SOIL SURVEY OF TITUS COUNTY, TEXAS.

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DESCRIPTION OF THE AREA.

Titus County lies in the northeastern part of the State of Texas, being separated from Oklahoma on the north by Red River County and from Arkansas and Louisiana on the east by Morris and Cass counties. Sulphur River forms the boundary on the north between it and Red River County, and Big Cypress Creek separates it from

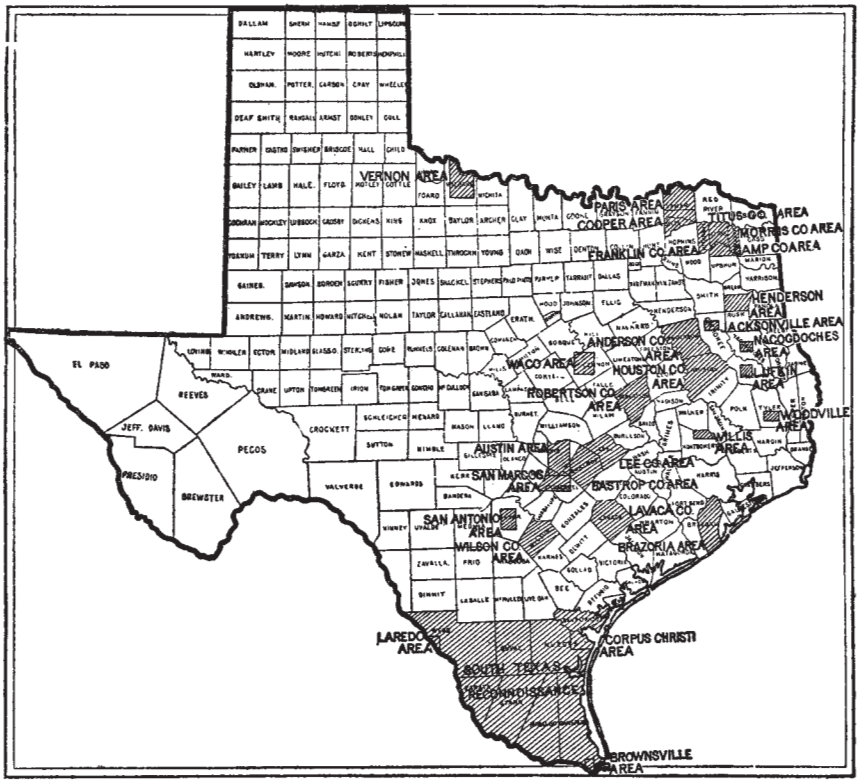

FIG. 33.—Sketch map showing location of the Titus County area, Texas.

Camp County on the south. It is about 26 miles in length and 17 miles in width, and has an area of about 426 square miles, or 272,640 acres. With the exception of a small prairie region covering a few square miles in the northeastern corner, the county lies within that natural geographical division known as the Hard Timber region of

east Texas. The soils, with the exception of the prairie region noted above, are characteristic of the Gulf Coastal Plain deposits.

Titus County is a part of a rolling plateau having a range in elevation of 300 to 500 feet above sea level, but with no abrupt or marked changes in elevation. There is a broad east and west divide near the middle of the county and north of the St. Louis Southwestern Railway, with slopes on each side. The streams have cut rolling valleys toward Big Cypress Creek on the south and Sulphur River on the north. The central divide, which is slightly rolling and covered by sandy soils, probably represents the original surface strata of the country slightly changed by weathering, while the more broken valleys show the modification brought about by weathering and erosion in the soft strata that make up the region.

The county is well drained by a number of small creeks which flow in almost parallel courses to Sulphur River on the north or to Big Cypress Creek on the south. The greater part of the drainage to the north does not flow directly into Sulphur River, but is intercepted by its tributary, White Oak Creek, which flows from west to east across the county, parallel to and only a few miles distant from Sulphur River. The largest streams which flow into it are Ripley, Piney, and Horse creeks, and the streams that flow south are Tankersley and Harts creeks. All except the largest creeks are intermittent and become dry during long droughts. The streams are bordered by strips of alluvial land, which on the larger creeks vary from one-half to 2 miles in width. This low-lying bottom land is subject to overflow in years of excessive rainfall and after rainy seasons is covered by pools of standing water. Numerous sloughs traverse the bottoms, and in places where these old channels or cutoffs have been obstructed, lakes of considerable size are formed.

The northeastern part of Texas, including Titus County, was the first portion of the State to be taken by permanent settlers. Here there was an abundance of wood and water, game was plentiful, and the soil resembled that of their native States. Titus County was early settled by farmers from Tennessee, Georgia, and Alabama. In 1846 the county was organized, but in 1875 about half of the original county was cut off to form the county of Franklin on the west and the county of Morris on the east.

The growth of population was slow at first and by 1880 the county had less than 6,000 inhabitants, of whom 23 per cent were colored. After the completion of the railroad in 1887, immigration increased and the development of the resources of the country was more rapid. In 1900 Titus County had a population of 12,292, and since that date the increase has been more rapid than before. The establishment of new industries has caused a rapid growth of the towns of Mount Pleasant, Cookville, and Winfield.

Mount Pleasant, the county seat, with a population of about 3,500, is advantageously situated near the center of the county and at a distance from other large towns in this part of the State. Besides being an important market and shipping point for farm products and a distributing point for merchandise, there are cotton gins and yards, an oil mill, and a factory where barrel heads are manufactured. Red Springs, a health resort that adds considerably to the population, is in the edge of this town. Cookville and Winfield are thriving towns, and at the latter place there is a pottery whose wares have a good reputation.

The only railroad in operation at the present time is the St. Louis Southwestern, the main line of which comes from the east and turns south at Mount Pleasant, and a branch line continues west to Sherman and Fort Worth. The farming and lumbering interests of the northern part of the county have suffered from a lack of adequate transportation facilities, but the railroad now under construction from Mount Pleasant to Paris will supply this need and add greatly to the population and wealth of the county.

