet it becomes stiff and tenacious, and, like the heavier clay soil, has a tendency to form into hard, brick-like clods if plowed in this condition. Small particles of partially disintegrated limestone are usually present on the surface and in the soil.

The subsoil is a dark-brown stiff clay, which immediately becomes lighter in color and more silty as depth increases, grading at 25 to 30 inches into a white silty material composed of soft, chalky limestone. This chalky material can be easily crushed between the fingers, and often extends for several feet below the surface before it becomes hard enough to offer any resistance to the roots of plants. The largest unbroken area of this type occurs northeast of Austin, and extends from near the river to the northern boundary of the survey. A much smaller area extends from the Colorado River at South Austin to Manchaca Springs.

This soil occurs on the rolling uplands between the rough, hilly country to the west and the black prairie lands. The hills are rounded, with gently sloping sides, but often have steep bluffs of white limestone along the stream courses. The streams have cut deep gorges through the soft, chalky formation underlying this soil, and though drainage in this climate is seldom necessary, they serve to carry off the excess water in times of heavy rains.

The Austin clay is easily eroded, and small areas where the underlying chalky white limestone outcrops are frequently seen on the steeper hillsides and on the summits of the rounded knobs. Deep erosions extending from the hills to the small streams are also common. These erosions are often cut down several feet into the soft, white chalky material. In an area of greater rainfall the tendency of this soil to wash and become gullied would be attended with much more serious results than it is in this area.

The soil is derived from the weathering of a soft limestone formation, known as the Austin chalk. This rock weathers rapidly, breaking up into thin, shaly layers which are soon transformed into the white, silty material which composes the greater proportion of the subsoil.

The Austin clay can not withstand droughts as well as the Houston black clay, but in a wet season it produces as large yields of cotton as any of the other upland soils, and a very large part of this soil is under cultivation, even the steeper hillsides, where much of the soil has been eroded and washed down into the valleys, making good pasture lands. The crops grown are cotton, corn, sorghum, and Johnson grass. Cotton averages about one-third of a bale per acre, but in a wet season a yield of three-fourths of a bale to 1 bale per acre has often been realized. Corn is not extensively cultivated, as it is likely to suffer

from the summer droughts, but 18 to 20 bushels per acre are obtained when there is an average rainfall during the growing season. Sorghum produces about 2 tons per acre. Johnson grass is also produced for feeding purposes, 2 tons per acre being estimated as an average yield. Wheat and oats are very seldom cultivated, and are then used for pasturage or cut for feed, a very small part being thrashed out.

Small "gall spots" also occur on this type, affecting cotton and fruit, but other crops can be successfully grown on these small areas.

This soil is valued, according to its location, at from \$30 to \$45 an acre.

The following table shows the results of mechanical analyses of the fine earth of both soil and subsoil of this type:

Mechanical analyses of Austin clay.

No.	Locality.	Description.	<i>Mechanical analyses of Austin clay.</i>							
			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.	
10466	2 miles S. of Austin	Brown clay, 0 to 10 inches	P. ct. 1.1	P. ct. 2.2	P. ct. 1.8	P. ct. 7.2	P. ct. 11.6	P. ct. 38.5	P. ct. 37.6	
10462	4 miles N. of Austin	Light brown clay, 0 to 8 inches.	P. ct. 1.5	P. ct. 3.1	P. ct. 2.3	P. ct. 7.2	P. ct. 12.8	P. ct. 35.2	P. ct. 37.7	
10464	1½ miles SW. of Fiskville.	Clay, 0 to 10 inches	P. ct. 1.6	P. ct. 1.9	P. ct. 1.6	P. ct. 5.3	P. ct. 6.5	P. ct. 42.0	P. ct. 41.2	
10465	Subsoil of 10464	Calcareous clay, 10 to 36 inches.	P. ct. 2.7	P. ct. 3.8	P. ct. 2.5	P. ct. 8.0	P. ct. 8.4	P. ct. 37.8	P. ct. 36.6	
10463	Subsoil of 10462	Calcareous clay, 8 to 36 inches.	P. ct. .7	P. ct. 2.5	P. ct. 1.8	P. ct. 5.3	P. ct. 8.2	P. ct. 37.8	P. ct. 43.5	
10467	Subsoil of 10466	Brown clay, 10 to 36 inches	P. ct. 1.9	P. ct. 2.7	P. ct. 1.8	P. ct. 6.1	P. ct. 8.6	P. ct. 34.3	P. ct. 44.6	

The following samples contained more than one-half per cent of calcium carbonate (CaCO₃): No. 10462, 39.6 per cent; No. 10463, 69.4 per cent; No. 10464, 54.3 per cent; No. 10465, 69.3 per cent; No. 10466, 35.1 per cent; No. 10467, 57.3 per cent.

