
Soil Survey

Kaufman County Texas

By

E. H. TEMPLIN, in Charge, and J. W. HUCKABEE, Jr.
Texas Agricultural Experiment Station



UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF PLANT INDUSTRY
In cooperation with the
Texas Agricultural Experiment Station

This publication is a contribution from
BUREAU OF PLANT INDUSTRY
E. C. AUCHTER, *Chief*
DIVISION OF SOIL SURVEY
CHARLES E. KELLOGG, *Principal Soil Scientist, in Charge*
TEXAS AGRICULTURAL EXPERIMENT STATION
A. B. CONNER, *Director*

Authority for printing soil survey reports in this form is carried in the Appropriation Act for the Department of Agriculture for the fiscal year ending June 30, 1933 (47 U. S. Stat., p. 612), as follows:

There shall be printed, as soon as the manuscript can be prepared with the necessary maps and illustrations to accompany it, a report on each soil area surveyed by the Bureau of Chemistry and Soils, Department of Agriculture, in the form of advance sheets bound in paper covers, of which not more than 250 copies shall be for the use of each Senator from the State and not more than 1,000 copies for the use of each Representative for the congressional district or districts in which a survey is made, the actual number to be determined on inquiry by the Secretary of Agriculture made to the aforesaid Senators and Representatives, and as many copies for the use of the Department of Agriculture as in the judgment of the Secretary of Agriculture are deemed necessary.

SOIL SURVEY OF KAUFMAN COUNTY, TEXAS

By E. H. TEMPLIN, in Charge, and J. W. HUCKABEE, Jr., Texas Agricultural Experiment Station

Area inspected by WILLIAM T. CARTER, Inspector, District 4, Division of Soil Survey,¹ Bureau of Plant Industry, United States Department of Agriculture

United States Department of Agriculture, in cooperation with the Texas Agricultural Experiment Station

CONTENTS

Page		Page
	County surveyed.....	1
	Climate.....	7
	Agricultural history and statistics.....	8
	Soil-survey methods and definitions.....	11
	Soils and crops.....	12
	Acid soils of the prairies.....	18
	Smooth tight heavy soils.....	19
	Wilson clay loam.....	20
	Wilson clay.....	21
	Irving clay loam.....	22
	Irving clay.....	23
	Smooth sandy soils.....	24
	Wilson very fine sandy loam.....	25
	Wilson very fine sandy loam, mound phase.....	26
	Crockett very fine sandy loam.....	27
	Crockett fine sandy loam.....	28
	Irving fine sandy loam.....	28
	Sloping tight heavy soils.....	29
	Wilson clay loam, slope phase.....	29
	Wilson clay, slope phase.....	30
	Sloping sandy soils.....	31
	Crockett very fine sandy loam, rolling phase.....	31
	Crockett clay loam, eroded phase.....	32
	Crockett fine sandy loam, steep phase.....	33
	Heavy calcareous soils of the prairies.....	34
	Smooth crumbly heavy soils.....	35
	Houston Black clay.....	35
	Hunt clay.....	36
	Bell clay.....	37
	Lewisville clay loam.....	38
	Sloping crumbly heavy soils.....	39
	Houston clay.....	39
	Lewisville clay, slope phase.....	40
	Steep eroded heavy soils.....	41
	Sumter clay.....	41
	Soils and crops—Continued.	
	Light-colored sandy soils of the forested lands.....	41
	Smooth well-drained soils.....	43
	Tabor fine sandy loam mound phase.....	43
	Leaf fine sandy loam.....	44
	Cahaba fine sandy loam.....	45
	Norfolk loamy fine sand.....	46
	Kalmia loamy sand.....	46
	Sloping soils.....	47
	Kirvin fine sandy loam.....	47
	Ruston fine sandy loam.....	47
	Leaf fine sandy loam, slope phase.....	48
	Cahaba fine sandy loam, slope phase.....	49
	Very slowly drained soils.....	49
	Lufkin very fine sandy loam, mound phase.....	50
	Tabor-Lufkin complex.....	51
	Myatt silt loam.....	53
	Myatt clay loam.....	54
	Soils of the bottom lands.....	54
	Trinity clay.....	55
	Catalpa clay.....	56
	Kaufman clay.....	57
	Kaufman clay loam.....	57
	Kaufman clay loam, high-bottom phase.....	58
	Kaufman fine sandy loam.....	58
	Kaufman fine sandy loam, high-bottom phase.....	59
	Ochlocknee loamy fine sand.....	59
	Land uses and agricultural methods.....	60
	Productivity ratings.....	65
	Morphology and genesis of soils.....	68
	Summary.....	76
	Map.....	

COUNTY SURVEYED

Kaufman County, an almost rectangular area 33 miles long north and south by 26 miles wide east and west, embraces a total area of 808 square miles, or 517,120 acres (fig. 1). It is in northeastern Texas, 85 miles south of the Oklahoma State line, 130 miles west of the Louisiana State line, and 230 miles inland from the Gulf of Mexico. Kaufman, the county seat, is 35 miles southeast of Dallas, Tex.

¹ The field work for this survey was done while the Division of Soil Survey was a part of the Bureau of Chemistry and Soils.

Physiographically, the county is part of an extensive plain produced by long-continued erosion of unconsolidated rocks under a prairie vegetation. This plain is the Blackland Prairie of Texas, part of the interior border of the Gulf Coastal Plain. The western edge of the main body of the forested section of the Gulf Coastal Plain, which is known in Texas as the east Texas timber country, lies about 5 miles east of the county.

The general upland plain extends as a broad, smoothly undulating expanse over the northeastern two-thirds of the county. Within this area, which is the broad divide between two large rivers, the Trinity and the Sabine, the drainage system is completely developed and the interstream divides are low and rounded. The elevations above sea level of the upland areas range from 520 feet on the divide between the East Fork Trinity River and Buffalo Creek along the Rockwall County line north of Forney to as low as 390 feet at Mabank in the southeastern corner. The elevation at Terrell is 514 feet and at Kaufman 434 feet.²

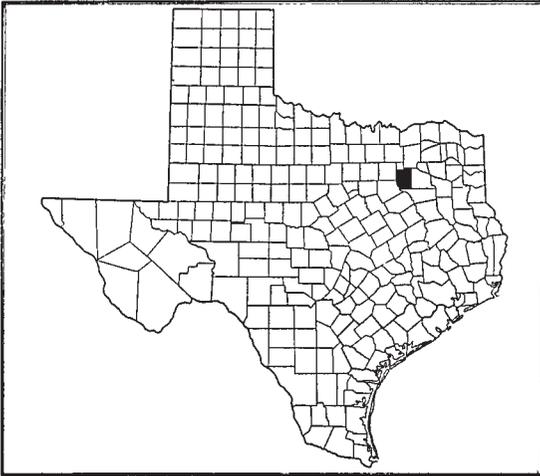


FIGURE 1.—Sketch map showing location of Kaufman County, Tex.

In the southwestern part, west of a line extending from Tolosa through Warsaw to Forney, is a series of high flats or terraces, lying at two general levels and interrupted by the valleys of various streams. The extensive higher flats lie very little lower than and grade imperceptibly into the undulating upland plain. Lower isolated small benches lie from 50 to 100 feet below the higher terraces, from which they are separated by a distinct escarpment, and they adjoin the river flood plains. They include Bakers Prairie in the south-central part of the county at Tolosa and the lower terrace 2 miles south of Peeltown, which extends from the middle of the Hymen Hertz survey southward into Henderson County. They also include the low bench immediately southwest of Rosser and a low terrace that occurs as a belt one-half mile wide along the eastern side of the Trinity River bottom and extends from a point 1 mile east of the southeastern corner of Dallas County northwestward into Dallas County. The area of Bell clay 1 mile west of Markout School and 4 miles south of Forney, and the isolated area occupying the point between the East Fork Trinity River and Buffalo Creek 1½

² The altitudes given for towns are those of the railway stations; the elevation given for the highest point is taken from the United States Geological Survey topographic map, Barnes Bridge quadrangle.

miles northwest of Forney, are terraces of this division. The terraces at the higher level consist of the Peeltown Flat, the high originally forested flat that embraces about 75 square miles and extends from the Henderson County line between Tolosa and Bois d'Arc Creek northward past Peeltown and Rosser to Warsaw; all the point of upland in Kaufman County between the Trinity River and the East Fork Trinity River except the low terrace along the Trinity River; and the isolated areas of Bell and Irving soils, which form an intermittent belt along the east side of the East Fork Trinity River from the vicinity of Warsaw into Rockwall County. None of these terraces has a regional drainage system, and their surfaces are so nearly level that prior to the construction of graded roads they were partly covered by shallow pools or thin sheets of water for weeks or months after heavy rains. Most of them have been adequately drained for successful crop production by the construction of graded roadways. Small parts of the Peeltown Flat have an undulating surface. The terraces are underlain by a permanent water table at a depth ranging from 10 to 50 feet.

The Trinity River, which forms the southwestern boundary of the county, flows through a broad flat-bottomed valley about 150 feet below the general level of the upland plain. The eastern slope to this valley is a band of rolling country, about one-fourth mile wide, in which the prevailing surface gradients range from 5 to 15 percent. This deeper valley of the master stream extends up the East Fork Trinity River beyond the county line and up the other large tributaries, Cedar Creek, Kings Creek, and Brushy Creek, about as far north as the Texas & Pacific Railway. An indentation of a similar dissected valley of another larger stream, the Sabine River, invades the northeastern corner along Duck Creek and gives rise to the rolling country around Richardson School.

Approximately 35 percent of the county is nearly level (0- to 1/2-percent gradient), about 45 percent is gently undulating (1/2- to 3-percent gradient), about 20 percent is rolling (3- to 8-percent gradient), and less than 2 percent is strongly rolling (gradients of more than 8 percent).⁸ The relief may be interpreted from the drainage pattern and the soil distribution. Each soil has a limited range of slope, which is set forth under the soil type descriptions. The nearly level areas are confined largely to the terraces and flood plains, but a few areas on the upland plain, such as the flat on the western side of Cedarvale, are nearly level and slowly drained. The areas of rolling relief occur almost exclusively on the slopes leading down to the flood plains of the larger streams. The largest areas of rolling land are between Coates School and Buffalo Creek in the extreme northwestern part of the county and on the south slope to Duck Creek near Richardson School in the northeastern part.

The Trinity River has a low gradient, and the fall of the stream where it borders the county is only 1.5 feet per mile of channel distance, or 2.6 feet per mile of air-line distance. The elevation of the channel at the southwestern corner of the county is 295 feet above

⁸ The ranges of gradient of these relief designations are set up in accordance with local conditions of suitability for agriculture. Inasmuch as the climate, prevailing soils, and type of agriculture all favor high rates of erosion, the ranges are much lower for these relief classes than in other sections having different soils.

sea level.⁴ The East Fork Trinity River has the same gradient as the Trinity River, and Kings Creek has a fall of 5.3 feet per mile of air-line distance between the Texas & Pacific Railway and a point west of Kemp.⁵ Inasmuch as the rate and quantity of run-off is high, the stream bottoms are wide in comparison with the area drained. Cedar Creek drains an area of approximately 750 square miles, and at the point of its egress from the county the normal width of the flood plain is 2 miles. In most places the width of the flood plain is regular and proportional to the size of the drainage area, but in some places, especially where faulting is noted by geologists, the flood plains are markedly constricted. The outstanding example of such constriction is the narrowing of the bottom of Kings Creek 5 miles south of Kaufman, where the average width of $1\frac{1}{4}$ miles narrows to less than one-half mile, although no resistant rock crops out.

Throughout a large part of the county well water is not generally obtainable, and most of the farms depend on rain water, which is collected and stored in cisterns and surface tanks. Well water is obtainable on the terraces and in most localities where the soils are sandy and light colored. In many areas of the heavy calcareous soils of the prairies some water is obtained from weak shallow wells. Few wells hold water permanently in areas of the acid soils. The only natural lakes are a few sloughs and abandoned stream channels within the flood plains of the larger streams. Deep artesian wells provide community water supplies at Forney and Crandall. There are a few small springs in the eastern part of the county and in the western part along the bases of the terraces adjoining the Trinity River. The largest are those at Able Springs School in the extreme northeastern part, in the bed of Rocky Cedar Creek north of Hiram, at Rosser, and 4 miles northwest of Mabank. All the streams are intermittent except the Trinity River and the East Fork Trinity River. Those creeks shown on the soil map as permanent flow during at least 9 months of the year. The stream channels are, as a rule, small and meandering, and the bottom lands are flooded several times each year.

The county was originally a grassy, nearly brushless prairie interrupted by strips of hardwood along the streams, and the uplands were dotted with isolated areas and belts of post oak trees growing on light-colored sandy soils. On the heavy calcareous soils of the prairies the dominant grasses were bluejoint turkeyfoot, locally called big bluestem (*Andropogon furcatus*); prairie beardgrass, locally called little bluestem (*A. scoparius*); and Indian grass or golden bluestem (*Sorghastrum nutans*). These were intermixed with lesser amounts of long-leaved dropseed grass (*Sporobolus asper*); silver beardgrass (*A. saccharoides*); and buffalo grass (*Buchloe dactyloides*), locally called mesquite grass.⁶ These grasses are the dominant species in the prairie hay produced in the vicinity of Forney.

⁴ Elevation from United States Geological Survey topographic map. Club House quadrangle.

⁵ Computed from topographic sheets of the Texas Reclamation Department.

⁶ Plant identifications were made in part by comparison with specimens submitted to and identified by V. L. Cory, range botanist, Texas Agricultural Experiment Station. In part, the scientific names are those given in an unpublished manuscript, A Short Survey of the Vegetation of Rockwall County, by H. Noss, in the files of the Division of Botany, Texas Agricultural Experiment Station, College Station, Tex.

The areas of Bell clay and Lewisville clay on the lower terraces once supported an open stand of elm in addition to the grass cover. Lewisville clay loam was covered with prairie grasses but also supported some trees of red oak, pecan, ash, and post oak. The vegetation on the heavy calcareous soils of the prairies, a meadowlike grass cover, was sufficiently dense on slopes of less than about 17-percent gradient to prevent very rapid erosion. Where the areas have been heavily pastured the original vegetation has given way in places to a dense sod of buffalo grass.

Areas of the Wilson and associated soils supported a somewhat different association of grasses, characterized by a smaller proportion of bluestems and greater abundance of smaller and less tall species, especially Hall's panicum (*Panicum hallii*), lace grass (*Eragrostis capillaris*), windmill grass (*Chloris verticillata*), Texas grama (*Bouteloua rigidisetata*), hairy grama (*B. hirsuta*), and three-awn grasses (*Aristida* spp.). The native vegetation affords a fairly accurate criterion for indicating the areas of the Wilson and Crockett soils. Native meadows on the acid soils of the prairies produce smaller yields of hay of poorer quality than do those on heavy calcareous soils of the prairies, but the native pastures have about the same carrying capacities. Buffalo grass does not spread rapidly on the acid soils of the prairies; and although it makes a good growth on the heavier soils of that group, it grows only in scattered patches.