The county is well provided with public roads, which are kept in fair condition. In very rainy seasons the clay roads get in bad condition, but they dry out rapidly after the rains cease. The sandy roads are being covered with clay, which makes an almost perfect roadbed.

Facilities are provided for marketing and shipping cotton, but other products heretofore have not been moved so readily. The peach crop has not always proved profitable, on account of poor prices at the markets to which they were shipped and the lack of organization on the part of the growers. Every effort is now being made to encourage the production of other crops than cotton, especially fruits and truck crops. A large cannery at Mount Pleasant will, in the near future, provide a market for the peach crop when it is found unprofitable to ship to northern markets, and it will also utilize other fruits and vegetables.

CLIMATE.

The northeastern part of Texas has a mild, pleasant climate, ordinarily free from extremes of heat or cold, and favorable for farm work in every month of the year. The summers are long, but there are but few days when the temperature rises above 100° F. In winter there may occur periods of warm sunny weather lasting for weeks. The most disagreeable features of the winters are the occasional sudden cold waves, known as "northers," which are usually accompanied by snow and sleet. These, however, are of short duration and do not interfere seriously with farm work. The mercury seldom drops to zero and many winters are mild, with no cold waves of any consequence.

The average dates of the last killing frost in spring and of the first in the fall, as obtained from records kept at Paris, are March 28 and November 15, and at Sulphur Springs (based on a period of eight years) March 19 and November 16, respectively. These figures show an average growing season of nearly eight months, longer than is needed for maturing the crops grown in this section.

The average annual rainfall is abundant and is well distributed throughout the year. Droughts sometimes cause injury to crops, but with proper preparation of the land and careful cultivation the short droughts in this section should do little or no damage. Of late years excessive rainfall has done more damage than droughts, especially in the lowlands. The heaviest precipitation, amounting to about one-third of the total for the year, occurs in the months of May, June, and July. The greater part of this falls in heavy showers. As the sandy soil permits of cultivation very soon after a rain little time is lost from work.

There being no Weather Bureau station in Titus County, the following table, compiled from the records kept at Paris, in the near-by county of Lamar, gives interesting data relating to temperature and precipitation:

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

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.	Snow, average depth.
	°F.	°F.	°F.	*Inches.*	*Inches.*	*Inches.*	*Inches.*
December	46	80	5	2.1	1.9	3.4	0.5
January	45	83	8	2.1	3.1	.4	1.8
February	44	84	—13	2.0	.3	2.2	1.4
Winter	45	.....	.....	6.2	5.3	6.0	3.7
March	55	92	18	3.5	.6	4.0	.0
April	65	96	29	2.9	3.2	4.7	.0
May	71	96	38	4.5	2.4	4.3	.0
Spring	64	.....	.....	10.9	6.2	13.0	.0
June	78	104	46	3.3	1.2	2.0	.0
July	83	108	60	3.1	1.5	4.6	.0
August	82	110	57	2.0	T.	.1	.0
Summer	81	.....	.....	8.4	2.7	6.7	.0
September	76	106	42	2.8	.6	6.7	.0
October	66	95	33	2.3	3.0	3.8	.0
November	54	85	18	2.7	.6	11.9	.0
Fall	65	.....	.....	7.8	4.2	22.4	.0
Year	64	110	—13	33.3	18.4	48.1	3.7

AGRICULTURE.

The early settlers in this part of Texas were farmers, and from the first agriculture has been the only industry of general importance. Being without transportation facilities, they produced the crops that could be consumed at home or in the immediate vicinity. Corn and wheat were grown on the cleared land and cattle and hogs were raised on the public ranges. At an early date, however, cotton was grown, and it has ever since held its place as the principal crop of the region. The early settlers marketed their cotton with much difficulty and expense. Jefferson, nearly 50 miles southeast of Titus County, was the nearest water-shipping point, and cotton was hauled from all over the northeastern part of Texas to this port to find a market. The profit to the farmer under these conditions was small, even when good prices were obtained.

After the civil war the high price of cotton so stimulated production that as transportation became easier it was grown in many places to the exclusion of necessary crops for home consumption. Some corn has always been grown, the best farmers always providing enough corn for home use. The growing of wheat in the early days was soon discontinued, as it was not adapted to the sandy soils. Until recently cotton held its place as the money crop and on many farms was the only crop, with the attendant evils of a tenant system and credit advances to cotton growers. A few years of better prices for cotton and the growing independence of the farmers enabled them to turn their attention toward a diversification of crops, and it is well to state here that the credit merchants and bankers of the county have encouraged this course, recognizing its benefits in the long run to the community at large. Products for home use are now grown in abundance and various fruit and truck crops have been tried as money crops. Many peach orchards have been started, and while the profits realized have not been all that was expected, the prospects for the future are not discouraging. Canneries have been started, and if shipments to northern markets are not profitable the local canneries can use the fruit. Peanuts have been grown to some extent and have been found so profitable that this crop is likely to be one of the principal products of the county. Over 2,000 acres were planted in 1908 and the farmers have pledged themselves to put in 5,000 acres in 1909. The average yield of peanuts is about 15 bushels per acre and the price has ranged from 85 cents to $1 a bushel. Another crop of growing importance is ribbon cane. This part of Texas produces a superior grade of ribbon-cane sirup, and there is no difficulty in marketing all that can be produced at 50 cents a gallon. Besides a large local consumption of this sirup, 12 carloads were shipped from Mount Pleasant during the past year.

Corn is the next crop to cotton in importance in the county. The better farmers try to produce enough corn to feed the farm stock, and those who have a surplus find a ready local market. In quality the corn is not what might be expected. The ears are often small, and in rainy seasons much of the corn rots in the ear. The climate may have some effect, but it is probable that the difficulty could be removed in large part by proper selection of seed. As a rule the seed corn is taken from that grown in the country and but little attention is paid to selection and improvement.