LUFKIN FINE SANDY LOAM.

The Lufkin fine sandy loam consists of a fine sandy loam, 12 inches deep, varying in color from gray to brownish red. The sand content is of medium to very fine grades. This overlies a subsoil of stiff, sticky red or brown laminated clay. This clay can be easily separated into thin layers, having very thin strata of fine sand between them. For the first few inches the subsoil has a small sand content derived from the upper soil, but it becomes very stiff and waxy as depth increases.

This soil occurs in one large, unbroken area, covering about 40 square miles in the extreme southeastern corner of the area, only a few small isolated areas being found outside of this belt. On a few of

the rounded hills are found small areas, having rounded pebbles and fragments of sandstone scattered over the surface and in the soil itself, but these are of small extent and infrequent occurrence.

The Lufkin fine sandy loam occurs on a series of low, rounded hills, having a general elevation of 500 feet above sea level. It is easily eroded, and the small streams have cut deep gullies between the rounded hills.

Crops on this soil are often affected by droughts, the rolling topography and sandy nature of the soil allowing the water to be carried off by the numerous small streams, which contain water only in times of heavy rains.

This type is derived from a series of sand, sandstone, and stiff clays known as the Lytton formation. The sandstone is fine-grained and grayish in color, but when in a state of decomposition it often becomes red or brown, the color varying with the proportion of iron present. Some of the hills are capped by layers of sandstone, but only very thin strata now exist over most of the area, and these are in a state of almost complete decomposition. Small areas of the red clay subsoil are often exposed on the steeper hillsides, the sandy soil having been removed in times of heavy rainfall. A few rounded, waterworn pebbles are often embedded in the stiff red clay.

Cotton, corn, sorghum, oats, fruits, potatoes, and vegetables are grown on this type. Up to the season of 1903 cotton had averaged from one-fourth to one-third of a bale per acre, but during that season, owing to the damage done to the crop by the Mexican boll weevil, it averaged only about one-eighth to one-seventh of a bale per acre. Corn will yield 15 bushels per acre under ordinary conditions, while in a wet season 25 to 30 bushels are often produced. Sorghum is largely cultivated; and is sown broadcast. It produces about 2 tons per acre, two or three cuttings being usually obtained. Oats is an uncertain crop, and only a small acreage is devoted to it. The crop is seldom thrashed, being used mainly for feeding purposes.

There are a few small orchards on this type, which are in a flourishing condition, and almost any variety of fruit adapted to the climatic conditions seems to do exceedingly well. Potatoes, especially sweet potatoes, are very successfully grown, and cabbage and early vegetables are well adapted to this soil. A small quantity of tobacco has been grown for home use, and when the season is favorable it gives excellent results. The soil is productive and well adapted to a large variety of crops, its inability to withstand the droughts being the main difficulty in its successful cultivation. A large part of the area embraced by this soil type is covered with a thick growth of hardwood. A small scrub oak or post oak is the principal variety. The wooded sections are used for pasturage and are valued at from \$4 to \$6 an acre, while the cultivated lands sell for \$10 to \$15 an acre.

The following table shows the results of mechanical analyses of both soil and subsoil of this type:

Mechanical analyses of Lufkin fine sandy loam.

No.	Locality.	Description.	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>
10425	1 mile S. of Cedar-creek.	Fine sandy loam, 0 to 10 inches.	0.4	0.7	0.5	15.6	59.4	15.5	7.9
10427	3 miles S. of Glass ...	Very fine sandy loam, 0 to 10 inches.	.3	1.1	.7	8.9	51.8	28.5	8.3
10423	3 miles S. of Cedar-creek.	Fine sandy loam, 0 to 12 inches.	.5	1.0	.6	14.4	56.5	16.1	10.5
10424	Subsoil of 10423	Stiff clay, 12 to 36 inches.	.4	.4	.3	7.3	33.3	19.0	39.2
10426	Subsoil of 10425	Red stiff clay, 10 to 36 inches.	.2	.4	.2	8.5	34.5	14.6	41.2
10428	Subsoil of 10427	Red stiff clay, 10 to 36 inches.	.4	.4	.3	2.8	22.6	25.9	47.5

COLTON STONY CLAY.

The soil of the Colton stony clay averages about 8 to 10 inches in depth, and consists of a dark-brown to reddish-brown clay or clay loam. When cultivated it becomes loose and friable, and, but for its stony nature, would be well adapted to farming. The soil contains from 40 to 60 per cent of fragments of flint and hard, honeycombed limestone. The subsoil also carries a large quantity of rock fragments of various sizes. Owing to the large proportion of stone, cultivation is impracticable over a great part of the area.