On the light-colored sandy soils the native growth is hardwood forest of post oak and blackjack oak trees, with some red oak, hickory, and elm. The forested areas contain little underbrush and practically no grass. The maximum size of trees is approximately 2½ feet in diameter and 40 feet in height. Abandoned fields have not reforested themselves. Where not pastured they are covered with broomsedge, Bermuda grass, three-awn grasses, partridge-pea, and various weeds. Originally, considerable areas of the Lufkin and Myatt soils had a transitional prairie-forest vegetation, with post oak and blackjack oak on the sand mounds and grasses on the intervening heavier poorly drained swales.

The flood plains originally were covered with a growth of hardwood trees. In those locations where underdrainage is slow the principal trees are cedar elm, slippery elm, white ash, willow oak, water oak, and hackberry. In the areas with free underdrainage, underlain by permeable layers and having a permanent water table within the reach of tree roots, the trees are southern red oak, mossycup oak or bur oak, overcup oak, bitternut hickory, pecan, and, along the stream channels, sycamore. Some of the forest trees of the flood plain have been utilized for lumber, and Osage-orange, locally called bois d'arc, is highly valued for fence posts and other uses. Two areas of frequently flooded bottom land, one in Cedar Creek bottom 1½ miles north of Cedarvale, and the other in Lacy Creek bottom at the railroad crossing of the Texas & New Orleans Railroad, originally were prairies of buffalo grass, with some small mesquite trees. Buffalo grass originally grew in scattered spots throughout the bottoms of Cedar and Kings Creeks. It withstands overflows lasting not longer than a few days, provided a rain follows to wash the mud off the foliage.

The principal noxious weeds in cultivated fields are Johnson grass, Bermuda grass, and a plant locally called tie vine. Johnson grass grows chiefly on the heavier soils and the bottom-land soils, and Bermuda grass is most abundant in the sandy sections. The tie vine is confined almost exclusively to the Trinity River bottom. The common grass in cultivated fields on the heavy calcareous soils of the prairies is Texas millet, locally called hurrah grass or Colorado grass; and on the acid soils of the prairies and light-colored sandy soils crabgrass abounds.

The census for 1930 reports the population of Kaufman County as 27,274 native whites, 11,511 Negroes, 1,784 Mexicans, and 336 foreign-born whites, a total of 40,905. Of this number, 8,795 are classed as urban, 24,632 as rural-farm, and 7,478 rural-nonfarm population. The farm population is rather evenly distributed throughout the county; it is slightly more dense in the northwestern or blackland part. The principal towns are Terrell, with 8,795 inhabitants in 1930; Kaufman, the county seat, with 2,279; Forney, with 1,216; Kemp, with 990; and Mabank, with 963.

Kaufman County was created from a part of Henderson County and organized in 1848. At an earlier date the land was included with Nacogdoches County. The county was reduced to its present size in 1873, when an area of 149 square miles was taken from its northwestern extension to form Rockwall County. The county lines are shown on the accompanying soil map in accordance with the county line surveys (with the exception of the offset shown in the Kaufman-Henderson boundary, which, although widely recognized, is not called for in the field notes of the county line survey) and do not correspond exactly with the reporting of property for taxes.

Permanent settlement of the county commenced soon after Texas won its independence from Mexico in 1836. The earliest deed on record, a patent from the Republic of Texas to George T. Walters for the survey of that name, which is located in Mabank, is dated September 14, 1841, and marks the first private ownership of land and the beginning of settlement. By 1860 nearly all of the land was privately owned, and widely separated farms were located throughout the sandy and forested parts where wood and water were readily available. Settlement, principally of native whites from the older Southeastern States, was slow but steady until about 1900, by which time the county was almost as thickly settled and as well developed agriculturally as it is today. Short periods of rapid settlement occurred after the close of the Civil War in 1865 and the construction of the Texas & Pacific Railway through the county in 1872-73. The rate of settlement is indicated by the census figures for total county population as follows: 1880, 15,448; 1890, 21,598; 1900, 33,376; 1910, 35,323; 1920, 41,276; and 1930, 40,905.

The main line of the Texas & Pacific Railway (Missouri Pacific lines) crosses the northern part of the county from east to west. Two lines of the Southern Pacific—the old Texas Midland Railroad and the Texas & New Orleans Railroad from Dallas to Beaumont—extend through the county. No farm is farther than 15 miles from a railway shipping point. The county is traversed by two Federal and three State highways. In 1936 United States Highways Nos. 80 and 175

were hard surfaced through the county, and Texas Highway No. 34 was hard surfaced from Terrell to Kaufman. Most of the main county roads serving the smaller towns are surfaced with gravel; the rest of the roads are graded and are generally passable except for a few days after heavy rains. Few farm homes have telephones, and none except those immediately adjacent to towns are served with electric power lines. Schools and churches are adequate.

Kaufman County has no manufacturing industries other than those connected with the processing of agricultural products. The manufacturing are mainly cotton-oil mills and cotton gins. Immediately after the discovery of the Powell oil field 30 miles southwest of Kaufman, the county was the scene of intensive prospecting for oil. Many landowners have received considerable incomes from the sale of oil leases covering their lands, but so far no producing oil fields have been discovered.

CLIMATE

The climate is continental, warm, and humid. The precipitation is somewhat variable, and much of it is in the form of torrential showers. The relative humidity is low, and the rate of evaporation is high.

The summers are long and moderately hot with warm nights; the winters are short, mild, and characterized by periods, a few days long, of springlike weather suddenly followed by freezing or near-freezing temperatures, generally accompanied by north winds, which are locally called northers. The difference between the mean temperatures of the winter and summer seasons is 36° F. Temperatures higher than 90° have been recorded in every month except November and December.

The ground seldom freezes and never to a depth of more than 6 inches. The average annual snowfall is only 2.3 inches. Farm work can be performed throughout the winter.

Kaufman County lies east of the part of Texas that has a pronounced period of low rainfall during the winter, and there are no manifest wet and dry seasons. The period of heaviest precipitation—April, May, and June—is followed by the driest period—July, August, and September—which receives about two-thirds as much rainfall. Owing to the high rate of evaporation and the large demands for moisture made by growing crops during the summer, late summer stands out as a distinct dry period, and crops frequently deteriorate because of lack of sufficient moisture during that time. Fall is a secondary period of high rainfall. Although the winter rainfall is about the same as that of late summer, as regards the growth of crops winter is a wet season. This is the only time of the year when the soils generally become very moist below a depth of 2 feet. August is the month of greatest variation in rainfall, followed by November and December, and March is the month of most uniform rainfall.

The average frost-free season is 243 days, extending from March 17 to November 15. Hardy vegetables, winter cereals, and winter legumes make some growth throughout the winter, but winter oats are sometimes destroyed by freezes. Local hailstorms occasionally occur

with consequent damage to crops in small areas. The average relative humidity is 79 percent at 7 a. m. and 55 percent at 12:27 p. m.⁷

The climate is such that the crops that do best are those having the ability to become practically dormant during dry periods and to recuperate quickly when the rains come. The climate is very favorable for cotton, which withstands dry conditions well. Although the yields of cotton are somewhat reduced nearly every year by dearth of soil moisture at some time during the growing season, as a rule, owing to less damage from insects and cotton root rot disease, the yields are generally higher during normal than during unusually wet seasons. The climate is generally too hot and too dry and the precipitation too variable for the best production of corn, and 4 years out of 5 the corn crop deteriorates because of lack of moisture during the latter period of its growth. Of the feed crops, sorghums adapt themselves to the climate better than does corn. The climate is not favorable for many of the leguminous hays.

Table 1, compiled from the records of the United States Weather Bureau station at Kaufman, is representative of climatic conditions for the county as a whole.

TABLE 1.—Normal monthly, seasonal, and annual temperature and precipitation at Kaufman, Kaufman County, Tex.

[Elevation, 448 feet]

Month	Temperature			Precipitation		
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1910)	Total amount for the wettest year (1926)
	°F.	°F.	°F.	Inches	Inches	Inches
December.....	47.4	81	9	3.75	3.45	7.03
January.....	46.7	91	1	2.61	1.16	5.61
February.....	49.8	91	3	2.73	2.94	.99
Winter.....	48.0	91	1	9.09	7.55	13.63
March.....	58.1	92	21	2.97	2.44	6.03
April.....	65.8	96	29	4.73	1.81	4.26
May.....	73.1	102	37	5.26	3.38	6.98
Spring.....	65.7	102	21	12.96	7.63	17.27
June.....	81.5	107	47	3.91	3.62	2.68
July.....	85.0	110	59	2.73	.55	6.76
August.....	85.2	112	56	2.76	.91	1.43
Summer.....	83.9	112	47	9.40	5.08	10.87
September.....	78.9	105	40	3.44	.56	6.74
October.....	68.1	98	25	3.72	1.92	7.56
November.....	57.0	87	19	3.07	.05	2.26
Fall.....	68.0	105	19	10.23	2.53	16.56
Year.....	66.4	112	1	41.68	22.79	58.33

⁷ Data for Dallas, Tex., 30 miles west of Kaufman.

AGRICULTURAL HISTORY AND STATISTICS

The history of the agricultural development of Kaufman County closely parallels that of the entire Blackland Prairie of Texas. The early agriculture, beginning with the first settlement about 1840, included cattle grazing on ranches on the prairies and scattered pioneer farming on the forested lands. These agricultural activities rapidly gave way to the present cash-crop system of cotton farming.

In the earlier period the prairies constituted an excellent range for cattle. It is reported they supported from 100 to 150 head to the square mile. The native grasses cured on the ground to furnish winter feed, and prairie hay was available for emergency feed during poor growing seasons. Adequate water was obtained from creeks and branches. There was no practical way of fencing the prairies before the introduction of barbed wire, and the heavy soils were difficult to work with the draft animals and tillage implements available at that time. Railroad transportation was not available, and farm products had to be hauled in wagons to distant markets. The soils of the prairies therefore were not farmed but were more valuable as ranch land, as the cattle were transported to market readily by driving. The forested soils were almost worthless for grazing, but they furnished a supply of wood for buildings, fuel, and fences. This forested land was easily cultivated and was well suited to produce food crops required for home use. The crops consisted largely of corn produced for food for man and beast, native prairie hay, garden vegetables, a little wheat for flour, some oats, and a small quantity of cotton.

With the construction of the Texas & Pacific Railway through the county in 1872-73 and the introduction of barbed wire for fencing and of implements designed to cultivate heavy soils, the prairies began to be placed in cultivation and the area of sandy soils in cultivation increased. From 1880 to about 1915 native prairie hay, especially that produced in the vicinity of Forney, was an important agricultural product shipped from the county. By 1900 most of the area of soils well suited to crop production was in cultivation. The total acreage of cropland had increased to 75 percent of that now in cultivation, and farming had almost entirely taken the place of ranching in all sections. Most of the cropland has been cultivated from 40 to 60 years.

From 1900 to 1930 the increase in cropped land was small but fairly steady. Many old fields in the sandy and rolling sections were abandoned, but abandonment was insufficient to change the general trend of land going into cultivation. The acreage devoted to cotton more than doubled from 1899 to 1929, although it declined during the next 5 years; tenancy increased from 59.7 to 79.4 percent of the farms; and the average acre yield of cotton decreased from approximately 220 to 150 pounds of lint. Nearly all of the decrease in the average acre yield of cotton occurred prior to 1919. The cotton boll weevil first became injurious to cotton about 1905. A marked increase in the acreage devoted to feed crops took place between 1929 and 1934, although it did not offset the decrease in the production of cotton. Crops were harvested from about 50,000 fewer acres in 1934 than in 1929. Tenancy decreased slightly to 75.2 percent.

Table 2, compiled from the United States census reports, gives selected crop data for Kaufman County.

TABLE 2.—*Acres of principal crops and numbers of peach trees in Kaufman County, Tex., in stated years*

Crop	1879	1889	1899	1909	1919	1929	1934
	<i>Acres</i>						
Cotton.....	26,659	54,353	107,428	149,335	202,602	227,161	135,068
Corn.....	24,386	35,038	54,330	57,630	34,189	40,251	51,872
Oats, threshed.....	4,522	4,434	14,376	2,267	29,296	10,854	22,621
Oats, cut and fed unthreshed.....						3,260	5,593
Wheat.....	8,921	1,450	7,177	27	11,064	603	1,033
Sorghums for grain.....				48	475	1,439	3,513
Watermelons.....						113	331
All hay.....	1,003	14,465	19,961	14,343	4,161	15,427	19,979
Alfalfa.....			77	676		1,311	3,364
Other tame hay.....			2,704	2,774	2,059	1,782	6,615
Wild hay.....			17,180	10,893	2,102	2,334	
Sorghums for silage, hay, and fodder.....					5,702	6,610	15,100
Peaches ⁴	<i>Trees</i>						
		53,818	65,765	51,218	29,050	20,541	16,513

¹ Excludes sorghums for hay.

² Includes wild hay.

³ Sorghums for forage.

⁴ Number of peach trees reported are for the years 1890, 1900, 1909, 1919, 1930, and 1935.

On January 1, 1935, according to the census, livestock on farms included 24,286 cattle, 10,959 mules and mule colts, 2,809 horses and colts, 9,103 hogs and pigs, 2,721 sheep and lambs, and 130,339 chickens.

More than four-fifths, in fact, the entire area of the county except the small amount included in towns, roads, and railroad rights-of-way, and the like, is used for agricultural purposes. The 1935 census reports 4,793 farms with an average size of 94.5 acres, of which an average of 51.7 acres was cropland harvested and 3.8 acres land on which crops were a failure. In 1930, farms ranging from 100 to 174 acres in size embraced 29 percent of the total area in farms, and farms between 50 and 99 acres embraced 26 percent. In 1935 the trend was slightly toward fewer and larger farms.

In 1935, 24.3 percent of the farms were operated by owners, 75.2 percent by tenants, and 0.5 percent by managers. About 42 percent of the tenants are sharecroppers; that is, they rent farms on which the landlord furnishes the work animals, feed, and equipment and receives one-half of all crops as rent. Nearly all of the rest of the tenant farms rent for one-fourth of the cotton and one-third of the feed crops. Cash leases are very unusual and are confined largely to land leased for grazing. The leases commonly are for 1-year periods.

Farm labor usually is plentiful. Most of the labor is performed by the farmer and his family; extra help is commonly employed for cotton chopping and picking. Most of the laborers hired for cotton picking are Negroes or transient whites. An expenditure of \$615,820 for wages was reported by 1,875 farms in 1929, or an average of \$328 per farm reporting.

Very little commercial fertilizer is used in the county, and none is used on the regular cropland. Barnyard manure is not conserved carefully, and, owing to its rapid decomposition in this warm climate and the small number of livestock kept, very little manure is available. Practically none is used for farm crops. Most of the available manure is applied to the gardens.