Cowpeas are grown to some extent with the corn, but the acreage could be greatly increased with profit to the farmer.

The system of agriculture that has prevailed in this section for so long a time is now entirely inadequate to meet the needs of the people. Cotton is not profitable enough to be the sole crop when the yield is decreased by the boll weevil and cost of production increases with the enhanced price of labor. The diversification of crops has proved so profitable during the short time it has been tried that it will no doubt become the general practice, with the result that while cotton may for some time be the chief money crop the farmer will in addition make his supplies at home and have a surplus of other crops to sell. Under this system a rotation of crops can be practiced that will preserve the productiveness of the soil and gradually increase the yields of cotton as well as other crops. Fortunately the soils of this region were of such high productiveness that they have given profitable yields without the aid of commercial fertilizers, which have been so expensive to farmers in other parts of the south. Their productiveness should not be impaired by continual cropping to cotton or any other single crop. No fertilizers should ever be bought to supply nitrogen when cowpeas, peanuts, and other legumes that furnish nitrogen to the soil can be grown so profitably, and every crop rotation should include one of these crops. Another advantage of diversification is that with crops coming to maturity at different times the farmer does not require so much help, and the labor problem, which is a serious one in Titus County, is solved to some extent.

The available laborers of the county are both white and colored. The greater part of the land, however, is cultivated under the tenant system. Where the landlord furnishes only the land the rental paid is one-third of the cotton and one-fourth of the corn; when he furnishes everything except the labor his part is usually one-half of the crops.

One of the greatest obstacles to the prosperity of the farmer is the credit system which prevails here and over a large part of the South, especially where cotton is practically the only crop. Under this system advances are made to the farmer, who gives a lien on the

coming crop. A large number of the farmers of Titus County are now producing their home supplies. This gives them the opportunity to farm on a cash basis and become independent of the credit merchant and the money lender. At the lowest cash prices the merchant can make, corn and hay brought from the North are too costly for the farmer of this county to buy when he can raise these products at home to such good advantage.

SOILS.

The soils of Titus County fall into two natural divisions, based upon the method of their formation, and distinguished by topographic position as well—the upland or sedimentary soils and the lowland or alluvial soils. Both of these may be subdivided into two general groups, based upon the character and the origin of the materials from which they are derived. The upland soils may be divided into the prairie group, which include the soils weathered from the Cretaceous rocks, and the woodland group, which comprises the various soils weathered from materials of Eocene age.

The lowland division may be subdivided into groups based upon the character and origin of the materials of which the soil is composed. The dark-colored soil of the Sulphur River bottom is made up of wash from the black prairie region farther west, and the other stream bottoms of the county are built up of soils of local derivation.

The soils of the prairie region have certain well-marked characteristics. They are derived from the more calcareous rocks of the Cretaceous and have a greater content of lime. A large part of the area covered by this group of soils is treeless and on any part the tree growth is sparse. The growth of grass is heavy and characteristic. These soils are of two series—the Lufkin and the Wilson—based principally upon the character of the subsoil. The surface soils of both are gray to dark gray, while the subsoils are light to dark brown in color and heavy and compact. The prairie region covers only a few square miles in the northwestern corner of the county.

Most of the upland soils are included within the woodland division, and were derived by weathering from the sands and shales of the Eocene, which cover the northeastern part of Texas. These soils are all of a sandy nature and occur in two principal series, the Norfolk, whose soils have a yellow porous sandy clay subsoil, and the Susquehanna, characterized by subsoils of mottled red and yellow clays. The Sulphur River bottom has only one soil type in this county, the Trinity clay. It is a dark, nearly black, soil, and shows clearly its derivation from the black prairie soils. The bottoms of the smaller streams throughout the county have three soil types—the Sanders clay, the Sanders silt loam, and Meadow, the latter being the heterogeneous material washed from the hills.

The following table gives the names and areas of the several soil types, and the accompanying map shows their distribution over the county:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Susquehanna fine sandy loam	125,824	46.2	Lufkin fine sandy loam	2,368	0.9
Norfolk fine sandy loam	61,952	22.7	Caddo fine sandy loam	1,920	.7
Meadow	18,432	6.8	Susquehanna clay	1,856	.7
Sanders clay	15,104	5.5	Sanders silt loam	960	.4
Susquehanna gravelly loam	14,848	5.4	Wilson clay loam	384	.1
Trinity clay	12,032	4.4			
Norfolk fine sand	11,136	4.1	Total	272,640	.....
Wilson loam	5,824	2.1			

NORFOLK FINE SAND.

The Norfolk fine sand is the sandiest soil found in the area. The surface 6 inches consists of a gray fine sand containing more or less organic matter. Below this the material is composed of the same grades of sand having a light-gray color and passing at lower depths to a white or yellowish-white sand. In depth it is usually 3 to 4 feet, but in places areas of very loose sand have been mapped with this type where the depth was only 2 to 3 feet. Below the sand is found the yellow sandy clay characteristic of the subsoils of the Norfolk series. The top soil is loose and incoherent and where it is stirred frequently it becomes worked up to a considerable depth. The roads over areas of Norfolk fine sand are difficult to travel in dry seasons when the sand is worked up deep and loose. For several days after rains the sand is compact and forms a good roadbed.

The type occurs in a few areas of several square miles and in a number of smaller areas in nearly all parts of the county. Often patches of this type cover only one small hilltop. Extensive stretches of the type occur along the central divide of the county and on the broad ridges where the surface material has not been disturbed except as the finer material has been removed and the sand has been left to form soil.