The subsoil, from 10 to 36 inches, is a stiff, dry, compact clay, becoming stiffer and slightly redder in color as the depth increases. Large rock fragments, embedded in it, are often encountered at from 20 to 30 inches, and on the steeper hills the underlying stratum of hard white limestone is encountered at a depth of from 30 to 60 inches.

The Colton stony clay extends across the northwestern section of the area, comprising about 90 square miles, and occurs also on the more level areas of the rough, hilly section, or on the flat summits of the high ridges.

The general character of the country is rough and hilly, with an average elevation of from 100 to 200 feet above the black prairie belt. The hillsides are steep and stony, large areas of Rock outcrop occurring on the steeper slopes.

There are numerous small streams, which have cut their channels to a great depth through the alternate layers of hard and soft limestone, and now flow between perpendicular limestone walls, often 50 feet or more in height.

This soil is derived mainly from the disintegration of the hard white limestone of the Edwards formation, containing interbedded strata of flint. The softer material has weathered into the stiff clay soil, leaving the fragments of flint and harder limestone scattered on the surface and through the soil.

A very small proportion of this type is under cultivation, but small, level areas occur, scattered over the area, which are comparatively free from stones, or in which the stones have been removed from the surface. These are successfully cultivated to all crops grown on any of the upland soils.

The greater part of the Colton stony clay is covered with a heavy growth of timber, post oak and live oak predominating, while the more hilly and rocky sections support a heavy growth of cedar. This rough section is devoted chiefly to pasture for stock, the largest herds of cattle in the area being found on this type of soil, and the type as a whole is better adapted to grazing than to cultivation.

Where cultivation is practicable, fair yields of cotton, corn, sorghum, and oats are obtained. Cotton averages about one-fourth bale per acre, and up to the present time the crop on this soil has been comparatively free from the boll weevil. Corn will yield from 15 to 20 bushels per acre in a season of average rainfall. Oats yield 30 bushels per acre, and wheat, though seldom grown, produces 10 to 15 bushels per acre.

The soil is well adapted to fruit and grapes, limited experiments showing that both orchards and vineyards do exceedingly well.

Its value varies with topography and location, a fair general average being about \$8 an acre.

The following table shows the results of mechanical analyses of fine earth of both soil and subsoil of this type:

Mechanical analyses of Colton stony clay.

No.	Locality.	Description.	Gravel, 2 to 1	Coarse sand, 1	Medium sand,	Fine sand, 0.25	Very fine sand,	Silt, 0.05 to 0.005	Clay, 0.005 to
			mm.	to 0.5 mm.	0.5 to 0.25 mm.	to 0.1 mm.	0.1 to 0.05 mm.	mm.	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>
10409	7½ miles SW. of Duval.	Brown clay, 0 to 9 inches.	0.3	0.9	0.7	3.1	6.1	55.4	34.4
10413	1 mile N. of Rutledge.	Brown stiff clay, 0 to 8 inches.	1.2	1.9	1.1	3.2	7.4	48.2	36.9
10411	2 miles W. of Duval.	.....do.....	.8	1.8	1.1	3.2	4.5	33.9	54.4
10410	Subsoil of 10409.....	Red stiff clay, 9 to 30 inches.	.5	1.1	.6	3.3	7.2	54.9	32.2
10414	Subsoil of 10413.....	Brown clay, 8 to 36 inches.	2.4	2.8	1.4	2.8	6.4	45.0	39.0
10412	Subsoil of 10411.....	.....do.....	.6	1.9	1.3	3.5	6.0	42.3	43.9

The following samples contained more than one-half per cent of calcium carbonate (CaCO₃): No. 10410, 3.5 per cent; No. 10412, 3 per cent; No. 10413, 3.6 per cent; No. 10414, 17.6 per cent,

YAZOO SANDY LOAM.

The Yazoo sandy loam is one of the most productive soils of the area, and is adapted to a greater diversity of crops than any of the other soil types. The soil is composed of a grayish to light-brown fine sandy loam 0 to 15 inches deep, with a large silt content. This grades into a subsoil which becomes slightly red or brown in color, and more silty as the depth increases. The subsoil is very compact, and at a depth of 4 to 6 feet contains a very small percentage of sand.

This type occupies the broad, level bottom lands on each side of the Colorado River, but has a sufficient elevation above the stream level to protect it from overflow. The topography is level, except for an occasional gentle swell and a very gradual slope toward the stream bed.

The Yazoo sandy loam covers an area of 60 square miles, and extends along the course of the Colorado River from Austin to the point where the river leaves the area. In some places the bottoms occupied by this soil are 3 or 4 miles wide.