Most of the farmhouses are unpainted four- or five-room wooden buildings, but a few are excellent well-kept homes. The other farm

buildings are few and small. Livestock require little shelter, and the requirements for storage space for feedstuffs are small. The investment in farm machinery is very small. The implements used on most farms are a middlebuster, a turning plow, a cotton planter, a riding cultivator, a section harrow, a wagon, and various hand tools. According to the census of 1930, the value of all farm property per farm was \$5,911, of which \$5,364 represented land and buildings. The average investment in farms was distributed as follows: 74.6 percent in land, 16.2 percent in buildings, 3.4 percent in implements, and 5.8 percent in domestic animals. In 1935 the average value of land and buildings was \$3,267 per farm.

SOIL-SURVEY METHODS AND DEFINITIONS

Soil surveying consists of the examination, classification, and mapping of soils in the field.

The soils are examined systematically in many locations. Test pits are dug, borings made, and exposures, such as those in road or railroad cuts, are studied. Each excavation exposes a series of distinct soil layers, or horizons, called, collectively, the soil profile. Each horizon of the soil, as well as the parent material beneath the soil, is studied in detail; and the color, structure, porosity, consistence, texture, and content of organic matter, roots, gravel, and stone are noted. The reaction of the soil⁸ and its content of lime and salts are determined by simple tests.⁹ Drainage, both internal and external, and other external features, such as relief, or lay of the land, are taken into consideration, and the interrelation of soils and vegetation is studied.

The soils are classified according to their characteristics, both internal and external, especial emphasis being given to those features influencing the adaptation of the land for the growing of crop plants, grasses, and trees. On the basis of these characteristics soils are grouped into mapping units. The three principal units are (1) series, (2) type, and (3) phase. In places two or more of these principal units may be in such intimate or mixed pattern that they cannot be clearly shown separately on a map, but must be mapped as (4) a complex. Areas of land, such as coastal beach or bare rocky mountainsides that have no true soil, are called (5) miscellaneous land types. None of the latter class occur in this county.

The most important group is the series, which includes soils having the same genetic horizons, similar in their important characteristics and arrangement in the soil profile, and developed from a particular type of parent material. Thus the series includes soils having essentially the same color, structure, and other important internal characteristics, the same natural drainage conditions, and the same range in relief. The texture of the upper part of the soil, including that commonly plowed, may differ within a series. The soil series are given names of places or geographic features near which they were first recognized. Thus Wilson, Houston, Crockett, and Trinity are names of important soil series in this county.

⁸ The reaction of the soil is its degree of acidity or alkalinity expressed mathematically as the pH value. A pH value of 7 indicates precise neutrality, higher values indicate alkalinity, and lower values indicate acidity.

⁹ The total content of readily soluble salts is determined by the use of the electrolytic bridge. Phenolphthalein solution is used to detect a strong alkaline reaction.

Within a soil series are one or more soil types, defined according to the texture of the upper part of the soil. Thus, the class name of the soil texture, such as sand, loamy sand, sandy loam, loam, silt loam, clay loam, silty clay loam, and clay, is added to the series name to give the complete name of the soil type. For example, Wilson clay loam and Wilson very fine sandy loam are soil types within the Wilson series. Except for the texture of the surface soil, these soil types have approximately the same internal and external characteristics. The soil type is the principal unit of mapping, and because of its specific character it is usually the soil unit to which agronomic data are definitely related.

A phase of a soil type is a variation within the type, which differs from the type in some minor soil characteristic that may have practical significance. Differences in relief, stoniness, and the degree of accelerated erosion are frequently shown as phases. For example, within the normal range of relief for a soil type, some areas may be adapted to the use of machinery and the growth of cultivated crops and others are not. Even though there may be no important difference in the soil itself or in its capability for the growth of native vegetation throughout the range in relief, there may be important differences in respect to the growth of cultivated crops. Under such conditions the more sloping parts of the soil type may be segregated on the map as a sloping or a hilly phase. Similarly, soils having differences in stoniness may be mapped as phases, even though these differences are not reflected in the character of the soil or in the growth of native plants.

The soil surveyor makes a map of the county or area, showing the location of each of the soil types, phases, complexes, and miscellaneous land types, in relation to roads, houses, streams, lakes, section and township lines, and other local cultural and natural features of the landscape.

SOILS AND CROPS ¹⁰

Kaufman County lies in the eastern part of the Blackland Prairie of Texas, and extensive areas consist of smooth dark-colored soils of the prairies, which have medium to very high natural fertility. In

¹⁰ Owing to the mapping of soil distribution in greater detail and to modifications in soil classification necessitated by development of soil knowledge during recent years, some of the soil areas along the county boundaries are mapped differently from adjoining areas in previously surveyed counties. Most of the differences are in areas along the boundaries between Kaufman County and Van Zandt and Henderson Counties. Many areas of soils formerly included in the Susquehanna series in the last counties have been correlated with the Tabor and Kirvin series in Kaufman County. The difference in classification of areas along the western part of the Kaufman-Henderson County line is largely the result of recognition of old high terraces in that vicinity. The following tabulation shows the principal differences in designation of adjoining areas in Kaufman and adjacent counties:

<i>Soil name used in Kaufman County</i>	<i>Soil name used in Dallas County</i>	<i>Soil name used in Henderson County</i>
Lewisville clay, slope phase-----	Lewisville clay.	
Cahaba fine sandy loam, slope phase--	Cahaba fine sandy loam.	
		Crockett fine sandy loam.
Crockett very fine sandy loam-----		Susquehanna fine sandy loam.
Crockett very fine sandy loam, rolling phase-----		Crockett fine sandy loam.
Kirvin fine sandy loam-----		Susquehanna fine sandy loam.
Leaf fine sandy loam, slope phase-----		Crockett fine sandy loam.
Leaf fine sandy loam-----		Susquehanna fine sandy loam, mound phase.
Tabor fine sandy loam, mound phase-----		
Lufkin very fine sandy loam, mound phase-----		
Irving clay-----	Wilson clay.	
Irving clay loam-----		

the eastern and southwestern parts are sections of light-colored sandy forested soils of low or moderate natural fertility. These are westward segments or outliers of the main sandy forested body of the Gulf Coastal Plain, which is known in Texas as the east Texas timber country. The soils and agriculture are similar to those of several counties lying partly within the Blackland Prairie and partly within the east Texas timber country.

The soils of Kaufman County are of four general divisions. They are grouped according to their broader relationships in general characteristics, their types of development, and their associated occurrence. These groups are as follows: (1) Acid soils of the prairies, (2) heavy calcareous soils of the prairies, (3) light-colored sandy soils of the forested lands, and (4) soils of the bottom lands. These four groups, for the most part, occupy separate sections of the county, as shown in figure 2.

The soils differ widely in both physical and chemical characteristics; that is, they range from pale-yellow almost loose sandy soils of low productivity to black heavy highly productive clays. The upland soils have been developed through soil-forming processes from unconsolidated beds of sands and clays, some of which are noncalcareous, but most of which range in content of calcium carbonate from moderate to extremely high. Those developed under forest cover from sands and sandy clays containing little or no carbonate of lime are light-colored, acid, leached, and of low natural fertility. Those developed under grass from clays containing little or only moderate amounts of calcium carbonate are acid and dark-gray or brown soils. They have very compact and slowly pervious subsoils of tough heavy clay and, where smooth, are of good productivity. The soils developed on smooth surfaces under grass from very highly calcareous clays or marls are black deep crumbly very fertile heavy soils with calcareous to neutral surface layers.

Large bodies of smooth dark-gray tight acid soils (Wilson soils) occur in the central and eastern parts of the county. These soils range from very fine sandy loam to clay in texture. Although of somewhat droughty character, owing to the compact subsoils, they are naturally of medium to fairly high productivity for general crops other than

¹⁰—Continued.

<i>Soil name used in Kaufman County</i>	<i>Soil name used in Henderson County</i>
Cahaba fine sandy loam, slope phase----	Ruston fine sandy loam, deep phase.
Catalpa clay-----	Trinity clay.
Kaufman fine sandy loam-----	Ochlockonee fine sandy loam.
Kaufman clay-----	Johnston clay.
	<i>Soil name used in Hunt County</i>
Norfolk loamy fine sand-----	Bowie loamy fine sand.
Tabor fine sandy loam, mound phase--	Tabor fine sandy loam.
Tabor-Lufkin complex-----	Tabor loamy fine sand.
	<i>Soil name used in Rockwall County</i>
Wilson clay loam, slope phase-----	Wilson clay loam.
Hunt clay-----	Houston Black clay.
Bell clay-----	Houston clay.
Houston Black clay-----	
Wilson clay-----	
	<i>Soil name used in Van Zandt County</i>
Crockett clay loam, eroded phase-----	{ Crockett clay loam.
Crockett very fine sandy loam, rolling phase-----	
Kaufman fine sandy loam-----	{ Crockett very fine sandy loam.
Kaufman clay loam-----	{ Durant fine sandy loam.
Kirvin fine sandy loam-----	{ Ochlockonee fine sandy loam.
Tabor fine sandy loam, mound phase----	{ Johnston silt loam.
	{ Susquehanna fine sandy loam.

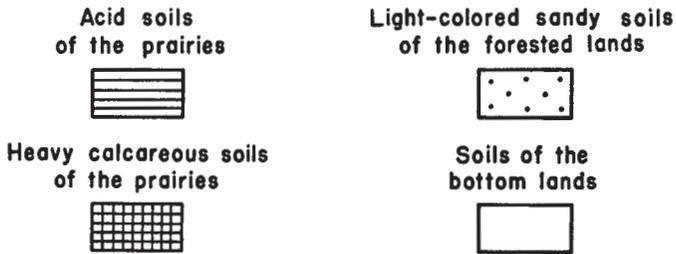
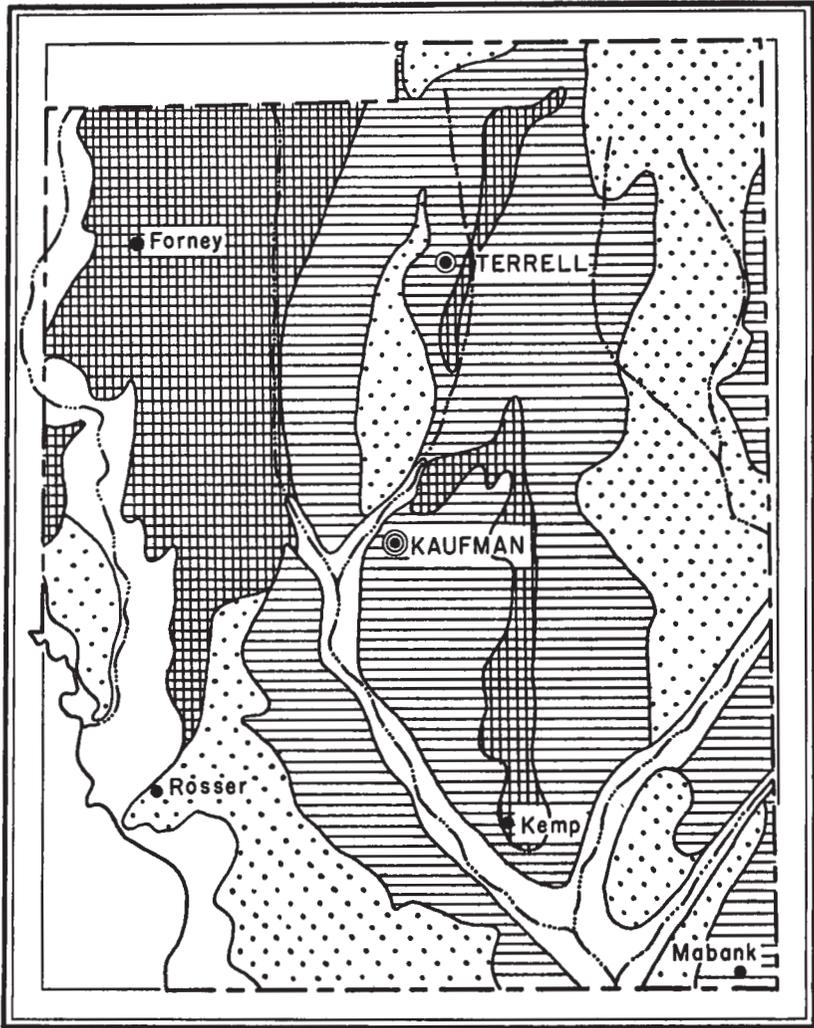


FIGURE 2.—General soil areas of Kaufman County, Tex.

corn. They have been developed from calcareous clays containing only moderate quantities of calcium carbonate. They are very largely in cultivation and are used chiefly for general cotton farming. Most

of the smaller associated areas of brown or grayish-brown soils with reddish-brown subsoils are sloping, eroded, and of low productivity for field crops. They are used mostly as pasture.

The northeastern quarter of the county is underlain by highly calcareous clays or marls. The areas were prairies, and the extensive smooth soils are the deep black crumbly heavy clays, chiefly of the Houston Black and Hunt series, of such physical character that crops withstand dry weather very well. They are highly productive for all general field crops and are almost entirely cultivated. They are used mainly for the production of cotton. Small associated areas of strongly sloping eroded soils, chiefly of the Sumter series, are of low productivity for general field crops and are used mostly as pasture.

Light-colored sandy soils that have developed under forest growth from beds of sands and clay containing very little or no calcium carbonate occur in a belt about 5 miles wide along the eastern side of the county and on the extensive high forested flats (old stream terraces) in the southeastern part, also in two smaller bodies north of Kaufman and Terrell. These soils are for the most part light-gray or pale-yellow sandy loams with clay or sandy clay subsoils of various colors. These soils are representative of extensively developed soils in the main body of the east Texas timber country, which is separated from the isolated forested belts of eastern Kaufman County by a strip of prairie ranging from 5 to 10 miles in width. These soils are naturally of rather low fertility but produce good crops of cotton, corn, and a wide variety of special fruit and truck crops when fertilized and well managed. The smooth areas are partly in cultivation and are used in general for cotton farming. Small numbers of livestock are kept, and some truck and fruit crops for local markets are grown. Under prevailing practices of farming, fertility is not maintained and productivity is very low, except on comparatively new land. Considerable acreages of the smooth areas, together with most of the sloping areas, are uncleared. They are used mainly as woodland pasture but furnish little grazing. On these sandy soils a considerable proportion of the areas that have been cleared and cropped is now in abandoned fields, which are idle or utilized for the scant pasturage they afford. A growth of trees does not naturally reestablish itself in the pastured fields.

The broad flood plains of the Trinity River, the East Fork Trinity River, and Cedar Creek, and some of the smaller flood-plain areas of many small streams are occupied by soils consisting largely of surface soil material washed from soils of the upland prairies. These bottom-land soils are potentially very productive, but they are overflowed several times a year. The larger areas are very heavy clays with slow internal drainage and are, for the most part, too poorly drained for the successful production of field crops except where protected from overflow. Many areas have been protected by the construction of levees. Such areas, together with many areas in the smaller flood plains where drainage conditions are better are highly productive and are largely in cultivation. They are used chiefly for cotton and corn, but grain sorghums and alfalfa are grown to some extent.