The Norfolk fine sand is naturally well drained, both by reason of its location on ridges with slopes on every side and by reason of the texture and structure of the soil itself, which favors the rapid percolation of the water and prevents surface accumulations and an excess of water in the soil. The porosity of the soil and its sandy texture make it one of the warmest soils of the area and well suited to the production of early truck crops.

The agricultural value of the Norfolk fine sand depends largely upon its depth. There are a few small areas occurring along ridges

where the sand is so deep that it is not productive. Such areas suffer in droughts, lack organic matter, and are very difficult to improve. This land, locally known as "black-jack land," is largely uncultivated and covered by a growth of scrub or black-jack oak. The larger part of the Norfolk fine sand, however, is valuable farming land. For such a sandy soil it is remarkably productive and retains its productiveness after years of cultivation. With the exception of a loss of organic matter most areas of the Norfolk fine sand seem to be as productive after years of cultivation as when first cleared.

The principal crops grown on this soil in the past have been cotton and corn, but the tendency toward a diversification of crops has resulted in the trial of other crops. The legumes have been grown with success, and peanuts especially have been very successful. The yield of cotton is fair, ranging from one-fourth to one-half bale to the acre. Corn yields from 15 to 25 bushels.

This would naturally be considered one of the best peach soils of the area, and the good orchards found upon it prove this to be the case. Where the sand is not too deep and leachy, peach orchards are uniformly successful. It is held by the farmers that peaches do better where iron crusts are scattered through the soil, as is sometimes the case.

The results of mechanical analyses of samples of the soil and subsoil of the Norfolk fine sand are given in the following table:

Mechanical analyses of Norfolk fine sand.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
20480	Soil	0.0	0.1	2.6	76.1	7.7	10.3	3.3
20481	Subsoil	.0	.1	2.9	76.3	7.3	9.8	3.6

NORFOLK FINE SANDY LOAM.

The soil of the Norfolk fine sandy loam consists of a gray or yellowish-gray fine sandy loam or loamy sand. The depth usually ranges from 10 to 20 inches, with an average depth of about 12 inches. The subsoil is a yellow or brownish-yellow sandy clay, which passes at 3 feet or more into a mottled gray or yellow clay. In some places at the lower depths there is a zone of red and yellow mottled clay closely resembling the subsoil of the Susquehanna fine sandy loam. The surface 2 inches of the soil is of a darker gray color, due to organic matter. This is more noticeable in timbered or newly cleared land, as the soil loses its humus quickly when cultivated.

This type of soil is found in all the upland part of the county outside of the prairies. The largest uniform areas occur in the

southern part of the county. There are frequently small patches of the type within areas of the Susquehanna fine sandy loam that are too small to indicate on the map.

The Norfolk fine sandy loam is not confined to any one kind of topography nor to any particular elevation, but it is more likely to be found on flats where the drainage is slightly retarded and weathering has taken place under conditions different from those that produced the mottled and red subsoil.

The Norfolk fine sandy loam is derived by weathering from the Eocene deposits. It is possible that it may have been derived from newer deposits than those which produced the Susquehanna series, but the evidence is not sufficient to prove this fact.

Some areas of this type occur on nearly level flats, where drainage is not rapid, but the greater part has good natural drainage. The porous character of the soil and subsoil prevents any accumulation of water on the surface or in the soil for any length of time. Any part of the type can be drained by the simplest methods and at small expense for ditching.

The Norfolk fine sandy loam is as highly valued as any type of soil in the county, and some regard it as the most desirable soil for the system of farming now practiced. It is very productive without the use of fertilizers and so retentive of moisture that crops withstand drought as well as on any other soil in the county. It is especially adapted to truck, peanuts, and all crops that require a sandy soil. As on the other types of the area, cotton and corn are the principal crops. The yield of cotton under ordinary conditions is from one-fourth to one-half bale to the acre and of corn from 15 to 25 bushels. These yields can be increased by careful and thorough methods of farming. Peanuts do well, and the acreage of this crop is steadily increasing. Cowpeas are grown to some extent with the corn. Potatoes have been grown of late years for market, and the profits have been encouraging. This is probably the best soil in the county for peaches, and some of the most valuable orchards are found on it.

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

Mechanical analyses of Norfolk fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
20482	Soil	0.0	0.2	0.4	29.4	37.9	25.9	5.9
20483	Subsoil	.0	.1	.3	29.9	24.0	25.1	20.2

SUSQUEHANNA FINE SANDY LOAM.

The Susquehanna fine sandy loam is the most extensive and important soil type of Titus County. The soil is a gray, fine, very sandy loam and in some places almost a sand. The depth ranges from 6 to 18 inches, but the average is about 12 inches. The subsoil is usually a red and yellow clay mottled with drab, passing before a depth of 3 feet is reached into a less weathered clay of solid drab or brown color. The top soil does not differ in appearance from that of the Norfolk fine sandy loam, except that in places it may have a reddish tinge and it is more likely to contain scattering iron concretions and iron crusts, though these are not always present. It is always loose, porous, and easily cultivated. Where the clay has been exposed, as in ditches or steep hillsides, it has weathered to a deep red on the surface, but it is usually only from 1 to 3 inches to the mottled clay. The subsoil is a fine clay, stiff and waxy, but not so impervious as to be injurious to crops where the position of the land is favorable to drainage.

South of White Oak Creek and between it and Sulphur River, numerous low, depressed areas occur where the drainage is naturally poor. Here the soil is more silty and the drab color predominates in the subsoil, and in many places the drab color is solid, due to weathering under conditions of imperfect drainage. Such areas may cover a square mile or more, but many of them occur as a network of narrow, winding glades too small to indicate in the soil map. In texture and physical features this phase closely resembles the Caddo fine sandy loam.

The Susquehanna fine sandy loam is found in all parts of the upland, except in the prairies in the northwestern part of the county. In the southern and central parts of the county the areas of this type are irregular in shape and interspersed with patches of the Norfolk soils, but in the northern part there are large uniform stretches of the type, the largest of which lies between White Oak Creek and Sulphur River. In this section the numerous narrow glades are found.