Only once or twice since the area has been settled has the river overflowed these bottom lands, its present level being from 20 to 30 feet below them. This insures good drainage, as well as protection against floods. The river, in cutting its present channel through the deep canyons of the hills west of the area, took in suspension the silty material forming the majority of these alluvial deposits, and on reaching the more level country east of the hills deposited it along its course. Later inundations have added a layer of sand to this material, forming this productive sandy loam of the river bottoms. The light reddish-brown color of the silt deposit is seen in the limestone of the bluffs along the canyon cut by the river.

This soil can easily be irrigated, and experiments show that its productiveness is greatly increased where irrigation is practiced. Its texture makes it easy to cultivate and capable of holding a plentiful supply of water, as well as preventing it from packing when wet, or baking into hard clods.

The Yazoo sandy loam is well adapted to the cultivation of cotton, and under ordinary conditions produces one-half to three-fourths bale per acre. It is the most valuable corn soil in the area, 40 to 50 bushels per acre being ordinarily secured. Sorghum will produce from 3 to 5 tons of forage per acre, and Kafir corn is also successfully grown. Oats and wheat are seldom sown on this soil, but produce a strong, rank growth, suitable for hay, for which they are used.

Alfalfa is not at present cultivated, except on a very limited acreage, but good stands are easily obtained and large yields are realized. This soil is adapted to the production of early truck and vegetables, and to alfalfa. Large areas can be irrigated at small expense, and truck growing could be made an important industry.

The soil is very productive, and if properly cultivated much larger yields of the various crops grown could be produced. It is valued at from \$40 to \$60 an acre.

The following table shows the results of mechanical analyses of both soil and subsoil of this type:

Mechanical analyses of Yazoo sandy loam.

No.	Locality.	Description.	Gravel, 2 to 1	Coarse sand, 1	Medium sand,	Fine sand, 0.25	Very fine sand,	Silt, 0.05 to 0.005	Clay, 0.005 to
			mm.	to 0.5 mm.	0.5 to 0.25 mm.	to 0.1 mm.	0.1 to 0.05 mm.	mm.	0.001 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>
10450	1 mile N. of Montopolis.	Fine sandy loam, 0 to 10 inches.	0.5	1.9	2.5	29.8	33.7	22.8	8.8
10448	Near Webberville...	Silty loam, 0 to 15 inches.	.2	.4	.5	3.0	20.5	64.6	10.7
10452	2 miles SE. of Delvalle.	Fine sandy loam, 0 to 12 inches.	2.4	11.5	9.2	22.1	22.4	16.2	16.2
10451	Subsoil of 10450	Fine sandy loam, 10 to 36 inches.	.1	.2	.2	5.8	47.5	34.6	11.5
10449	Subsoil of 10448	Silty loam, 15 to 56 inches.	.1	.3	.5	3.8	20.6	62.2	12.5
10453	Subsoil of 10452	Fine sandy loam, 12 to 36 inches.	2.6	8.4	6.3	16.6	24.4	22.1	19.6

The following samples contained more than one-half per cent of calcium carbonate (CaCO_3): No. 10448, 16.2 per cent; No. 10449, 16.4 per cent; No. 10450, 18.4 per cent; No. 10451, 17.4 per cent; No. 10452, 11.9 per cent; No. 10453, 12.5 per cent.

TRAVIS GRAVELLY LOAM.

The Travis gravelly loam covers an area of about 24 square miles. The soil is a coarse sandy loam containing a large amount of rounded gravel on the surface and in the soil itself. This grades, at a depth of 10 to 12 inches, into a mass of coarse sand particles and rounded gravel, the latter often being from 2 to 4 inches in diameter. The sand and gravel are cemented together by a stiff, sticky red clay.

This soil type is located on the higher ridges in the immediate vicinity of the river, and also occurs at intervals in small areas on the rolling uplands, from Austin to the eastern boundary of the area. The topography is rolling, the hills being rounded and covered with a thick growth of hardwood timber.

The material from which this soil is derived was brought down by the river at an early day and deposited along its course. At the present time this material forms a series of terraces on each side of the stream. Many of the rounded pebbles are of quartz and granite, indicating that they were transported from the hills northwest of the area.

The general characteristics of this soil make it of little agricultural value. Its location, together with its texture, causes water to seep rapidly through it to the lower levels, and as a consequence the crops

suffer severely from drought. On a few of the more level areas crops are cultivated, and fair yields are often obtained during a wet season.

The crops grown and average yields per acre are as follows: Cotton, one-sixth to one-fifth bale; oats, 4 to 8 bushels; corn, 8 to 10 bushels in an average season; but corn is an uncertain crop on this soil, as it is seldom able to withstand the summer droughts.

This land is valued mainly for the timber on it, a heavy growth of post oak and black-jack oak covering a large part of the type. It is also used for pasturage for stock, a fair growth of native grasses being afforded throughout the entire year.