The principal influence of soils upon agriculture in Kaufman County has been that of causing a highly intensive type of cotton production. Inasmuch as the county includes large areas of naturally

fertile soils, it is a good farming section. Climatic and economic factors largely determine the crops that are grown. In general, cotton is the cash crop best suited to the environment, and it is grown on practically all kinds of soils cultivated, regardless of their productive capacity. Prior to the recent restriction in the production of cotton, about three-fourths of all the cultivated land was devoted to this crop, and the rest was used mainly for the production of feed and subsistence crops for home and local use. The principal general farm crop is corn. Oats, grain sorghums, and sorgo are grown to less extent. Cotton so dominates the use of cropland that during some years insufficient feed is produced to maintain the farm livestock, and feed has to be brought into the county. In 1934 the proportion of cotton acreage to total cropland was reduced. Cotton is the major crop on all cultivated soils, but it occupies slightly larger proportions of the cropland on the more productive soils.

The prevalent type of farming consists of almost continuous cotton growing, alternated every third or fourth year with a nonleguminous feed crop, generally corn or oats, without the use of any manure, fertilizer, or soil-improvement crop. These crops afford very little protection from soil washing, and erosion is severe on moderately sloping cultivated fields unless they are protected. The moderately sloping soils are in places being utilized for a type of farming to which they are not well suited. When the average yield of cotton falls below about 75 pounds of lint to the acre, which has happened only in some fields on the light-colored sandy soils and on soils with rolling surfaces, the fields are usually retired from cultivation. The average yield of cotton throughout the county, as estimated by the Agricultural Adjustment Administration, is 146 pounds of lint to the acre. The trend of average cotton yields is downward, but not strongly so. The decrease in productivity with continuous cropping varies greatly among different soils. On the light-colored sandy soils of the forested lands and on soils with moderately to steeply sloping surfaces, the cotton yields are much lower in old fields than in new ones; on smooth, sandy soils of the prairies they are considerably lower; and on smooth, crumbly heavy soils of the prairies only slightly lower. In 1929, 57,698 bales of cotton were produced from 227,161 acres, whereas in 1934, 36,834 bales were produced from 135,068 acres. Normally the county produced about 65,000 bales of cotton annually prior to the inception of governmental crop control in 1933.

The selection of crops other than cotton is influenced to a large extent by soil conditions. The production of corn, the principal feed crop, is confined largely to fertile soils with very favorable moisture conditions, such as the smooth, crumbly heavy soils of the prairies and the better drained bottom-land soils. The average yield of corn is approximately 17 bushels to the acre over a period of years, but it differs greatly from year to year. Average yields of 30 bushels are obtained during very favorable seasons, but years of near failure are not uncommon. Corn frequently deteriorates because of a lack of sufficient available moisture during the latter period of its growth, but on the better soils it produces as well as other feed crops. In 1929, corn occupied about two-thirds of all the cropland not devoted to cotton, or one-seventh of all cropland, whereas in 1934 it occupied one-fifth of the total cropland.

Oats are grown more extensively on the acid soils of the prairies than on other soils. On these tighter and somewhat less fertile soils oats do better than corn. Oats are not so generally grown on the crumbly, heavy soils of the prairies, as they grow so rank that they lodge. Oats occupy about one-tenth of the total cropland, and their average yield is about 25 bushels to the acre. A very small acreage is devoted to wheat, which yields an average acre-yield of about 13 bushels.

The hay and forage crops, principally sorgo and grain sorghums, are commonly grown on the fields constituting the poorest cropland. Sorgo frequently is grown on land that is washing badly or is infested with Bermuda grass or Johnson grass. The average acre yield of sorgo is about 1 ton of hay for the county as a whole, but average yields of 3 tons to the acre are obtained on the better soils. The grain sorghums, principally kafir, milo, darso, and hegari, supplement corn as the intertilled feed crops, especially on the less productive soils. They are utilized either as forage, by harvesting and feeding in the bundle, or as a grain crop. The average yield of grain sorghum for the county is approximately 15 bushels of grain or 1½ tons of forage and heads to the acre. On thin or poorly drained soils the yields of grain are somewhat higher than those of corn, and on the most productive soils, the yields of grain of the better adapted varieties are approximately the same as those of corn. About 2,000 acres of rolling crumbly heavy soils of the prairies are in native meadow and are utilized for the production of prairie hay, the average yield being about 1 ton to the acre. An area including about 1,300 acres of bottom-land soils near Rosser, protected from overflows by levees, is devoted to alfalfa, of which the average acre yield is about 3 tons. Hay crops and sorghums for forage occupy about one-tenth of the total area in crops, and sorghums harvested for grain occupy less than 2 percent.

About 1,000 acres are devoted annually to the commercial production of onions, which are grown only on the smooth crumbly heavy soils of the prairies, in the vicinities of Crandall, Gastonia, and Forney. According to apparently well-informed farmers, onions grow well on many soils, but only on the deepest and most fertile soils are the yields high enough to warrant commercial production. A few farmers reported that many of the onions grown on tight heavy soils of the prairies, such as Wilson clay, are misshapen. Onions yield an average of about 100 bushels to the acre. Small acreages of the light-colored sandy soils are utilized for the production of peanuts, cowpeas, and sweetpotatoes. A small quantity of sorgo for sirup is produced on the sandy bottom lands and the light-colored sandy soils. Some of the principal vegetables produced for home use in the farm gardens are sweetpotatoes, potatoes, onions, black-eyed peas, snap beans, turnips, tomatoes, English peas, squashes, sweet corn, and mustard. In 1929 vegetables were harvested for sale from 176 acres and in 1934 from 839 acres.

In the following pages the soils of Kaufman County are described in detail, and their agricultural importance is discussed; their distribution is shown on the accompanying soil map, and their acreage and proportionate extent are given in table 3.

TABLE 3.—*Acreage and proportionate extent of the soils mapped in Kaufman County, Tex.*

Soil type	Acres	Per- cent	Soil type	Acres	Per- cent
Wilson clay loam.....	44,480	8.6	Leaf fine sandy loam.....	20,096	3.9
Wilson clay.....	24,576	4.8	Cahaba fine sandy loam.....	2,816	.5
Irving clay loam.....	2,944	.6	Norfolk loamy fine sand.....	1,856	.4
Irving clay.....	5,696	1.1	Kalmia loamy sand.....	832	.2
Wilson very fine sandy loam.....	29,248	5.7	Kirvin fine sandy loam.....	14,784	2.9
Wilson very fine sandy loam, mound phase.....	7,872	1.5	Ruston fine sandy loam.....	2,660	.5
Crockett very fine sandy loam.....	16,000	3.1	Leaf fine sandy loam, slope phase.....	2,752	.5
Crockett fine sandy loam.....	5,696	1.1	Cahaba fine sandy loam, slope phase.....	6,208	1.2
Irving fine sandy loam.....	2,112	.4	Lufkin very fine sandy loam, mound phase.....	22,976	4.4
Wilson clay loam, slope phase.....	18,240	3.5	Tabor-Lufkin complex.....	16,832	3.3
Wilson clay, slope phase.....	12,096	2.3	Myatt silt loam.....	3,264	.6
Crockett very fine sandy loam, roll- ing phase.....	30,400	5.9	Myatt clay loam.....	3,136	.6
Crockett clay loam, eroded phase.....	15,168	2.9	Trinity clay.....	47,808	9.2
Crockett fine sandy loam, steep phase.....	1,984	.4	Catalpa clay.....	1,728	.3
Houston Black clay.....	20,672	4.0	Kaufman clay.....	25,856	5.0
Hunt clay.....	22,144	4.3	Kaufman clay loam.....	15,168	2.9
Bell clay.....	9,856	1.9	Kaufman clay loam, high-bottom phase.....	832	.2
Lewisville clay loam.....	896	.2	Kaufman fine sandy loam.....	8,512	1.7
Houston clay.....	15,616	3.0	Kaufman fine sandy loam, high- bottom phase.....	4,096	.8
Lewisville clay, slope phase.....	3,328	.6	Ochlocknee loamy fine sand.....	896	.2
Sumter clay.....	3,264	.6			
Tabor fine sandy loam, mound phase.....	21,824	4.2	Total.....	517,120	

ACID SOILS OF THE PRAIRIES

The acid soils of the prairies may be separated into four subgroups, on the basis of physical characteristics and value for crops, as follows: (1) Smooth tight heavy soils; (2) smooth sandy soils; (3) sloping tight heavy soils; and (4) sloping sandy soils. This broad group of more or less acid soils occurs in a general belt in the eastern part of the Blackland Prairie and decreases in extent southward. It includes dark-gray, brown, and grayish-brown acid soils with compact and slowly pervious subsoils, of the Wilson, Crockett, and Irving series. The texture of the surface soils ranges from clay to fine sandy loam, and the consistence from gummy and tight to friable though somewhat crusty.

These soils are underlain by and developed from unconsolidated beds of clay containing small or moderate quantities of calcium carbonate. The subsoils and substrata are very slowly pervious to moisture, and little or practically no water passes down through the soil layers beyond the reach of plant roots. Most areas of the Wilson and Crockett soils have no permanent ground-water table to a depth of several hundred feet or more; in many areas of the Irving soils a permanent water table lies from 20 to 50 feet below the surface. Over most of the land there are no native trees, and only the most hardy species thrive when planted, apparently because of the compact subsoils and dearth of moisture during dry summers. The soils were developed under grass, and considerable amounts of thoroughly decomposed organic matter are intimately distributed through the upper soil layers. Though underlain by more or less calcareous materials, the soils have been leached so that the upper soil layers are now strongly to moderately acid. The reaction gradually becomes less acid with depth, becomes neutral within a depth of 2 or 3 feet, and slightly to moderately calcareous at a depth ranging from 4 to 10

feet in smooth areas. The acidity of the surface soil is greater than that commonly considered by agronomists to be the tolerance limit for good growth of alfalfa and sweetclover but not too great for good growth of the common field crops.

The Wilson soils have dark-gray crusty or tight surface soils underlain by dark-gray very compact heavy clay subsoils. They range in texture from very fine sandy loam to clay. They occur extensively in smooth nearly level to gently undulating slowly drained areas. The underlying formations are compact, nearly impervious beds of slightly to moderately calcareous clays of marine origin. These soils are moderately to highly productive for general field crops.

The Crockett soils have grayish-brown or brown surface soils ranging from 4 to 15 inches in thickness, underlain by mottled brown and brownish-red subsoils of heavy compact clay. The upper subsoil layer, which is mottled with red, ranges from 4 to 15 inches in thickness and grades into olive-yellow or mottled yellow and gray heavy clay. The relief is undulating to strongly rolling, and drainage is characteristically more rapid than in the Wilson soils. The natural fertility of the Crockett soils, which originally was fair to good for general field crops, has been very much reduced by severe erosion in rolling and steep areas. The subsoils of the smoother Crockett soils in Kaufman County are slightly more compact than is characteristic of soils of this series as developed elsewhere.

The Irving soils are very similar to the Wilson soils, but they have developed from parent materials of alluvial origin and occur only in slowly drained positions on stream terraces.

SMOOTH TIGHT HEAVY SOILS

The subgroup of smooth tight heavy soils includes Wilson clay loam, Wilson clay, Irving clay loam, and Irving clay. These soils are productive and are well suited to cotton farming. They are smooth, and, so far as relief is concerned, all types of agricultural implements may be used with ease. Erosion has not become a serious problem, and, where necessary, soil washing can be controlled at a comparatively low cost without greatly reducing the proportion of cultivated land used for intertilled crops. Surface drainage is slow to very slow, and there is very little underdrainage, but these soils are not too wet for good growth of the general field crops. They dry more slowly than do the blackland soils and are frequently too wet for corn to grow well during early spring. They are somewhat intractable, puddle and pack if worked too wet, and crust on drying after rains, so that seed frequently does not come up. When worked under proper moisture conditions, they crumble to fine particles. The stores of organic matter and available plant nutrients are fairly high in the virgin soil. Yields have decreased considerably but comparatively slowly under continuous cropping without fertilization or manuring.

These soils are almost entirely used for cotton farming. About four-fifths of each soil is in cultivation and is devoted mainly to the production of cotton, together with oats and corn as the principal feed crops. The proportion of cultivated land in oats is much larger and in corn much smaller than on the smooth blackland soils. The soils are commonly too cold and wet in spring and too dry in summer

to produce good yields of corn. Small acreages are devoted to grain sorghums and sorgo for feed and to wheat for sale.

Farmers who have tried alfalfa on these soils report the crop does not grow very well, possibly because of lack of moisture. It seems that the moisture conditions in these soils are not generally satisfactory for alfalfa.

Vegetables grow sufficiently well to supply home needs but not well enough to justify their commercial production. The few peach and pear trees planted to supply fruit for the farm home produce fairly well but are not generally very thrifty and are reported to be short-lived.

Wilson clay loam.—Wilson clay loam is locally known as mixed land or gray prairie loam. In some parts of Texas it is known as rawhide land. It is a smooth gray soil that crusts on drying but is productive for cotton, small grains, and sorghums. It is regarded by farmers as a desirable soil but less productive and more difficult to cultivate than some heavy calcareous soils of the prairies.

The surface soil is dark-gray moderately acid clay loam or silty clay loam, averaging about 6 inches but ranging from 3 to 12 inches in thickness. This material grades, through a thin transitional layer, into a subsoil of dark-gray or very dark gray tough and dense heavy clay. Below a depth of about 24 inches the subsoil gradually becomes less dark and grades into gray noncalcareous very compact clay at a depth of about 48 inches. This deeper material is mottled with some yellow and becomes calcareous at a depth ranging from 5 to 6 feet.

Dry clods of the surface soil are porous but extremely hard, and they break under pressure into fine powder. The tilled surface layer is either cloddy or a loose layer of fine crumbs. In undisturbed areas the material between depths of about 4 and 12 inches is faintly granular, that is, the natural breakage surfaces are bumpy or nodular and the material is porous. Below a depth of about 12 inches the material is extremely compact, almost massive in place, and blocky when dug out. The material between depths of 12 and 36 inches appears to be slightly more compact than that below. A very few inconspicuous shotlike concretions of iron oxide are present in all soil layers.

Typical areas of Wilson clay loam are gently undulating and have a surface gradient of less than 3 percent. Most of the soil is not subject to severe erosion. Surface drainage is slow but adequate for good growth of crops. The lower soil layers are so slowly permeable that no appreciable amount of soil moisture is lost through percolation, and the soil has practically no underdrainage. In the few nearly level areas where water stands for short periods after rains the soil is very slightly darker than in areas that have free surface drainage.

Wilson clay loam is the most extensive soil of the uplands in the county. It occupies broad uniform areas within a north-south belt which extends through the central part.