With the exception of the glady areas the topography of the Susquehanna fine sandy loam is gently rolling to hilly. It occupies a greater proportion of the deeper stream valleys and more rarely occurs on the high ridges and broad, nearly level divides. The sandy mounds, which are scattered over all parts of the upland and well distributed over areas of this type, are less common on the more rolling portion, while in some parts of the flat, glady land they cover almost the entire surface. They are usually quite sandy, but in most cases at a depth of 2 feet the typical Susquehanna subsoil is seen.

A large portion of the type is still uncleared in the sections distant from the railroad, though the cultivated acreage of the type probably exceeds that of any other type in the county. The native forest growth consists of oak, hickory, and other hardwoods. Very few pines are found on this soil in Titus County.

The type is productive and holds its productiveness well under continuous cultivation. It is well adapted to all crops which thrive on a sandy soil. Cotton and corn have been the principal crops since the land has been under cultivation, and in many fields cotton has been grown many years in succession. Cotton yields from one-fourth to one-half bale per acre with the cultivation given by the average farmer, but those who give more labor and care to the crop realize much larger yields. Some fields of this type may be made to produce a bale of cotton to the acre. The common yield of corn is about 15 to 20 bushels. Peanuts have proved a success, and the acreage is increasing every year. Irish potatoes, sweet potatoes, cowpeas, and all truck crops do well, and while they are generally grown for home use, small shipments are made. This type of soil is probably not the best for peaches, but many of the orchards are on this type and the yields have been good.

Until within the last few years fertilizers were scarcely used on this type of soil. Small quantities are now applied, but the farmers disagree as to the profit derived therefrom. It is certain that in many cases the results do not justify the expense, but it is very likely that fertilizers will be used in increasing amounts, especially to force truck crops and to mature cotton before the boll weevil becomes destructive.

The Susquehanna fine sandy loam yields rapidly to erosion, and washes and gullies soon dissect all exposed hillsides. This condition follows neglect and poor farming, for the productiveness of the soil makes it possible to keep the land covered with useful vegetation which will check the tendency to wash on uncultivated hillsides. Contour plowing and in places some terracing will hold the soil in cultivated fields.

The following table shows the results of mechanical analyses of a typical sample of the soil and subsoil of the Susquehanna fine sandy loam:

Mechanical analyses of Susquehanna fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
20486	Soil	0.4	0.7	0.9	53.4	16.0	21.2	7.2
20487	Subsoil	.0	.2	.8	36.6	10.8	19.0	32.8

SUSQUEHANNA CLAY.

The soil of the Susquehanna clay to a depth of about 4 inches is a fine, very sandy loam having a gray color, but sometimes tinged with red where the clay is near the surface. It differs from the soil of the Susquehanna fine sandy loam only in that it has a less depth and in many places a higher percentage of silt. The subsoil is red clay, passing into the typical red and drab mottled clay of the Susquehanna series. In the cultivated areas the plow turns up the red subsoil, and in some fields the sandy soil has been completely removed. Where the proportion of sand is small the land is difficult to till and washes rapidly on exposed hillsides.

The Susquehanna clay occurs on eroded slopes and comparatively level flats in the valley of White Oak Creek. It is derived from the same materials as the Susquehanna fine sandy loam and in the same manner, except that the sandy portion has been more rapidly removed, leaving the clay on the surface or with a shallow covering of sand. It is a comparatively unimportant type. A few areas occur in the northern part of the county near White Oak Creek and between this creek and Sulphur River.

Very little of the type is cultivated. The native growth consists of hardwood trees, such as oak, hickory, and gum. When the clay is first plowed it is unproductive, but yields should increase as weathering takes place. Its chief defects are a lack of organic matter and its tendency to wash and gully, but with careful treatment it should become fair farming land.

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

Mechanical analyses of Susquehanna clay.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
20488	Soil	0.2	0.6	0.3	21.8	34.3	34.2	8.6
20489	Subsoil	.0	.2	.1	8.8	19.7	23.2	48.1

SUSQUEHANNA GRAVELLY LOAM.

The soil of the Susquehanna gravelly loam is a gray or reddish-gray very sandy loam to an average depth of about 12 inches. The subsoil is a deep red clay, with more or less sand, passing at lower depths into a heavy mottled red and yellow clay. The distinguishing feature of this type is the considerable quantity of gravel scattered over the surface and through both soil and subsoil. This gravel

consists of fragments of iron crusts and small iron concretions and in some places there is also a smaller percentage of quartz gravel. The iron crust is usually broken into small fragments and there is seldom found a block 2 inches in diameter. Both crusts and concretions range in size for the most part from that of a grain of corn to one-half inch in diameter. The gravel is derived by weathering from ledges of iron conglomerate interspersed with iron crusts and iron concretions. This gravelly material is hardly ever present in such quantity as to interfere with cultivation.

The Susquehanna gravelly loam is found in small areas in nearly all parts of the upland where other types of the Susquehanna series occur, but there are several large areas southeast of Mount Pleasant. There are numerous small patches on hillsides in areas of the Susquehanna fine sandy loam that are too small to be indicated on the soil map. The large areas cover high ridges and sharply rolling country. This topography may be seen to good advantage on the Daingerfield road, 4 miles from Mount Pleasant. The type is everywhere well drained, and for this reason it is considered one of the earliest soils of the county.

The type is derived by weathering from the Eocene rocks, in which there were beds of ferruginous sandstone and iron crusts which have furnished the gravel characteristic of the type.