The Travis gravelly loam seems best adapted to melons and fruit trees. Small orchards of peach trees and other varieties of fruit suitable to this climate thrive and give excellent yields.

The following table shows the results of mechanical analyses of the fine earth of both soil and subsoil of this type:

Mechanical analyses of Travis gravelly loam.

No.	Locality.	Description.	Gravel, 2 to 1	Coarse sand, 1	Medium sand,	Fine sand, 0.25	Very fine sand,	Silt, 0.05 to 0.005	Clay, 0.005 to
			mm.	to 0.5 mm.	0.5 to 0.25 mm.	to 0.1 mm.	0.1 to 0.05 mm.	mm.	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>
10417	1 mile E. of Austin ..	Coarse sandy loam, 0 to 10 inches.	34.7	24.5	5.7	8.9	6.5	15.2	4.4
10415	4½ miles SE. of Manor.	Gray gravelly sand, 0 to 8 inches.	28.8	22.8	8.0	12.2	11.1	12.4	4.6
10419	2 miles NW. of Hornsby.	Gravelly sandy loam, 0 to 10 inches.	22.0	17.5	8.2	12.1	8.9	12.1	19.2
10418	Subsoil of 10417	Red stiff sandy clay, 10 to 36 inches.	19.6	21.6	6.7	9.8	5.7	13.8	22.6
10416	Subsoil of 10415	Gravelly clay, 8 to 36 inches.	18.6	13.7	3.4	5.3	5.0	11.7	42.3
10420	Subsoil of 10419	Gravelly clay, 10 to 36 inches.	12.0	13.3	7.2	7.0	5.9	8.9	45.7

YAZOO CLAY.

To a depth of 12 inches the soil of the Yazoo clay is a heavy dark-brown to black clay loam or clay, being heavier in the small, shallow depressions and more loamy on the slight elevations. The subsoil has a lighter brown color, and is very stiff and tenacious. It often contains small waterworn pebbles. The largest area of this type occurs in the valley along the course of Cedar Creek, in the southeastern part of the area, but most of the smaller streams have a narrow strip of this soil along each bank.

The Yazoo clay is an alluvial soil, occurring along the courses of most of the small streams, but seldom extending very far from their immediate banks.

These alluvial areas are comparatively level, having a gentle slope toward the stream and an occasional shallow depression or gentle swell. Its nearness to the streams, which have generally cut their channels down many feet below the level of the bottom lands, gives this type good drainage. There are no swamps or sink holes, but immediately after an overflow water often stands for some time in the lower depressions. This can be easily remedied by surface ditching to the adjacent stream.

This type is derived from material brought down by the streams in times of heavy rainfall and deposited along the flat areas in the valleys. This material consists chiefly of the black clay and silt forming the upland prairie, which is easily eroded and washed down into the small "arroyos," and thence to the streams. This soil also contains a large amount of organic matter and is very productive. Cotton, corn, oats, sorghum, and potatoes are the crops cultivated. Cotton yields from one-half to three-fourths bale per acre under ordinary conditions, but the cool, moist conditions of the bottoms seem better suited to the boll weevil than those of any other type of soil, and very small yields have been obtained in the last two seasons. For corn, 25 to 30 bushels is the average yield. A heavy, rank growth of oats is produced, giving a large quantity of straw with very little grain. Sorghum yields about 2 tons of fodder per acre, and potatoes are successfully grown, large crops being secured.

The soil is not subject to frequent overflow, as the steep banks of the streams are sufficient to protect it during any ordinary rainfall. It is considered a very good type of land for general farming purposes. Much of this soil along Cedar Creek could be very easily irrigated and cultivated to rice or alfalfa.

The following table shows the results of mechanical analyses of the fine earth of both soil and subsoil of this type:

Mechanical analyses of Yazoo clay.

No.	Locality.	Description.	Gravel, 2 to 1	Coarse sand, 1	Medium sand, 0.5	Fine sand, 0.25	Very fine sand,	Silt, 0.05 to 0.005	Clay, 0.005 to
			mm.	to 0.5 mm.	to 0.25 mm.	to 0.1 mm.	0.1 to 0.05 mm.	mm.	0.0001 mm.
			P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
10458	½ mile S. of Williams store.	Clay, 0 to 12 inches	0.1	0.3	0.5	4.6	12.6	40.1	41.7
10456	1 mile S. of Science Hall.	Clay, 0 to 10 inches	1.7	2.1	1.2	3.5	7.9	32.6	50.9
10459	Subsoil of 10458	Dark stiff clay, 12 to 36 inches.	.1	.2	.4	4.5	10.6	39.0	45.0
10457	Subsoil of 10456	Heavy clay, 10 to 36 inches	.5	1.1	.9	4.0	9.1	37.9	46.6

The following samples contained more than one-half per cent of calcium carbonate (CaCO_3): No. 10456, 13.4 per cent; No. 10457, 36.5 per cent; No. 10458, 1.6 per cent.