Wilson clay loam is good farming land. About 85 percent of the total area is in cultivation, and normally about three-fourths of the cropped acreage is planted to cotton. No abandoned fields are to be seen. Oats constitute the principal feed crop grown on this soil, and it is generally reported to be one of the best soils in the county

for small grains. The soil is not very well adapted to corn, as in dry seasons this crop suffers more quickly from lack of moisture on this soil than on bottom-land soils and heavier granular soils of the prairies. The average acre yields over a period of years are estimated at about 160 pounds of cotton lint, 15 bushels of corn, 35 bushels of oats, 15 to 25 bushels of grain sorghums, and 2 to 3 tons of sorgo forage.¹¹ The best cotton yields generally are obtained in years of high rainfall. At such times yields may be higher than those on the smooth blackland soils, such as Houston Black clay, as injury from insects and plant diseases generally is less. Cotton makes a moderate growth of stalk on this soil and fruits heavily. The maximum yield of cotton under very favorable conditions is about 300 pounds of lint to the acre.

Wilson clay.—This soil is commonly known as blackland, although it is recognized as being less black and crumbly than such heavy calcareous blackland soils as Houston Black clay. It is the darkest, heaviest, and most productive Wilson soil. It is a dark-gray tight heavy soil which, although somewhat intractable, produces very good crops of cotton, small grains, and sorghums, and fairly good crops of corn. It is regarded by farmers as a very desirable soil but rather difficult to work and somewhat less productive and less drought-resistant than Houston Black clay.

The plowed surface soil is dark-gray acid crusty clay or light clay. Below this is dark-gray or very dark gray acid tough extremely heavy clay. Below a depth of about 20 inches, the subsoil gradually becomes less dark and grades into gray noncalcareous very compact clay slightly mottled with yellow at a depth of about 40 inches. The underlying material is light-gray or grayish-yellow calcareous very compact clay below a depth of about 5 feet.

When worked within the narrow range of proper moisture content, the soil pulverizes readily to medium crumbs. It puddles and dries to intractable clods, however, if worked too wet, or works up very cloddy if dry. It bakes and crusts over on drying if not cultivated after rains, and the surface crust which forms frequently prevents emergence of germinating plants.

In undisturbed areas there is a surface film ranging from $\frac{1}{8}$ to 2 inches in thickness of gray or dark-gray faintly platy silty clay loam. This grades into dense dark-gray or very dark gray heavy clay. The clay material is gummy and very plastic when moist and extremely tough and hard when dry, breaking into irregular clods. The material between depths of 12 and 36 inches appears to be slightly more compact than the other layers, but all materials, including the underlying parent material, are very dense.

Wilson clay occupies many large and small areas, one of the largest being 2 miles south of Gastonia. Many of the bodies are transitional between Wilson clay loam and Hunt clay. Typical areas of this soil are nearly level or gently undulating and are not subject to severe soil washing where intertilled crops are grown. The areas have surface gradients of less than about $2\frac{1}{2}$ percent. Drainage is

¹¹ All estimates of crop yields were made by carefully evaluating information obtained from local farmers, Agricultural Adjustment Administration data, census reports, and available experimental work. Unless otherwise stated, they refer to average yields over a period of years on all cultivated areas of the soil. As productivity varies with management, the estimates should not be interpreted as applicable to each individual field.

slow, in places very slow, but generally it is adequate for good growth of field crops.

This soil is very good cropland. About 85 percent of the total area is in cultivation. Normally, cotton occupies about 75 percent of the cropped acreage, and corn, oats, and sorghums occupy about equal proportions of the rest. Yields of cotton are slightly less, yields of corn are considerably less, and yields of small grains are about equal to those obtained on Houston Black clay. Wilson clay is somewhat more droughty and is distinctly more tight and crusty than is Houston Black clay. The average acre yields over a period of years are about as follows: Cotton, 175 to 200 pounds of lint; corn, 15 to 25 bushels; oats, 35 bushels; grain sorghums, about 20 bushels; and sorgo, 2 to 3 tons of forage.

Irving clay loam.—This soil is of much the same character, appearance, and agricultural value as Wilson clay loam. It is a gray, slowly drained, tight soil occupying nearly level high flats or old stream terraces. It is a productive soil for general field crops and is regarded by farmers as desirable land, although it is somewhat cold and difficult to work.

The surface soil is dark-gray moderately acid clay loam or silty clay loam, about 6 inches thick in most places but ranging from 3 to 12 inches in others. This grades through a thin transitional zone into the subsoil of dark-gray or very dark gray noncalcareous tough dense very heavy clay. Below a depth of about 24 inches the subsoil gradually becomes less dark and grades into gray very compact slightly calcareous heavy clay at a depth of 50 or 60 inches below the surface. This underlying material is slightly mottled with dull yellow and contains a few crumbly concretions of white calcium carbonate and rusty black iron oxide.

The soil is readily worked within a very limited range of moisture content. When dry, it is very hard, and when fairly moist it puddles if disturbed. The structure and consistence of the various layers appear the same as in the corresponding layers of Wilson clay loam.

Irving clay loam occupies high practically level old stream terraces in the southwestern part of the county. The principal areas are on Bakers Prairie in the south-central part and on the point of highland between the Trinity River and the East Fork Trinity River. The land is slowly drained. According to old residents, before the construction of graded roads and a few drainage ditches, shallow pools of water stood on the surface for a month or longer during wet seasons. Drainage now is adequate for good yields of nearly all field crops, although water occasionally stands in places for a few days. The areas originally were covered with grass, for the most part, but the margins adjacent to sandy soils and some of the lower lying areas supported an open growth of small elm trees.

Irving clay loam is a very good soil for many crops. Drainage is slightly deficient, and the soil is cold and late. About 80 percent of the total area is cultivated. Normally, cotton occupies about three-fourths of the area in cultivation, and corn, oats, and sorghums occupy about equal portions of the rest. This is a comparatively productive soil for both cotton and oats, and a relatively unproductive soil for corn. Acre yields over a period of years are as follows: About 160 pounds of cotton lint, 15 bushels of corn, 30 to 40 bushels

of oats, 15 to 25 bushels of grain sorghums, and 2 to 3 tons of sorgo forage.

Irving clay.—This soil has essentially the same appearance and utility as nearly level areas of Wilson clay, from which it differs mainly in being underlain by parent materials laid down by fresh-water streams. It is commonly known as blackland but is recognized as being tighter, somewhat grayer, and slightly less productive than the deep heavy calcareous blackland soils. Local farmers consider it highly productive but somewhat difficult to work.

The 4-inch tilled surface soil in fields is dark-gray acid crusty clay or light clay. This rests on very dark gray acid dense very heavy clay, which becomes less acid with depth and grades into dark-gray noncalcareous very tough and compact clay at a depth ranging from 24 to 45 inches. The dark-gray clay continues to a depth of about 5 feet where it grades into gray very compact nearly impervious clay. The material below a depth of about 4 feet is either slightly calcareous or a noncalcareous mass containing a few soft white concretions of carbonate of lime. It is slightly mottled with dull yellow and contains some friable black lumps, which are probably iron oxide.

This soil has the same structure as Wilson clay. It is friable only within a very narrow range of moisture content and dries to a very hard mass unless cultivated before becoming too dry or if worked when too wet.

Irving clay occupies several medium-sized areas on flat high old stream terraces in the southwestern part of the county. The largest are between Crandall and Rosser and in Crawfish Prairie, Long Prairie, and Bakers Prairie. These prairies are areas of Irving soils surrounded by sandy forested soils of the Leaf series. The more typical areas are flat and practically level. Drainage is very slow, and surface water may stand for short periods. The native vegetation is grass.

About 80 acres in the eastern part of the area 3 miles southeast of Crandall, the body of about 160 acres in the Flinn survey 3 miles northeast of Rosser, and the area of about 300 acres 1.6 miles east of Rosser are much like Myatt clay. In these areas the 2- to 4-inch surface soil is dark-gray strongly acid heavy clay. It grades into pale-gray strongly acid extremely compact heavy clay having a faint tinge of yellow and a few spots of rusty brown. The pale-gray clay continues to a depth of about 4 feet where it grades into gray slightly calcareous clay containing concretions of calcium carbonate. All soil layers contain a number of black pellets of iron oxide. This included soil is naturally too poorly drained for successful production of general field crops. Where artificially drained by ditching, it appears to be fairly productive but somewhat less so than Irving clay. The undisturbed areas of this included soil have an uneven, or hog-wallow, surface and for the most part are covered with native grasses. Some of the areas adjacent to sandy soils are covered with small elm and post oak trees. About one-half of the included soil is in cultivation. Farmers report that productivity increases for several years after the land is placed in cultivation, and they assign the cause to the gradual improvement of drainage conditions due to tillage.

Practically all of the typical soil is in cultivation. The crops grown and yields are about the same as on Wilson clay. Cotton normally occupies more than one-half of the cropped acreage and produces from 175 to 200 pounds of lint to the acre. The rest of the land is utilized mainly for oats and corn, together with some grain sorghums. The average acre yields of these crops are about 35 bushels of oats, 20 bushels of corn, and 20 bushels of grain sorghums.

SMOOTH SANDY SOILS

The subgroup of smooth sandy soils of the prairies includes Wilson very fine sandy loam, Wilson very fine sandy loam, mound phase, Crockett very fine sandy loam, Crockett fine sandy loam, and Irving fine sandy loam. These soils are of moderate to fairly good productivity and are well suited to cotton farming. All types of agricultural machinery can be used without hindrance. With the exception of Crockett very fine sandy loam, which is gently rolling, the areas are so smooth that erosion in cultivated fields has not been rapid nor has it generally caused serious damage. Where control of erosion is necessary, it can be effected at a comparatively low cost and without greatly reducing the production of intertilled crops.

Surface drainage is very slow to free, and internal drainage is very slow; nevertheless, these soils are not too wet for good yields of field crops. They are friable throughout a wide range of moisture conditions and are more easily worked than are the soils of the first subgroup of acid soils of the prairies. The surface crust, which forms on drying after heavy rains, however, frequently prevents emergence of sprouting plants. The surface crust is somewhat less hard than in the smooth, tight, heavy soils.

These soils are of fine sandy texture and in their natural condition contain somewhat smaller quantities of organic matter and available plant nutrients than do the smooth tight heavy soils of the prairies. The difference between the productivity of fields that have been cropped for many years and new land is greater than in those soils, and the response of plant growth to additions of manure is well marked.

The land use capabilities of these soils are generally very similar to those of the smooth tight heavy soils of the prairies, except that these soils are somewhat less productive. They are almost entirely in use for general cotton farming. About four-fifths of each soil is devoted to crops, mainly cotton, together with smaller areas in oats, corn, grain sorghums, and sorgo. Although considerable corn is grown, the farmers generally select, wherever possible, the heavier soils of the bottom lands for this crop. Oats are the principal feed crop on these soils, as their production is more certain than that of corn.

Vegetables do very well in farm gardens that have received applications of manure, especially where well drained, but apparently not well enough to warrant their production on a commercial scale. Large areas of soils in the county produce better truck and fruit crops than do these soils. Peach and pear trees supply the needs of the farm homes but are not especially thrifty and are reported to be short-lived.

Wilson very fine sandy loam.—This soil is known throughout the prairies as gray sandy land. It is nearly level and has a dark-gray very fine sandy loam surface soil about 10 inches thick over a very compact subsoil of dark-gray clay. It is moderately productive for general field crops, especially for small grains, and, though crusty, is rather easily worked. The soil is regarded by farmers as fairly good land but much less valuable than the smooth, crumbly, calcareous blackland soils.

Typically the soil has a 4- to 18-inch surface soil of dark-gray strongly acid very fine sandy loam which is friable and crumbly when moist but hard when dry. This grades through a 2- to 4-inch transitional layer of crumbly light clay into the subsoil of dark-gray medium-acid very compact and dense heavy clay. Below a depth ranging from 24 to 30 inches the subsoil is gray or pale grayish-yellow very compact noncalcareous tough heavy clay. The material in this layer is faintly spotted with light brown and is about 24 inches thick. It grades at a depth of about 54 inches into the parent material, which is grayish-yellow or gray calcareous compact massive slightly sandy clay.

If cultivated when moist, the surface soil is crumbly and easily worked into an excellent seedbed of crumb tilth. Dry clods of this layer are very hard, and a surface crust forms on drying, which, if the land is not cultivated, is sufficiently hard to prevent emergence of germinating cotton plants. In undisturbed areas and below the plowed layer in fields the surface soil material is porous and faintly granular. The transitional layer at the top of the subsoil, when dug out in a moist condition, breaks into friable nutlike fine clods, from one-fourth to one-half inch in diameter, coated with inconspicuous gray films. The subsoil is almost massive when in place.

In a few flat areas adjacent to light-colored sandy soils the sandy surface soil is thicker than typical, and the transitional layer of friable clay is absent. In these areas the gray films just above the subsoil are sufficiently thick and abundant to constitute a very thin gray layer. All, except the practically level areas of Wilson very fine sandy loam, include small spots of Crockett very fine sandy loam.

The prevailing nearly level to gently undulating relief of Wilson very fine sandy loam is very favorable for the production of crops. The surface gradient of most areas ranges from 0 to 2 percent. The area one-half mile north of Blackjack School, which is 9 miles northeast of Kaufman, however, is rolling and has a surface gradient of about 5 percent. In nearly all areas drainage is very slow although adequate, but the subsoil is so compact that there is almost no under-drainage. Erosion is not a problem on the typical soil. A few areas of Wilson very fine sandy loam are so nearly level that water stands on them during wet seasons. Such areas lie near Scurry, west of Grays Prairie School 6 miles east of Rosser, on the northeast side of Little Brushy Creek 3 miles northwest of Kaufman, near Elmo, and 3 miles northwest of Cedarvale. Crops on the poorly drained spots are late, and the yields are slightly lower than those obtained on adequately drained areas.

Wilson very fine sandy loam is one of the more extensive soils in Kaufman County. It occupies broad smooth areas on the upland prairie plain, mostly within the north-south belt of acid soils of the prairies, which crosses the central part of the county. About four-fifths of the land is in cultivation, and no fields have been abandoned. Normally, cotton occupies about three-fourths of the cropland, and oats occupy most of the remainder. Some corn is grown, but so far as possible the farmers select bottom-land soils or heavy soils of the prairies for that crop. Grain sorghums are grown almost as extensively as corn. The average acre yields over a period of years are about 150 pounds of cotton lint, 10 bushels of corn, 30 bushels of oats, 20 bushels of grain sorghum, and 2½ tons of sorgo forage. Cotton produces rather small and heavily fruited plants. Less than 1 percent of the cotton on this soil at the time of the survey was infested with cotton root rot, and farmers report that damage from the cotton flea hopper is much less than on the heavy soils of the prairies. The maximum yield of cotton obtained on this soil is about one-half bale to the acre; and of oats, about 70 bushels. The soil responds well to applications of manures and fertilizers, but these are used to only a slight extent.