The Susquehanna gravelly loam is considered one of the most desirable soils of the county. Good crops are produced without fertilizers, and this type probably retains its crop-producing power under constant cultivation longer than any other soil of the county. Cotton and corn have been the principal crops, with less attention paid to peanuts, potatoes, oats, and fruits. The yield of cotton is one-fourth to two-thirds bale to the acre, and of corn about 20 bushels. Yields may be easily increased by careful farming. A proper crop rotation, including legumes, will greatly improve the soil and increase the yields.

The soil is not so well adapted to peaches as the more sandy types, but several good orchards may be seen on it. Apple and pear orchards have been planted with fair results though the soil is not well adapted to apples. Peanuts do well and this should be a favorite crop on this type of soil.

Commercial fertilizers have been used to a small extent. Their use does not seem advisable, as the leguminous crops will supply the necessary organic matter and nitrogen to maintain the fertility of this type.

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

Mechanical analyses of Susquehanna gravelly loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
20490	Soil	0.5	1.0	0.7	37.7	32.3	20.8	7.0
20491	Subsoil	.8	1.2	.8	31.6	17.3	15.6	32.4

CADDO FINE SANDY LOAM.

The soil of the Caddo fine sandy loam to an average depth of 12 inches is a light-gray or white silty fine sandy loam. The subsoil is usually a drab, heavy, compact clay, though in places it may have a brown or mottled yellow and gray color. The subsoil is impervious, and drainage would be somewhat difficult, even if the topography were more favorable. A most noticeable feature of this type is the number and size of the sandy mounds. It is not known by what agency these mounds were formed. They occur in all parts of the upland in Titus County, but on the Caddo fine sandy loam in such number and of such size as almost to cover the ground. These mounds are always more sandy than the types with which they occur, and in some cases they are almost pure sand. They add much sand to the soil when the Caddo fine sandy loam is cultivated.

The Caddo fine sandy loam is found in numerous small areas distributed throughout the upland, but areas of considerable size occur in the northern part of the county on each side of White Oak Creek. Numerous narrow, winding glades traverse the areas of Susquehanna clay in the northern part of the county that might properly be classed with this type, but it was impossible to represent all such small areas on the map.

The type occupies most of the depressed areas, locally known as "glades" or "glady land." The soil has probably been formed by wash of fine sand, silt, and clay from the higher ground into the lowlands. With the exception of the mounds, the areas are low and flat, and drainage is so restricted that for a time after rains the ground is covered with standing water.

Very little of the Caddo fine sandy loam is cultivated, on account of its undrained condition and its poor productiveness during the first few years of cultivation. It is said, however, that yields increase year by year as the land is drained and tilled. Pasture grasses do well where the timber is removed and the land drained so as to remove standing water. The soil seems naturally adapted to post oak, which

makes up a large part of its timber growth. While other lands in the county remain cheap it is not likely that this type will be cultivated very extensively. If well drained and the soil deeply plowed, it would, no doubt, soon become good farming land. It might be beneficial to use fertilizers at first to insure a good crop.

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

Mechanical analyses of Caddo fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
20470	Soil	0.0	0.2	2.8	21.8	12.7	52.9	9.6
20471	Subsoil	.0	.2	.1	5.2	8.6	51.7	34.3

WILSON LOAM.

The soil of the Wilson loam to an average depth of 8 inches is a heavy brown loam containing very fine sand and a large percentage of silt. The subsoil is a yellow to brown, sticky, impervious clay to a depth of 3 feet or more, underlying which is a gray silty clay. When dry the soil pulverizes readily and there is no difficulty in keeping it in good tilth. In a wet season, however, its sticky, plastic nature causes it to turn up in clods. It also puddles when wet and upon drying bakes hard. Crops upon the Wilson loam are quickly damaged by too much rain and do not withstand drought as well as on other types of the area. Where drainage is good, however, this is one of the most valuable types of the county, and in normal seasons large crops are produced.

A common feature of this type is the presence of waterworn pebbles of various sizes, ranging from one-half inch to 2 inches in diameter. These gravels were originally in beds, but after weathering of the strata in which they occurred they have been scattered over the surface and through the soil. In places where these beds outcrop on a hillside they are in such quantities as to interfere seriously with cultivation. The mounds so common in all parts of Titus County are quite numerous over parts of the Wilson loam.

The Wilson loam, though covering only a few square miles, is the most important soil of the prairies. There are two principal areas—one on the western edge of the county south of White Oak Creek and the other directly north in the vicinity of Goolesboro. Several small bodies of the type are found in other parts of the prairie or near its border.

The central portion of the prairie covered by the Wilson loam is level or very gently rolling. Here the drainage is inadequate and little of the land is cultivated. On the slopes, however, toward the streams, there are considerable strips which have good drainage. This type is the product of the weathering of the Cretaceous clays mingled on the border with the Eocene deposits.

A large part of the Wilson loam has never been cultivated. It produces a heavy growth of grasses that can be pastured or cut for hay with profit. Most of it is inclosed in large pastures and grazed by cattle and horses. More of this land would no doubt be under cultivation at the present time if tenants could be easily secured. All of it will no doubt be tilled as soon as the railroad comes within a few miles of it. Near Goolesboro farms have been cultivated for many years. On the well-drained portion to which these farms belong the average yield of cotton is high, one-half to two-thirds of a bale being produced under indifferent methods. Good farmers have secured a bale to the acre in favorable years. The soil retains its productiveness well under cultivation and no considerable quantity of fertilizers has yet been used. Corn yields 20 to 30 bushels and the quality is good for this section. Potatoes and garden crops do well and ribbon cane is grown on the lower portions. It is probable that alfalfa could be grown if great care were taken in the preparation of the land and lime were liberally used.

The following table gives the results of mechanical analyses of fine-earth samples of the soil and subsoil of the Wilson loam:

Mechanical analyses of Wilson loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
20476	Soil	0.7	1.1	0.8	12.0	21.0	47.0	17.5
20477	Subsoil	.8	1.9	1.2	8.4	4.9	49.5	33.4

WILSON CLAY LOAM.