YAKIMA STONY CLAY.

The Yakima stony clay, to a depth of 10 inches, is a stiff, dark reddish-brown clay and has a large amount of rock fragments scattered on the surface and extending down into the soil and subsoil. The subsoil becomes slightly yellowish in color as the depth increases and is a stiff, sticky clay, containing a large percentage of rock fragments. These rocks are a species of basalt and are present in such large quantities as to render the land unfit for cultivation. A heavy growth of native grasses covers almost the whole extent of this type, affording excellent pasturage during the entire year.

This soil covers a very small area in the south-central part of the area surveyed. It is located on a rounded hill, known as Pilot Knob, about 7 miles south of Austin. This hill rises about 100 feet above the surrounding prairie and is the remains of an ancient volcano.

The total area embraced by this type is only about 2 square miles.

The following table shows the results of mechanical analyses of the fine earth of both soil and subsoil of this type:

Mechanical analyses of Yakima stony clay.

No.	Locality.	Description.	Gravel, 2 to 1	Coarse sand, 1	Medium sand,	Fine sand, 0.25	Very fine sand,	Silt, 0.05 to 0.005	Clay, 0.005 to
			mm.	to 0.5 mm.	0.5 to 0.25 mm.	to 0.1 mm.	0.1 to 0.05 mm.	mm.	0.001 mm.
			P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
10431	S. of Austin.....	Brown heavy clay, 0 to 12 inches.	2.2	5.2	2.5	3.8	4.6	26.3	55.5
10433	S. of Austin.....	Brown heavy clay, 0 to 12 inches.	.2	.3	.2	.4	1.8	22.7	74.5
10432	Subsoil of 10431	Stiff heavy clay, 12 to 36 inches.	3.9	7.2	4.1	8.5	6.6	23.8	45.9
10434	Subsoil of 10433	Stiff heavy clay, 12 to 36 inches.	.1	.4	.6	2.3	3.2	21.8	71.3

ROCK OUTCROP.

The largest areas of Rock outcrop occur in the rough, hilly section west and northwest of Austin.

These hills rise to an elevation of 1,000 feet or more in a series of bare limestone terraces, which are either entirely destitute of soil or are too stony to support more than a very scrubby growth of cedar.

Large areas are often encountered on most of the higher hills, reaching from their summits to their bases, where the bare white limestone formations are exposed, the slope being too steep and the process of erosion too rapid to permit the accumulation of even a thin layer of soil.

AGRICULTURAL METHODS.

The growing of cotton has for a number of years entirely replaced extensive cattle grazing in the Austin area, and more intensive methods of cultivating this staple are coming into favor with the increased value of lands and the greater number of small farms.

The gradual loss in productivity of the soil that must result from growing one crop continuously is noticed to only a slight extent on even the oldest cultivated fields. But this fact and the recent ravages of the cotton-boll weevil are causing a recognition of the need for more diversified farming. This will make possible a rotation of crops besides adding to the income in seasons when the usually profitable returns from the cotton crop can not be obtained because of a depression in prices or an especially low yield.

Rotation of cotton with the minor crops, such as sorghum, corn, and oats, is practiced with beneficial results. The latter, however, are grown on so small a scale, comparatively speaking, that the cotton crop must usually follow itself.

In preparing for cotton the ground is plowed in ridges, which are placed about 3 feet apart on the upland soil and 4 feet on the river bottoms. The plowing is about $4\frac{1}{2}$ inches deep on all the soil types, and four or five furrows with a two-horse plow form a ridge. The usual and more approved method of plowing, however, is with a double-moldboard plow, drawn by four horses or mules. Its use dispenses with that of a second plow, and saves the labor of one man, as well as considerable time, for only one trip across the field is required to make each ridge. One-third or more of the ground is turned in this operation. Those farmers who are practicing the most thorough culture of the crop precede the above ridging by making a furrow with a smaller shovel plow where the center of the ridge will lie, thus loosening up the soil over which the row is to be planted. The plowing is done during the winter months, at times when it is not too wet. Before planting the ridges are partially leveled down with a smoothing harrow or log. An improved cotton planter is used, and the seed is put in the middle of the ridge, 4 inches deep, at the rate of a half bushel per acre. The usual time of planting has been from April 1 to May 10, but the presence of the boll weevil now makes early planting important, and March 15 is not considered too soon. Earlier maturing varieties are being used to aid in escaping the weevil. Cultivation begins when the plants appear, the weeds often being destroyed at the start with a smoothing harrow. With the first hand hoeing the plants are chopped out to 16 or 18 inches apart. The two-horse cultivator is used in tending the crop, and it is recognized that shallow tillage is best, because it preserves more moisture and is less injurious to the roots.