Wilson very fine sandy loam, mound phase.—The mound phase of Wilson very fine sandy loam consists of nearly level slowly drained areas of Wilson very fine sandy loam, which are dotted with low sandy mounds. The dominant and typical soil occupying the flat areas between the mounds is the same as that in very flat and slowly drained areas of Wilson very fine sandy loam. The surface soil ranges from 4 to 16 inches in thickness and consists of dark-gray strongly acid friable very fine sandy loam. The lower 2 or 3 inches of the surface soil is vesicular and contains conspicuous films of light-gray material. The surface soil rests rather abruptly on the upper subsoil layer of dark-gray acid very compact clay. At a depth of about 24 inches the material in the upper part of the subsoil grades into a lower subsoil layer of gray noncalcareous very compact tough clay. At a depth of about 48 inches the lower subsoil layer grades into the parent material of light-gray slightly calcareous compact slightly sandy clay, which continues downward without further change. All soil layers contain a few pitted, nearly round, black iron-oxide concretions about one-sixteenth inch in diameter.

The soil of the mounds consists of grayish-brown fine sandy loam grading at a depth of about 12 inches into light-brown fine sandy loam. This is underlain by a compact subsoil of mottled gray, red, and yellow tough clay at a depth equivalent to the height of the mound plus the thickness of the surface soil in the adjacent flat. The mounds are from 10 to 50 feet in diameter, rise from 1 to 3 feet above the intermound flats, and occupy from 10 to 30 percent of the land. Cultivation has leveled the mounds and distributed the sandy material, making the surface soil a fine sandy loam in many areas. Dry cultivated fields are gray on the surface, with light-brown spots indicating the former location of the mounds.

Wilson very fine sandy loam, mound phase, is a transitional prairie-forest soil. The areas originally were prairies with groves of post oak and blackjack oak trees on many of the sandy mounds. This soil occurs as transitional bands between Wilson very fine sandy loam and

the light-colored sandy soils. The area 3 miles northwest of Terrell is representative. Here, the land is practically level, drainage is very slow, and water stands on the surface at times. The danger of detrimental erosion is remote.

Wilson very fine sandy loam, mound phase, is fairly productive for crops. About two-thirds of the soil is in cultivation, and a few areas are abandoned fields. Normally, about three-fourths of the cultivated acreage is planted to cotton; most of the rest is about equally divided among oats, corn, and sorghums. Small acreages are devoted to cowpeas, peanuts, and other minor crops. Over a period of years the average acre yields are about 125 pounds of cotton lint, 10 bushels of corn, 25 bushels of oats, and 2 tons of sorgo forage.

Crockett very fine sandy loam.—This is a grayish-brown sandy prairie soil with a compact subsoil of reddish-brown heavy clay. It resembles Wilson very fine sandy loam on the surface but differs from that soil in its grayish-brown rather than gray color and in its generally more rapidly drained position. The soil is fairly productive for common field crops and is easily worked though somewhat crusty. It is regarded by farmers as rather desirable land for crops but generally slightly less productive than Wilson very fine sandy loam.

In cultivated fields the tilled surface soil is grayish-brown acid very fine sandy loam. The undisturbed part of the surface soil is friable dark grayish-brown very fine sandy loam, with a 1- to 3-inch layer of gray or light grayish brown at its base. At a depth ranging from 6 to 18 inches the sandy surface soil rests almost abruptly on an upper subsoil layer from 6 to 10 inches thick of dark-brown or dark reddish-brown very compact and heavy clay, which is strongly mottled with fine spots of brownish red. The red coloration decreases with depth, and the lower subsoil layer is yellowish-brown or mottled brownish-yellow and gray very compact noncalcareous clay. At a depth of about 45 inches the lower subsoil layer grades into the substratum, or parent material, of olive-yellow or yellow and gray noncalcareous compact slightly sandy clay containing a few white concretions of calcium carbonate.

The line of contact between surface soil and subsoil is wavelike. In smooth uneroded areas the thickness of the surface layer ranges from 6 to 18 inches within a horizontal distance of 25 feet. The gray layer at the base of the surface soil is thickest in the troughs of the subsoil waves. All soil layers contain a few hard black pellets of iron oxide of a maximum size of one-eighth inch in diameter. Concentrations of similar material are present in the material below a depth of 4 feet but are larger, less abundant, and more friable than those in the soil proper.

Crockett very fine sandy loam occupies a few broad, undulating, uniform areas, the largest of which are in the vicinity of Mabank, and along the Van Zandt County line north of Hiram. Surface drainage is free, and internal drainage is very slow. The surface gradient ranges from about 1 to 3 percent. Soil washing is moderately severe, and in most cultivated areas the sandy surface soil is from 1 to 4 inches thinner than in adjoining areas that have not been plowed.

Crockett very fine sandy loam is land of fairly high productivity. About three-fourths of the total area is in cultivation. Normally,

cotton occupies about three-fourths of the cropped acreage, and oats, corn, and sorghums occupy about equal parts of the remainder. The normal yields of the land now in cultivation are from 125 to 150 pounds of cotton lint, 10 bushels of corn, 10 to 20 bushels of grain sorghums, 20 to 30 bushels of oats, and 1½ to 2½ tons of sorgo forage to the acre. The soil responds well to applications of barnyard manure, commercial fertilizers, and additions of organic matter; however, very little of these are used.

Crockett fine sandy loam.—The surface soil of Crockett fine sandy loam ranges from 8 to 15 inches in thickness and consists of dark grayish-brown or grayish-brown acid friable somewhat crusty fine sandy loam. The lower 2 to 4 inches of this layer are slightly less dark than the upper part. The surface soil rests abruptly on the subsoil, which is mottled brownish-red and dark-gray acid very compact clay. At a depth of about 24 inches, the subsoil grades into olive-yellow or yellow and gray very compact noncalcareous clay, which continues downward without change other than becoming slightly calcareous and slightly sandy at a depth of about 42 inches. Crockett fine sandy loam differs from Crockett very fine sandy loam in being slightly coarser and looser. The native vegetation was a transitional prairie-forest type, consisting of scattered post oak and blackjack oak trees with a fairly dense ground cover of grasses.

Areas of Crockett fine sandy loam include a few small sandy mounds similar to those on Wilson very fine sandy loam, mound phase. Small swales are occupied by spots of Wilson very fine sandy loam. Crockett fine sandy loam occurs in areas 2 miles north of Mabank, 1 mile east of Ola, 1½ miles northeast of Elmo, in the vicinity of Scurry, and in smaller areas in the eastern and southern parts of the county. The areas on the Peeltown Flat, 1 to 3 miles west of Tolosa, probably are parts of ancient high stream terraces. Here, the gray layer at the base of the surface soil is lacking and the subsoil is only moderately compact.

The areas of Crockett fine sandy loam are nearly level or undulating. Surface drainage is slow but free; however, small slightly depressed spots are poorly drained. Erosion is not active.

The productivity of Crockett fine sandy loam is only fair. The soil is not especially esteemed by farmers. Considerable areas have been invaded by Bermuda grass and turned into pasture. The areas west of Tolosa are fairly good land for crops. About 60 percent of the total area is in cultivation. Normally, cotton occupies about three-fourths of the cultivated acreage. Corn, oats, grain sorghums, and sorgo are the principal minor crops. Somewhat lower yields are obtained than those on Crockett very fine sandy loam. Cotton returns about 100 pounds of lint, corn from 5 to 10 bushels, and oats 15 to 25 bushels to the acre. The very compact clay subsoil causes very slow absorption of water and prevents free underdrainage.

Irving fine sandy loam.—This is a gray nearly level soil similar in many respects to Wilson very fine sandy loam. The profile of Irving fine sandy loam consists of the following layers: (1) A surface soil, 6 to 12 inches thick, of dark-gray acid friable crusty fine sandy loam; (2) a transitional layer, 1 to 5 inches thick, of very dark gray acid crumbly light clay; (3) an upper subsoil layer, about 24 inches thick, of dark-gray very compact noncalcareous heavy clay;

and (4) the lower subsoil layer of gray noncalcareous compact clay underlain at a depth of 48 to 60 inches by (5) the parent material, which is gray noncalcareous slightly sandy compact clay with yellow spots, which becomes calcareous at a lower depth. The parent material is composed of alluvial materials.

Areas of Irving fine sandy loam include a few sand mounds similar to those on Wilson very fine sandy loam, mound phase. The areas are nearly level and very slowly drained, and water may stand on the surface. Drainage is generally adequate for fair productivity, but some areas are too wet for good growth of crops. The areas originally supported an open post oak forest with prairie glades. The soil occurs as a few small areas on the Peeltown Flat, which occupies the southwestern corner of the county. The area around Styx, about 7 miles east of the southwestern corner, is typical.

This soil is fairly good land for crops. It is somewhat cold and late, but good yields are obtained nearly every year. About two-thirds of the total area is in cultivation, and none has been abandoned. Normally, cotton occupies about three-fourths of the cropped acreage, and corn, oats, and sorghums occupy the rest. The normal acre yields are about 150 pounds of cotton lint, 10 to 15 bushels of corn, 15 to 30 bushels of grain sorghums, and $1\frac{1}{2}$ to $2\frac{1}{2}$ tons of sorgo forage.

SLOPING TIGHT HEAVY SOILS

The subgroup designated as sloping tight heavy soils includes Wilson clay loam, slope phase, and Wilson clay, slope phase. These are soils of low to fairly high productivity, are suitable for cropland, but are subject to severe erosion when cultivated without protection. These soils have capabilities of land use rather similar to the sloping crumbly heavy soils of the prairies, but they are somewhat less productive, especially for corn, and somewhat more difficult to work.

Wilson clay loam, slope phase.—Those areas of Wilson clay loam that are sufficiently sloping to be subject to severe soil washing under intertilled crops constitute the slope phase. Most of the areas of this soil have a surface gradient between 3 and 6 percent; a few small areas have a greater slope. The dominant soil is nearly identical with Wilson clay loam as developed on nearly level surfaces and differs in having slightly thinner layers, more yellow substrata, and fewer or no iron concretions. Where uneroded, the representative Wilson clay loam, slope phase, consists of the following layers: (1) A 4-inch surface soil of dark-gray slightly acid friable clay loam or silty clay loam; (2) a 4- to 6-inch subsurface soil of dark-gray noncalcareous coarsely granular or fine-nut structured friable light clay; (3) an upper subsoil layer, about 20 inches thick, of dark-gray or very dark gray very compact noncalcareous blocky clay; and (4) a lower subsoil layer, also about 20 inches thick, of dark yellowish-gray slightly calcareous compact tough clay, which grades into the substratum, an olive-yellow calcareous compact clay containing a few calcium carbonate concretions. Nearly all of the cultivated areas have lost from 2 to 6 inches of soil material from the surface layers by soil washing.

Many areas of Wilson clay loam, slope phase, include small spots, from 5 to 10 feet in diameter, in which the upper part of the soil

consists of a 2-inch layer of dark-gray faintly calcareous friable clay loam over yellowish-brown calcareous clay containing hard irregular concretions of calcium carbonate. The yellowish-brown clay grades downward into an olive-yellow compact clay substratum at a depth of about 4 feet. These yellow spots, which are conspicuous in freshly cultivated fields, constitute from 1 to 20 percent of different areas of Wilson clay loam, slope phase. They are inclusions of a soil similar to Houston clay loam. Some areas of Wilson clay loam, slope phase, include small spots of Crockett clay loam, eroded phase, and small unproductive slick spots of apparently saline soil.

Wilson clay loam, slope phase, is fair to good cropland, the productivity varying with the amount of soil washing that has taken place. Probably the soil originally was as productive as typical smooth Wilson clay loam, with which the slope phase is associated. Two-thirds of the land is in cultivation. About 5 percent of the area in the more severely eroded spots is former cropland, which is now utilized as pasture. Cotton normally occupies about two-thirds of the cropped land and yields from 100 to 165 pounds of lint to the acre, the average being about 130 pounds. Oats and to less degree sorgo and grain sorghums, are generally grown as the feed crops on this land, but corn is seldom grown, as yields are very low. The acre yield of oats is 25 or 30 bushels; corn, about 10 bushels; grain sorghums, about 15 bushels; and sorgo, 1 to 2½ tons of forage.

This soil is freely drained and is subject to severe washing when cropped without protection. Owing to erodibility, it is inherently unfit for continuous use for intertilled crops, but erosion is not excessive in fields that are well terraced and strip cropped. Where well sodded with desirable pasture grasses, the land affords very good grazing.

Wilson clay, slope phase.—Those areas of Wilson clay that are sufficiently sloping to be subject to considerable soil washing under clean-tilled crops constitute Wilson clay, slope phase. The surface gradient ranges from about 2½ to 7 percent. The dominant soil in these sloping areas is nearly identical with Wilson clay as developed in more level areas, but the soil layers are slightly thinner, the surface soil is slightly less acid and not quite so tight, and the lower soil layers are yellower than the corresponding layers of Wilson clay.

Wilson clay, slope phase, consists of the following layers: (1) A surface layer, from 20 to 30 inches thick, of very dark gray non-calcareous cloddy somewhat crumbly but crusty clay; (2) a slightly calcareous dark-colored layer, about 12 inches thick, of dark-gray or very dark-gray very compact slightly calcareous heavy clay; (3) a transitional layer, about 12 inches thick, of olive-yellow compact calcareous clay; and (4) the substratum or parent material, a gray slightly calcareous shaly clay with limonite-yellow streaks and a few calcium carbonate concretions. All areas of Wilson clay, slope phase, include small spots of Houston clay. Most areas of this soil probably have lost from 2 to 10 inches of surface soil since they were placed in cultivation.

The moderately sloping, rapidly drained, for the most part small areas of this soil are associated with typical Wilson clay. A large representative area is 4 miles east of Kaufman. It is naturally

productive land, which is subject to severe soil washing when cropped without protection. It is suitable for the production of crops but is unsuited to cropping systems consisting of nearly continuous intertilled crops, which afford little protection from soil washing.

About two-thirds of the soil is in cultivation, and, before the contraction in the production of cotton, about three-fourths of the tilled land was devoted to this crop. Oats, corn, and sorghums occupy about equal proportions of the cultivated land not used for cotton. The acre yields over a period of years probably are about 150 pounds of cotton lint, 25 or 30 bushels of oats, 10 or 15 bushels of corn, 15 or 20 bushels of grain sorghums, and 1 to 2½ tons of sorgo forage.

SLOPING SANDY SOILS

The subgroup of sloping sandy soils includes Crockett very fine sandy loam, rolling phase, Crockett clay loam, eroded phase, and Crockett fine sandy loam, steep phase. These are shallow eroded soils of such low productivity that, for the most part, they are best suited to pasture. The first two are moderately sloping soils, which originally were productive but now are severely eroded and infertile. Crockett fine sandy loam, steep phase, however, never was very fertile. All these soils are capable of growing good grass when properly managed. They are soils generally unsuitable for field crops but productive for pasture.