The Wilson clay loam consists of a brown silty loam or clay loam, 6 inches deep, underlain by a brown, heavy, rather impervious clay. When wet the soil is difficult to cultivate. Waterworn gravel is found on this type as in the Wilson loam.

This type of soil occurs in small bodies and irregular strips within areas of Wilson loam, from which it differs only in its heavier texture. It has the same origin and surface features.

Very little of the Wilson clay loam is under cultivation. Where it is devoted to pasturage it furnishes good grazing. It is capable

of producing good crops, especially those that are favored by a heavy soil. Good drainage, however, would have to be provided where needed and the land well tilled to prevent loss from droughts.

LUFKIN FINE SANDY LOAM.

The soil of the Lufkin fine sandy loam is a silty fine sandy loam 12 inches deep and dark gray to brown in color. The soil is but little lighter in texture than that of the Wilson loam. The subsoil is an impervious, stiff, compact clay having a brown color. Lime concretions are sometimes present in the subsoil. If it were well drained this soil could be easily cultivated, but in its usual poorly drained condition it is very difficult to handle, as it tends to run together when wet and becomes compact and cohesive. In wet seasons roads over this type get into bad condition.

This type of soil is limited to the prairie region and to some small, sparsely wooded areas on the edge of the prairie. The largest area lies south of White Oak Creek and west of Ripley Creek. As a rule the surface is level and the natural drainage is not sufficient to permit of farming. Very small expenditures on surface ditches in most cases would provide adequate drainage.

The Lufkin fine sandy loam, as well as the other prairie soils, has weathered from calcareous shales of Cretaceous age. Occasional white limy rocks that have resisted weathering are found through the soil.

Very little of the type is cultivated, though if drained and tilled it would have about the same agricultural value as the Wilson loam.

It is adapted to cotton, corn, and oats. The greater part of it is fenced and used for pasture. The native sod supports a good growth of grasses and good hay might be cut. Cattle are grazed in considerable numbers and also a few horses and sheep.

The growth on the sparsely wooded portion of this type is principally post oak and scrub oak, which have little value for lumber.

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

Mechanical analyses of Lufkin fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
20478	Soil	0.0	0.2	0.2	4.3	23.9	62.3	9.1
20479	Subsoil	.5	1.8	.4	3.0	7.7	16.7	69.8

TRINITY CLAY.

The Trinity clay to an average depth of 12 inches is a dark-brown to black, heavy, sticky clay, underlain by a brown or slaty colored clay of the same texture. The difference in color is due to the black organic matter of the top soil, and this causes it to break up more readily when dry. When wet it is impossible to get the soil into condition to plant crops. It is so sticky and tenacious that travel through the bottoms in rainy seasons is extremely difficult. In very dry seasons the soil bakes hard, and its shrinkage is so great that large cracks appear. With an optimum amount of moisture, however, the soil can be brought to a good state of tillage.

The Trinity clay is found along both sides of Sulphur River in a strip averaging about 2 miles in width, but in Titus County the width depends on the bends of the river and ranges from one-fourth of a mile to 2 miles.

The type is alluvial in origin, and the materials from which it is derived have been brought from other parts of the State. The dark calcareous character of the soil shows unmistakably its derivation from the wash from the black prairie soils farther west.

It occurs on flat, low bottoms that are subject to overflow in rainy seasons. Drainage is also difficult after the floods have subsided. Numerous sloughs and cut-offs traverse these bottoms, and in several places they have been obstructed and form lakes of considerable size. The largest of these is Prairie Lake, which is more than three-fourths of a mile long and nearly one-fourth of a mile wide.

Although this type is naturally very productive, its low position and exposure to overflow have prevented its cultivation. It is nearly all forested with a heavy growth of oak, hickory, gum, ash, bois d'arc, and other valuable hardwood trees. Many attempts have been made to cultivate these bottoms, and for some years with success, but a series of rainy years would discourage such efforts. At the present time only the edge of the bottom is cultivated where the land is higher. Here the Trinity clay is mixed with wash from the hills, so it may be said that no typical Trinity clay in the area is cultivated. It is capable of producing, if protected from overflow, as high as 1 bale of cotton and 40 bushels of corn to the acre.

As there is no way by which the land can be economically protected from overflows, the best use to which it can be put is to keep it in forests. It is well adapted to the hardwoods, such as hickory, walnut, and pecan. Bois d'arc makes a rapid growth on this type, and the wood is very valuable for fence posts and for wagon timber.

The following table shows the results of mechanical analyses of a sample of soil and subsoil of the Trinity clay:

Mechanical analyses of Trinity clay.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
20492	Soil	0.0	6.2	4.2	12.2	7.2	28.6	42.0
20493	Subsoil	1.8	1.2	.2	2.0	9.1	24.6	61.1

SANDERS CLAY.

The soil of the Sanders clay to a depth of 9 inches consists of a brown heavy silty clay. The subsoil is a lighter colored clay loam with usually a larger proportion of silt. In many places the subsoil is streaked and mottled by brown iron stains. No considerable areas of this type are uniform, as the flood plain which it occupies receives the wash from the adjacent hills with their various soil types. Though the soil has a heavy texture, it could be put into a good state of cultivation under proper conditions of drainage.

The Sanders clay is found in a continuous body along White Oak Creek, the stream meandering from one side of the bottom to the other. The creek has slowly built up this flood plain by materials deposited in times of overflow.

Very little of the type is cultivated and crops are very uncertain in most places where cultivation has been attempted. North of Bridges Chapel are a few farms on this type of soil that have been cultivated for years with fair success, though occasionally losses occur. These farms are on the higher land at the edge of the bottom. None of the lower land is cultivated. The soil is naturally very productive, and if protected from overflows large crops of corn and cotton could be grown. At present it is valued chiefly for its timber, which consists of valuable oak, hickory, ash, maple, dogwood, gum, bois d'arc, and other hardwoods.