The last plowing usually takes place when the bolls are forming. Because of the great natural productivity of the soils, commercial fertilizers have not been found profitable here. The beef and dairy animals and hogs that are kept in small numbers on most of the farms can be pastured throughout the year, so that little manure is accumulated that can be applied to cultivated fields. The practice of cutting and burning the old cotton stalks to destroy the boll weevil has grown, and during the last two years it has been carried out on a majority of the fields in the area.

Corn is planted from February 20 to March 20. The fields are usually plowed level in preparing for this crop, and the distance between the rows is 4 feet, with the stalks 2 feet apart. Level instead of ridge cultivation is usually practiced with corn. The ears are picked and cured without removing the husks, and the stalks are sometimes topped, but are generally not used.

Sorghum is grown largely for feed, it being the main fodder crop for both cattle and work animals. It is sown broadcast at the rate of 2 bushels per acre, the time of sowing ranging from April to June. From one to three cuttings are made each year, depending on the season and date of sowing. It is cut when in the milk or dough stage, and after curing is stacked for use throughout the year.

Oats and wheat, especially the former, are sown for hay and occasionally pastured during the winter, when grass is scanty. It is seldom that either crop is now grown for grain. Both these cereals are sown in the fall, and as they are removed from the ground as early as May a crop of sorghum can follow on the same field.

The fact that all classes of stock can be pastured the year round simplifies the question of winter feeding, which is much more of a problem in colder climates. Beef animals are fattened here on cotton seed, cotton-seed meal, and hulls, supplemented by corn, sorghum fodder, and pasturage. On a few farms in the area special attention is paid to the raising of hogs, and all conditions seem favorable to an extension of this industry.

As there has been no need for more fodder crops, alfalfa is hardly known in the area, but isolated fields show that it does exceedingly well on the river bottoms and fairly well on the Houston black clay. When the methods of growing it become well known here it will no doubt form an important addition to the list of crops now produced.

Truck is grown on the Yazoo sandy loam and the Austin clay with the aid of irrigation, but only for the local markets. The water to irrigate the former type is obtained from the river, and from a well for the Austin clay. The dam across the Colorado River above Austin, which was destroyed by flood in 1900, was built for the purpose of supplying water for irrigation and for the needs of the city. Its

repair, which is being agitated, will make it possible to irrigate all the Yazoo sandy loam and parts of some other types of soil.

AGRICULTURAL CONDITIONS.

The area surveyed is purely an agricultural district, there being no manufactories of any importance. Austin, the only city in the area, owes its present prosperity to the productiveness of the surrounding country. There is a marked difference in the prosperity of the farmers on the different soil types of the area. Those farming the rolling prairie lands have gradually acquired wealth, and while many are still of the tenant class, all have the necessaries and comforts of life. The farmers on the stony types of soil which lie in the hilly sections are, as a rule, less prosperous. None have acquired wealth, but none are very poor, the sale of the timber which covers this section, together with their small herds of cattle, being the chief source of income. Cotton is the money crop of the area, and under ordinary conditions a sufficient yield is always obtained to keep the farming class in good financial standing. Up to the present time the effect of the Mexican boll weevil has not been felt to any great extent, as the rise in price has more than balanced the decreased yield of the crop. In some parts of the area the cotton crop suffered less from the weevil than in others, about one-half the average yield being obtained, but in the extreme southeastern section only a tenth to a sixth of the usual crop was marketed.

An entire failure of this crop, under the present system of cultivating cotton exclusively, would have a marked effect on the whole district. The city as well as the farming classes would soon be in financial straits; hence the need of greater diversification of crops. About one-third of the farmers are tenants, the lowest proportion being among the Swedish and German farmers holding the rolling black prairie land in the northeastern and southwestern parts of the area. Farms are rented both on a cash basis and on shares. For corn and sorghum \$4 an acre is the usual rental, but for cotton the tenant pays from one-fourth to one-third of the crop produced. Cotton land is seldom rented for cash, because under present conditions no merchant will extend credit to cotton farmers renting for cash, the uncertainty of the crop preventing an assurance that the farmer will derive some income from the yield. The tenant commonly furnishes the seed, implements, work animals, and labor.

The farms on the Houston black clay and the Austin clay average about 200 acres each, and a large part of each farm is constantly under cultivation. The largest farms are on the Yazoo sandy loam along the river, 300 to 500 acres being the average size. Those situ-

ated on the Colton stony clay have a much smaller proportion cultivated, and though large tracts of 2,000 or 3,000 acres each are often owned by individuals, they are only held for their timber value and for the pasturage of cattle.