Crockett very fine sandy loam, rolling phase.—This soil differs from typical Crockett very fine sandy loam in that it is moderately sloping, shallower, and generally moderately to severely eroded. The subsoil is slightly less dense than that of the typical soil. The surface soil is brown or grayish-brown acid friable though crusty very fine sandy loam, ranging from 4 to 10 inches in thickness. It grades through a 2- or 3-inch transitional layer of dark-brown acid friable coarsely granular clay into a compact subsoil of noncalcareous dense and heavy clay. The upper 6- to 15-inch layer of the subsoil is reddish brown mottled with red, but the reddish-brown coloration gradually decreases with depth, and, below a depth ranging from 20 to 30 inches, the color is olive yellow or mottled yellow and gray. At a depth of about 4 feet the material in the lower part of the subsoil gives way to the parent material of yellow and gray slightly calcareous compact slightly sandy clay.

Owing in part to differences in degree of erosion since the land was first plowed, the thickness of the sandy surface soil is extremely variable. A representative area of Crockett very fine sandy loam, rolling phase, which is still in native grass, occurs 3.6 miles east of the depot in Terrell on the south side of the Texas & Pacific Railway. Here the surface soil is dark grayish brown. In most areas it seems that from 3 to 6 inches of surface soil has washed away since the land has been placed in cultivation. The clay subsoil is exposed in a few places, but in no area of 10 acres or more does the depth of the surface soil average less than 4 inches.

The areas of this soil include a few slick spots, which, in undisturbed locations, consist of a thin surface layer of grayish-brown light very fine sandy loam resting abruptly on yellowish-brown extremely tough compact very heavy clay. In most of the slick-spot areas the thin sandy layer has been removed by erosion, thereby ex-

posing the clay. These areas are bare of vegetation and valueless for crops. In most of them an efflorescence of white salts forms on the surface after rainy spells. No practical method of reclamation is known.

Crockett very fine sandy loam, rolling phase, as shown on the map, includes small areas of Crockett fine sandy loam, rolling phase. Such areas have a fine sandy loam surface soil, and most of them are adjacent to light-colored sandy soils. Small spots of Kirvin fine sandy loam also are included, especially in the large area around the head of Duck Creek in the northeastern part of the county. The 200 acres on the western end of the large area in the southwestern part of the John Roof survey, 6 miles northeast of Kaufman, have a 12-inch layer of very dark gray granular very fine sandy loam over yellowish-brown granular clay, which grades at a depth of 20 inches into yellow calcareous sandy clay.

Crockett very fine sandy loam, rolling phase, occurs in many small moderately sloping areas in association with bodies of Wilson very fine sandy loam, a much smoother soil. The slope ranges from about 2 to 7 percent. Drainage is excessive, and erosion is severe in unprotected cultivated fields.

Originally the productivity of this soil was good, but at present it is very low, due to both erosion and depletion of organic matter and available plant nutrients, so that cultivation is no longer profitable in most places. About 30 percent of the total area is cultivated land comprising, for the most part, the less rolling and less eroded areas. At least one-half of the area is abandoned-field pasture with low carrying capacity. The small areas in cultivation are devoted principally to cotton, oats, and sorgo. The productivity is extremely variable. The normal acre yields are about 100 pounds of cotton lint, 1 ton of sorgo hay, 10 to 20 bushels of oats, and less than 7 bushels of corn. The land can be converted into very good permanent pasture by sodding with Bermuda grass and other desirable pasture grasses and mowing to control weeds. The present carrying capacity of the pastures, which are mostly of three-awn grasses and weeds, is from 10 to 15 acres for one cow during the season.

Crockett clay loam, eroded phase.—This soil as mapped in Kaufman County consists of rather shallow areas of Crockett very fine sandy loam, from which most of the sandy surface soil has washed away, and the clay subsoil lies within plow depth. The surface soil consists of a 1- to 3-inch layer of grayish-brown moderately acid very fine sandy loam over reddish-brown noncalcareous very compact heavy clay which is mottled with red and some yellow. The reddish-brown upper subsoil layer is from 4 to 10 inches thick and grades into yellow compact noncalcareous clay mottled with some gray. At a depth of about 3 feet the subsoil grades into yellow compact slightly calcareous clay containing a few calcium carbonate concretions and numerous black spots and films of iron oxide.

Crockett clay loam, eroded phase, is sloping, eroded, and variable in thickness of soil layers and coloration of subsoil. The surface slope ranges from about 2 to 7 percent. Steep-walled gullies, ranging from 1 to 5 feet in depth, are numerous. Slick spots, ranging from 10 to 100 feet in diameter, are numerous in most areas. These spots generally are bare of vegetation and are worthless for crops. They con-

sist of a surface film, from $\frac{1}{4}$ to 3 inches thick, of grayish-brown very fine sandy loam resting on yellowish-brown or yellow extremely compact nearly impervious clay. Many of the slick spots occur at the heads of small natural drainageways.

The area on the county farm, 1 mile south of Kaufman, shown on the soil map as Crockett clay loam, eroded phase, is an included body of Crockett clay loam. This soil consists of a 4- to 6-inch surface soil of dark-brown noncalcareous clay loam grading into a subsoil of brown moderately compact clay mottled with brownish red. This material, in turn, grades, at a depth of about 2 feet, into olive-yellow plastic clay, which becomes calcareous at a greater depth. The included soil is moderately productive.

Crockett clay loam, eroded phase, occurs in many narrow sloping strips adjacent to areas of Wilson and other Crockett soils. One of the larger areas is 3 miles northeast of Terrell. About one-fifth of the total area of this soil is in cultivation, comprising mostly the small spots included within fields of better soils. Most of the rest is eroded abandoned-field pasture. The small acreage in cultivation is used for the production of cotton, oats, and sorgo. The normal acre yields are about 50 to 100 pounds of cotton lint, 10 to 15 bushels of oats, and 1 ton of sorgo forage. The old-field pastures have a carrying capacity ranging from 10 to 15 acres for one cow during the growing season. When first cropped, the areas of this soil were fairly productive; now they are so eroded and infertile as to be generally unsuitable for cropping. They are capable, when properly managed, of supporting a fairly good growth of pasture grasses.

Crockett fine sandy loam, steep phase.—Those areas of sandy Crockett soils that have a slope in excess of 7 percent and are so steep as to be entirely unsuitable for cropland are designated as Crockett fine sandy loam, steep phase. In characteristic areas the 4- to 10-inch surface soil is grayish-brown moderately acid friable fine sandy loam. It grades rather abruptly into a subsoil of compact noncalcareous brown clay mottled with brownish red and yellow. At a depth ranging from 2 to 4 feet, the subsoil grades into yellow calcareous sandy clay.

Crockett fine sandy loam, steep phase, is essentially a land type rather than a soil type. It is strongly rolling, sandy, and dark-colored. Not more than half of the total area has a typical Crockett profile. In many spots, which occupy a total of at least one-fourth of the area, the soil profile is as follows: A 2- to 6-inch layer of brown fine sandy loam over yellowish-brown moderately heavy noncalcareous clay which grades at a depth of about 24 inches into yellow slightly calcareous glauconitic sandy clay. Spots of Kirvin fine sandy loam and small outcrops of a thin limestone ledge also occur.

The steep phase of Crockett fine sandy loam is mapped at Richardson School in the northeastern corner of the county, on the south slope to Muddy Cedar Creek east of College Mound School 4 miles south of Elmo, and 3 miles south and 4 miles northeast of Terrell. The areas are partly prairie and partly forested with post oak and blackjack oak. Practically none of this land has ever been cultivated, and all is used for pasture. The carrying capacity is one cow to 10 or 15 acres during the season of good grass growth.

HEAVY CALCAREOUS SOILS OF THE PRAIRIES

The heavy calcareous soils of the prairies are extensive and closely associated. They are representative of soils of the largest part of the Blackland Prairie throughout a number of counties in Texas. Despite their heavy consistence, these soils are characteristically crumbly and, on drying, the surface soils have a granular structure. The parent materials are highly calcareous. Underdrainage is slow owing to the fine clay texture throughout, and the lime is not leached out.

The relief ranges from smooth to sloping, and the natural productivity is high. Cotton and the general farm crops are grown. The smoother soils have the more deeply developed profiles, and those that are sloping have thinner profiles and are less productive. These soils are of the Houston Black, Houston, Hunt, Bell, Lewisville, and Sumter series.

Soils of the Houston Black series have black or very dark gray calcareous crumbly heavy surface soils and dark-gray or black subsoils of somewhat less crumbly clay, which grade into parent materials of weathered chalk or marl. They are characteristically developed in undulating to gently rolling areas of upland prairie. They are highly productive and occupy a large proportion of the Blackland Prairie.

Soils of the Houston series have brown or dark-brown calcareous crumbly but heavy surface soils, which grade through subsoils of brownish-yellow calcareous somewhat less crumbly clay into parent materials of weathered marl or calcareous clay. They occupy rapidly drained rolling areas and are characteristically thinner and less fertile than are soils of the Houston Black series.

The Hunt soils have black or very dark gray surface soils, which are much like those of the Houston Black soils but differ chiefly in having little or no calcium carbonate in the upper horizons. The upper horizons are neutral or slightly acid, but the lower horizons are calcareous, and calcareous parent materials, similar to those beneath the Houston Black soils, underlie these soils.

The soils of the Bell series consist of black or dark-gray calcareous granular surface soils underlain by dark-gray or black calcareous crumbly clay subsoils, which grade into yellow or gray highly calcareous crumbly clay materials resting in some places on beds of gravel or sand. These soils occupy old stream terraces underlain by alluvium washed from calcareous soils of the prairies. They are similar to the Houston Black soils in several features.

The Lewisville soils have dark-brown or brown calcareous crumbly very granular surface soils and brown or yellow calcareous friable clay subsoils which rest on highly calcareous beds of gravel or chalky clay. They occupy old stream terraces, which are underlain by alluvium of much the same character as that on which the Bell soils have developed. They are more crumbly and have freer internal drainage than the Bell soils. The typical soils occupy smoothly undulating slowly but freely drained positions. Areas of slope phases, which are shallow, are extensive.

The Sumter series comprises soils of sloping areas associated with the Houston soils. The Sumter soils are yellowish-brown or yellow crumbly highly calcareous soils thinly developed over yellow marl.

They occupy steep slopes and are so severely eroded that they are of low productivity.

The calcareous soils that make up this group are used very largely for cotton, although cotton root rot, a fungus disease, is especially widespread on them during some seasons.

Based on the differences in relief, thickness of developed soil profile, and value for general farm crops, the soils of this group are divided among three subgroups: (1) Smooth crumbly heavy soils, (2) sloping crumbly heavy soils, and (3) steep eroded heavy soils.

SMOOTH CRUMBLY HEAVY SOILS

The subgroup of smooth crumbly heavy soils includes Houston Black clay, Hunt clay, Bell clay, and Lewisville clay loam. These are highly productive soils well suited to cotton and many other crops and are largely in cultivation. Erosion generally is not excessive in cultivated fields where a little care is exercised in cultivating and cropping the land. The supply of organic matter and available plant nutrients is high, and crops withstand droughty conditions well because of the large store of available soil moisture held within the thick heavy layers. These are the most intensively farmed soils of the county and are used for cotton, which has been grown on them for many years and yields an average of 225 pounds of lint to the acre under normal good farming practice. Fertilizers are not used. Some increases in production are obtained by the application of certain mixtures, but the results are too irregular to indicate that the use of commercial fertilizers would prove generally profitable throughout a period of years.

Houston Black clay.—This soil is commonly known as smooth heavy blackland. Although it is less extensive in Kaufman County than are the Wilson soils, it is the characteristic soil of the Blackland Prairie. It is a black deep limy crumbly clay soil with an undulating or very gently rolling relief.

It is very productive for general field crops and is regarded by farmers as one of the most desirable and valuable soils in the county.

The surface soil is black or nearly black calcareous heavy clay, which is extremely sticky and plastic when wet but very crumbly when slightly moist or dry. This black layer continues without apparent change to a depth of about 18 inches, where the material grades into black or very dark gray calcareous slightly less crumbly heavy clay. At a depth averaging about 48 inches and ranging from 36 to 60 inches, this grades through a thin transitional layer into olive-yellow very highly calcareous nearly impervious shaly clay—the parent material.

The virgin soil originally was occupied by slight depressions known as hog wallows, but these disappeared with cultivation. The thickness of the black or dark-colored layer is wavelike and related to the original hog-wallow relief.

In cultivated fields the tilled surface soil, when dry, is a loose mass of fine hard angular grains; when wet it is extremely sticky and plastic and nearly impervious. Exposed clods naturally crumble to fine grains with one wetting and drying. The plowed soil generally is too loose for a good seedbed until made firm by rain, and many

farmers roll the fields after planting cotton in order to insure rapid germination. The soil does not scour readily from tillage implements, and some difficulty is experienced in turning under crop residues.

A broad uniform belt of Houston Black clay extends from Cran-dal past Forney into Rockwall County. Small areas are northeast and southeast of Kaufman. Many farms in the larger area consist exclusively of this soil.

The surface gradient ranges from about $\frac{1}{2}$ to 3 or 4 percent. Surface drainage is very slow or moderately free, and internal drainage is very slow. With minor exceptions, the areas are not severely eroded or gullied.

About 85 percent of the area of Houston Black clay soil is in cultivation. Many areas are infested with cotton root rot, a fungus disease especially prevalent on this soil. Normally about three-fourths of the cultivated acreage is planted to cotton and most of the rest to corn. About 1,000 acres in the vicinity of Forney are planted to onions. Small areas are used for alfalfa and, where not infested with root rot, produce good yields. Although small grains are not grown generally, the soil is well suited to those crops. The acre yields over a period of years are 200 or 225 pounds of cotton lint, 25 or 30 bushels of corn, about 35 bushels of oats, 2 to 3 tons of alfalfa hay, and about 3 tons of sorgo forage. The native prairie meadows yield about 1 ton of hay to the acre, and buffalo-grass pastures have a year-round carrying capacity of about one cow to 5 acres. The maximum acre yields under very favorable conditions are about 1 bale of cotton, 80 bushels of oats, and 50 bushels of corn. No fertilizers are used. According to the reports of farmers, the few small areas lately placed in cultivation are only slightly more productive than are old fields.

Hunt clay.—Hunt clay, like Houston Black clay, is commonly known as smooth heavy blackland. It differs in having a much lower content of calcium carbonate, but is so similar that most farmers recognize no difference between the two soils. It is very productive for general field crops and is regarded by farmers as very desirable land.

The surface soil is black noncalcareous neutral or slightly acid heavy clay, which is extremely plastic and sticky when wet but very crumbly when slightly moist or dry. At a depth of about 18 inches this material grades into black or very dark gray slightly less crumbly noncalcareous clay. At a depth averaging about 48 inches and ranging from 36 to 60 inches the dark layer grades through a thin transitional layer into olive-yellow very highly calcareous nearly impervious shaly clay or marl—the parent material.