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

Mechanical analyses of Sanders clay.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
20472	Soil	0.1	1.9	1.3	8.6	4.3	43.1	41.0
20473	Subsoil	.0	1.1	.9	5.9	3.1	41.4	47.5

SANDERS SILT LOAM.

The soil of the Sanders silt loam to an average depth of 12 inches is a dark-gray to brown heavy silty loam. The subsoil to a depth of 3 feet or more is a gray to white silt loam. The darker color of the top soil is due to its large percentage of organic matter. It is porous, friable, and easily cultivated. This type differs from the Sanders clay only in its larger silt content and the lighter color of the subsoil.

It is a comparatively unimportant type, occurring only over a small acreage south of White Oak Creek. It is alluvial, and the materials from which it is derived have been brought down from the adjacent lands and, to some extent, from the lighter prairie soils farther west. Like the Sanders clay, it occupies low, flat bottoms subject to frequent overflow.

Very small areas of the type are cultivated on the higher ground at the edge of the bottom. Here crops are lost occasionally, but yields are so large in good years that it is profitable to cultivate the land. Cotton yields as high as 1 bale to the acre and corn 30 bushels. The average, however, is much lower, on account of total loss in some years and partial failures at other times.

The greater part of the type is covered by a heavy and valuable growth of oak, hickory, ash, and other hardwoods.

The following table gives the results of mechanical analyses of a sample of the soil and subsoil of the Sanders silt loam:

Mechanical analyses of Sanders silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
20474	Soil	0.0	0.9	0.5	5.8	23.5	49.2	20.1
20475	Subsoil	.0	1.5	.7	5.9	27.0	45.1	19.7

MEADOW.

The term Meadow is used to designate the alluvial soils which are not uniform in texture, color, or composition over any considerable areas. It includes the heterogeneous mixture of sands, clays, and silts washed from adjacent hills and deposited on the lowlands after being very imperfectly assorted by the water. Along the small streams the Meadow soils partake largely of the character of the adjacent hill soils, with the silts, sands, and gravels predominating. On the larger bottoms in the lower lands the soils become darker in color and heavier in texture and resemble closely the soils of the Sanders series.

Along every stream in the county is a strip of Meadow, but many of these are too small to indicate on the soil map.

A considerable portion of Meadow is farmed, though the lower portions may have overflows in rainy seasons. The most profitable crop is ribbon cane, from which an excellent grade of sirup is made. The yield of sirup is from 150 to 400 gallons to the acre, and if the quality is good it sells readily for 50 cents a gallon. As a rule only 1 to 5 acres of cane is grown on a farm. Corn is probably the crop next in importance. The yields average 20 to 30 bushels in good years. Cotton does well, but the boll weevil is more destructive in the lowlands. Bermuda and other pasture grasses do well.

The uncleared portion of this type is covered by the usual hardwood growth of the lowlands.

SUMMARY.

Titus County is located in the northeastern part of Texas, and with the exception of a few square miles of prairie in the northwestern corner it lies within the hard-timber belt. The greater part of the upland is rolling, but very little is too rough for farming. Drainage is good except on the bottom lands.

Titus County is one of the old counties of Texas, having been organized in 1846. The settlers came mostly from Tennessee, Georgia, and Alabama. Agriculture has always been the chief occupation of its inhabitants. Mount Pleasant is the county seat and the largest town. Winfield and Cookville are important shipping points.

The climate is mild, without extremes of heat and cold. The seasons are long enough to permit the maturity of all crops grown in this section and farm work can be carried on during every month of the year. Frosts rarely occur late enough in the spring to cut off the peaches and other fruits.

Cotton and corn are the principal crops. The area is of interest because it is rapidly changing from a one-crop system to a diversification of crops. The old system of growing cotton exclusively, or with a small acreage of corn, is being replaced by rotations that may include peanuts, cowpeas, potatoes, ribbon cane, forage crops, and truck crops. Many peach orchards have been planted and other fruits are grown to some extent.

Thirteen types of soil have been mapped in Titus County. Of the upland soils there are two groups—those of the prairies and those of the wooded areas. On the prairie there are two series, the Wilson, which has two types, and the Lufkin, which has one. The soils are derived from the Cretaceous rocks; they are dark-gray to brown sandy loams and clay loams and the subsoils are heavy in texture and

brown in color, the subsoil of the Lufkin series being the more compact.

The soils of the wooded areas are all of a sandy nature and are derived from sandy shales and clays of the Eocene. There are two principal series, the Norfolk and the Susquehanna. The Norfolk types, of which there are two, have fine sand and fine sandy loam soils underlain by yellow sandy clay. These soils are especially adapted to peaches and truck crops. They also produce good crops of cotton and corn. The Susquehanna series includes three types, which have gray or reddish gravelly soils and red and gray mottled clay subsoils.

The black alluvial soil along Sulphur River is called Trinity clay, and the gray to brown types on White Oak Creek are classed with the Sanders series. None of these soils have much agricultural value on account of the frequent overflows to which they are subject.

The Meadow bordering all the smaller streams is cultivated in many places. It is not a definite type but consists of soils of all textures, from sands to heavy clays. Portions of it are especially adapted to ribbon cane, and corn produces well on some of the bottoms.

All the upland soils of the area are productive and the sandy soils are remarkably lasting. Up to the present time, their fertility has been so well maintained that the farmers have not found it necessary to use commercial fertilizers. With careful management and wise crop rotations this should never be necessary except possibly for special crops.

The changes that will be beneficial to the farmers of the county, briefly stated, are (1) a diversification of crops which will enable the farmer to raise his home supplies and to have, besides cotton, a surplus of other crops to sell, and (2) a closer cooperation among the fruit and truck growers in order to establish standard grades of produce and to ship to the best markets in carload lots.

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