Labor is usually plentiful and cheap, and consists chiefly of negroes and Mexicans. Fifty to 75 cents a day and board is the usual wage, or, when hired by the month, about \$18 with board. Cotton is thinned out at from 40 cents to \$1 an acre, the wages depending on the condition of the field to be worked. During the cotton-picking season there is a great demand for labor, and many Mexicans come into the area from Mexico and the southwestern counties of Texas, while many negroes leave the cities for work in the rural districts. These are paid according to the amount of cotton picked, at the rate of 40 to 60 cents a hundred pounds. For scrap picking, the last thorough cleaning of the stalks before they are burned, \$1 per hundred pounds picked is generally paid.

The cultivation of cotton has gradually replaced stock raising, until cotton is now the chief product of the area. It is cultivated on every farm, and in many instances is the only crop grown. At least 90 per cent of the cultivated lands are devoted to its production. As a rule, each farmer has 8 or 10 head of cattle, and in the rougher section of the area, on the stony loam type of soil, a few herds are pastured which contain 200 or 300 head. However, the greater part of the area being adapted to cotton, all the large cattle ranches in that section have been divided into cultivated fields. As a greater diversity of crops becomes necessary, on account of the yearly increase in the ravages of the boll weevil, more cattle and hogs will be raised. A few farmers are raising hogs at present, and the industry is proving very profitable, as there is a great demand for them in the adjacent markets of Fort Worth and Houston.

The farm houses on the Houston black clay are neat cottages and two-story frame dwellings, usually painted, and often containing many modern conveniences. The barns are small, as the climatic conditions do not necessitate the housing of stock during the winter, and the cotton crop is usually sold immediately after it is taken from the fields and baled. The characteristic dwellings of the western and southeastern sections are much smaller, being seldom more than a small one-story cottage, with a small shed or barn for storing feed and farming machinery.

Truck, including sweet and Irish potatoes, is grown for the local markets, but no attempt has been made to cultivate these crops for shipment out of the area. The Yazoo sandy loam is excellently adapted to truck, and with the aid of irrigation, which can be easily

secured on this type, large quantities could be produced and shipped to the northern markets.

Alfalfa can be grown on both the black prairie soils and the river bottoms, but is better adapted to the latter, and when irrigated large yields are always obtained. A few experiments have demonstrated that tobacco can be grown successfully during favorable seasons on the Lufkin fine sandy loam, in the extreme southeastern section of the area. The difficulty in irrigating this type is the main hindrance to the successful production of this crop.

The Houston black clay and the Yazoo sandy loam are recognized as the best soils in the area for the production of cotton. These soils are of fine texture, and are able to withstand the summer droughts better than the sandy or more shallow soils. However, in a wet season the Lufkin fine sandy loam and the Austin clay often produce crops equal to those of the types named. The fine sandy loam of the Colorado River bottoms and the heavier loam along the small streams are the best corn soils of the area. A failure of the crop on these types is very rare, and excellent yields are realized.

Four railroads now reach the area, three of which connect it with the larger markets, both north and south. These furnish ample facilities for exporting the products of any section of the area to either the local or more distant markets. Well-kept roads lead from Austin to all the small settlements in the surrounding country, and a great many minor roads and lanes connect these with every locality. It is only just after excessive rains that these roads are difficult to travel. The level topography of the country and the dryness of the climate make it easy to keep all classes of roads in the area in excellent condition. Two large steel bridges over the Colorado River, together with a number of fords and ferries, enable the farmers of the southern half of the area to reach the local market. Austin is the market for almost all the products of the area. The cotton is first sold in the local market, but eventually goes to Galveston or New Orleans. Fort Worth and Houston have large packing houses, which furnish a ready market for all hogs and cattle shipped from the area. The large dairy farms in the immediate vicinity of Austin find a ready market for their produce in that city, and the demand for vegetables by the local canning factory can not be supplied from the small acreage cultivated at present in the surrounding country. There is now a tendency among the cotton planters of the area, on the recommendation of the Bureau of Entomology of this Department, to grow the early maturing varieties of cotton, and many experiments are being carried on with seed from Georgia and other more northern States. The introduction of these varieties, together with a more

thorough cultivation and early planting, has for its object the largest possible production before the most destructive work of the boll weevil begins. The number of weevils increases rapidly as the crop matures, and the early maturing varieties give the larger yields. The large area of cultivable lands and the seemingly permanent productivity of the soil form a substantial basis for the general prosperity of the area—a prosperity evidenced on every hand by the neatly kept farm buildings and general business activity.

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