The soil, as a rule, is not calcareous to a depth ranging from 30 to 42 inches. In transitional areas adjacent to bodies of Houston Black clay the spots of browner soil on the humps between the hog wallows are calcareous to the surface. A few black pellets of iron oxide are present.

The tilth and structure of this soil are not significantly different from those of Houston Black clay. The soil is very crumbly, but farmers working both soils state that Hunt clay is slightly more gumlike when moist and more compact when dry than Houston Black clay. The surface soil everywhere is black, and the color does not approach dark gray as it does in some areas of Houston Black clay. In some dry fields, which have not been cultivated since rains, a thin gray

film appears on the surface. This soil does not crust sufficiently to interfere with the germination and growth of young cotton plants, as do the Wilson soils.

Hunt clay occurs chiefly in a north-south belt of undulating land about $2\frac{1}{2}$ miles wide extending through the western part of the county and in smaller gently rolling areas east of Kaufman and Kemp. A representative area of this soil is in the vicinity of Gastonia. The soil is well drained and the surface slope ranges from about $\frac{1}{2}$ - to 3- or 4-percent gradient. At least two-thirds of the soil has a surface gradient of 2 percent or less. The tendency toward erosion is about the same as on Houston Black clay; that is, it is slight on land having a gradient of less than 2 percent and moderately severe but easily controlled on slopes of more than 3 percent.

This is an excellent soil for all the crops generally grown in the county. Some farmers state that corn yields are slightly lower than those obtained on Houston Black clay, but otherwise there is no observable difference in productivity. The soil is adapted to and utilized for the same crops as is Houston Black clay. Normally, cotton occupies about three-fourths of the cultivated acreage, and corn constitutes the principal feed crop. The acre yields over a period of years are about 200 or 225 pounds of cotton lint, 30 bushels of corn, 35 bushels of oats, 2 to 3 tons of alfalfa hay, 25 to 30 bushels of grain sorghums, and 2 to 3 tons of sorgo forage.

Bell clay.—This soil is commonly known as level heavy blackland. It is very similar in appearance to and apparently is of equal value for farming as nearly level areas of Houston Black clay. It differs from Houston Black clay in that it occurs in high, nearly level, very slowly drained flats and is underlain by beds of calcareous clays of alluvial origin, which in many places rest on beds of gravel. It is very productive for the general field crops, and practically all of the land is in cultivation.

The surface soil of Bell clay is black or very dark gray calcareous heavy clay, which is very plastic and sticky when wet but very crumbly when slightly moist or dry. At a depth of about 18 inches this material grades into very dark gray or black slightly less crumbly calcareous clay. This, in turn, grades at a depth of about 4 feet into gray or dark-gray highly calcareous clay containing a few spots of light brown or dull yellow. The parent material, a gray or light-brown highly calcareous clay of alluvial origin, underlies the soil at a depth of about 8 feet. It contains a few lenses of sand and water-worn gravel. The less dark layers contain conspicuous vertical tubes about 2 inches in diameter of black or dark-gray clay, which appear to be old crawfish holes filled with surface soil material.

The soil is of the same structure and tilth as Houston Black clay. The tilled surface soil is a loose mass of hard grains when dry; a porous very crumbly mass when moist; and waxy, sticky, and nearly impervious when wet. The plowed layer is very loose until made firm by rain, and clods naturally crumble to fine grains with wetting and drying.

A few of the areas have surface layers that are neutral in reaction and noncalcareous. The largest of these are the area at Crandall, and the part south of the Southern Pacific Railroad tracks of

the area $3\frac{1}{2}$ miles west of Crandall. These areas seem to be of similar productivity as the typical soil.

Bell clay occupies broad uniform areas on high flats adjacent to the East Fork Trinity River bottoms, and a few smaller areas are on the lower benches. The largest body is near Forney. The land is nearly level and very slowly drained, but drainage is adequate for very good growth of the field crops. This soil sometimes is too wet in the spring for good growth of corn. Well water is available beneath nearly all of the areas.

Bell clay is very highly productive and one of the very best soils for general crops in the county. During wet years crop yields generally are slightly lower than those obtained on Houston Black clay; during dry years, slightly higher; and over a period of years, about the same. About 90 percent of the total area is cultivated land, of which about three-fourths normally is devoted to cotton and most of the rest to corn. Cotton yields about 225 pounds of lint; corn, 25 or 30 bushels; oats, 30 or 40 bushels; and sorgo, 2 or 3 tons of hay to the acre. As a rule, this soil sells for more than any other soil in the county for agricultural use.

Lewisville clay loam.—Lewisville clay loam is a dark-brown smooth productive very crumbly terrace soil. The surface soil is about 18 inches thick and consists of dark-brown calcareous very friable granular clay loam. This grades into the subsoil of brown friable porous calcareous light clay, which, in turn, grades into the parent material at a depth of about 36 inches. The parent material is brown friable very highly calcareous clay loam containing numerous concretions of calcium carbonate in the upper part. The soil cultivates to a fine crumbly tilth, it scours from tillage implements, and tillage operations require less power than they do on Houston Black clay.

This soil occurs on low undulating benches adjacent to the flood plain of the East Fork Trinity River. The bodies are few and rather small. A typical area is that along the highway $2\frac{1}{2}$ miles south of the northwestern corner of the county. Surface drainage is slow but free, and internal drainage is fairly rapid. The relief ranges from nearly level to a slope of about 2 percent, and the areas are not subject to severe erosion under clean-cultivated crops. Some of the lower parts of the areas are overflowed occasionally.

Lewisville clay loam is very productive and is well suited to general field crops. It is especially productive for corn and affords excellent sites for pecan orchards. It is naturally not so strong a soil as the heavier blackland soils, such as Houston Black clay, and, under the prevailing system of agriculture, its productivity has decreased somewhat more than that of the Houston soil. The soil, however, has almost ideal physical characteristics and with proper management will produce as much as any soil in the county. It responds well to good soil management and to applications of manure. About three-fourths of the total area is in cultivation. Cotton occupies about one-half of the cultivated acreage and corn most of the rest. Corn occupies a larger proportion of the cultivated acreage than that grown on any other soil in the county. The average yields are about 200 pounds of lint cotton or about 30 bushels of corn to the acre. A growth of oak, elm, and other trees,

including some native pecans, covers the areas that have not been cleared.

SLOPING CRUMBLY HEAVY SOILS

The subgroup of sloping crumbly heavy soils includes Houston clay and Lewisville clay, slope phase. In general characteristics these soils are related to the smooth crumbly heavy soils but differ from them in having thinner development and greater susceptibility to erosion, together with somewhat lower general productivity. They are moderately productive soils suited to general field crops but are susceptible to severe erosion when cultivated without adequate protection. They are brown crumbly calcareous moderately eroded soils. For the most part, they occur in small bodies associated with large areas of smoother and more productive land, and considerable areas can well be used for permanent farm pastures and meadows. Nutritious pasture plants, especially buffalo grass, Bermuda grass, Johnson grass, and sweetclover, grow well once they are established, and the soils have a high potential value for pasture. These soils are used largely for growing cotton, but yields generally are lower than on the smooth heavy soils.

Houston clay.—This soil differs from Houston Black clay in that it is less deep, not so dark-colored, and more sloping and eroded. It is commonly known as rolling blackland. It is moderately productive and is well suited to the growth of general field crops but is susceptible to severe erosion when cultivated without protection.

The surface soil to a depth ranging from 6 to 18 inches is brown or dark yellowish-brown highly calcareous heavy clay, which is very sticky and plastic when wet but crumbly when dry or slightly moist. This grades through a 12- or 18-inch transitional layer of brownish-yellow slightly less crumbly highly calcareous heavy clay into the parent material at a depth ranging from 24 to 36 inches. The parent material is olive-yellow or yellow and bluish-gray nearly impervious highly calcareous shaly clay. This is a marl that contains rather numerous white lumps of calcium carbonate in the upper part.

The cultivated surface soil is a loose layer of hard angular grains when dry. The soil does not crust over on drying, and the structure and tilth enable ready cultivation.

In parts of the areas adjacent to bodies of Wilson soils the upper soil layers are not calcareous. One of the larger bodies of this kind is 4 miles west of Kaufman on United States Highway No. 175 on the west slope of Brushy Creek Valley. This noncalcareous included soil is crumbly and apparently of the same productivity as the typical soil.

Houston clay occupies rolling, rapidly drained areas with surface slopes ranging from about 3 to 7 percent. The soil occurs mostly as rather small areas associated with Houston Black clay and Hunt clay, the largest bodies lying between Kaufman and Forney, and north of Forney. Erosion is rapid in unprotected fields, and nearly all areas are moderately to severely eroded and somewhat gullied.

Houston clay is naturally productive land that, because of the sloping relief and tendency toward erosion, is not less suited to continuous intertilled crops. About two-thirds of the total area is in

cultivation, about one-fifth is abandoned-field pasture, and most of the rest is native-prairie meadow or native pasture. Normally about three-fourths of the cropped acreage is planted to cotton, and the rest is utilized for corn, oats, and sorghums. Oats and sorgo are grown on a larger proportion of this land than on the smoother areas of blackland. When first placed in cultivation, the productivity of Houston clay is reported as almost equal to that of Houston Black clay, but, with use and losses by soil erosion, the yields are lowered. The acre yields on Houston clay, over a period of years, are from 150 to 165 pounds of cotton lint, 15 to 20 bushels of corn, 30 to 35 bushels of oats, about 20 bushels of grain sorghums, and 1 to 3 tons of sorgo forage.

Lewisville clay, slope phase.—This soil is similar in many respects to Houston clay, except that it is more crumbly and has a loamier consistence. It is moderately productive and is suitable for general field crops. It is subject to severe erosion when tilled without the practice of methods designed to minimize erosion.

The surface soil is about 12 inches thick and consists of brown or dark yellowish-brown very crumbly granular rather friable clay. It grades into light-brown or yellowish-brown clay, gradually becoming more yellow and less brown with depth. At a depth ranging from 20 to 30 inches, this material is underlain by the parent material, a yellow or pale yellowish-brown friable chalky clay of alluvial origin. The upper part of the parent material contains numerous white concretions of calcium carbonate. In many places the parent material is stratified with thin lenses of sand and is underlain, many feet below the surface, by beds of water-worn gravel.

This soil is much more crumbly than Houston clay. The tilled surface soil when dry is a loose mass of fine crumbs and powder. The undisturbed surface soil is arranged naturally into subangular friable granules, from one-eighth to one-fourth inch in diameter, with very dark brown exteriors and dark-brown centers.

The areas indicated on the soil map 4 miles southeast of Crandall, and 4 miles north, 1 mile east, and 4 miles southeast of Rosser are bodies of a different soil included on account of its limited extent. This soil has a 4- to 8-inch surface soil of brown friable noncalcareous clay loam graduating into a subsoil of yellowish-brown noncalcareous rather friable clay. It is underlain by the parent material of light yellowish-brown calcareous friable clay at a depth of about 24 inches. The areas of this included soil are eroded, somewhat gullied, and of low productivity. They are moderately to strongly sloping, are largely abandoned fields used for pasture, and originally were covered with an open hardwood forest, mostly of oak trees. These included areas also contain small spots of Leaf fine sandy loam, slope phase.

Lewisville clay, slope phase, occupies narrow strips of sloping land comprising high terrace escarpments. These are associated with bodies of Bell clay and are adjacent to the flood plain of the East Fork Trinity River. The largest two areas lie 1 and 4 miles west of Crandall. All the areas have rapid and excessive surface drainage, especially in unprotected fields, and they are moderately to severely eroded and somewhat gullied. The range of surface slope is from 3 to 7 percent. A considerable proportion of the area 1 mile west of Crandall is strongly sloping, very severely eroded, and unsuitable

for the production of field crops. The native vegetation was grass, with scattered hackberry, bois d'arc, and a few oak trees.

About one-fourth of the land is in cultivation, about one-half is eroded abandoned-field pasture, and the rest is mostly native pasture. Cotton is the principal field crop, and oats, corn, and sorghums are the other crops grown. When grasses are well established, they grow well and afford very good pasture. Nearly all of the areas in cultivation are severely infested with Johnson grass. The average yields apparently are somewhat lower than those on Houston clay, but if the two soils were farmed equally well, the productivity would be about the same. The average yield of cotton under prevailing practices is about 125 pounds of lint to the acre.

STEEP ERODED HEAVY SOILS

The subgroup of steep eroded heavy soils is represented by a single soil—Sumter clay. This is a shallow, eroded, and steeply sloping soil, which for the most part is unsuitable for the production of cultivated crops.

Sumter clay.—The surface soil of Sumter clay is brownish-yellow highly calcareous crumbly plastic clay. It ranges from 4 to 12 inches in thickness and grades below into a substratum of olive-yellow or yellow and gray highly calcareous raw shaly clay.

The areas of Sumter clay are steeply sloping and have surface gradients ranging from about 7 to 20 percent. Surface drainage is very rapid and excessive, and erosion is very active. Practically all areas of Sumter clay originally had a surface soil of dark-brown clay and were Houston clay before cultivation.

This soil is so sloping that most areas should be used for pasture. Most of the surface soil is so gullied that the construction of adequate terraces would cost more than the reclaimed land would be worth. During the first few years in cultivation this land was highly productive, but erosion, which has been severe and rapid, has reduced its productivity to a point where cultivation is no longer profitable.

Sumter clay occurs in very narrow strips of strongly sloping country associated with smoother blackland soils. The principal areas are in the vicinity of Forney. Less than one-fourth of the total area is in cultivation. Cotton constitutes the principal crop on the small area in cultivation, and the yields are between 75 and 100 pounds of lint to the acre. Johnson grass has invaded most of the areas thoroughly. About one-half of the land is used for pasture and is covered with a growth of weeds, Johnson grass, and some Bermuda grass. One farmer has successfully reestablished an excellent stand of buffalo grass on a badly washed field of this soil. Sweetclover grows rankly where it has become established and may prove to be a valuable crop well adapted to this soil.

LIGHT-COLORED SANDY SOILS OF THE FORESTED LANDS

Light-colored sandy soils of the forested lands consist of gray and light-brown acid loose sandy soils with clay subsoils of widely different colors and consistence. These soils have developed from noncalcareous or only slightly calcareous clays and sandy clays under a forest growth, mainly of oak trees. The content of organic matter is low,

the supply of plant nutrients is small, and the fertility of the soils is only moderate.

The soils are farmed largely without following practices that maintain soil fertility and, therefore, for the most part have deteriorated greatly in productivity. They are, however, highly responsive to fertilization and can be managed in such a way as to maintain good yields of many crops. The soils are especially suited to vegetables and fruits, and under methods of management that include the application of fertilizers and incorporation of organic matter good yields of the general farm crops also may be obtained.

These soils are developed under a moderately high rainfall and are more or less leached. They have the same type of development and the same general characteristics as the soils of the east Texas timber country—that part of the Coastal Plain lying within the region of Red and Yellow soils. In Kaufman County the Red and Yellow soils occupy small isolated areas just west of the main area of the east Texas timber country, and they extend eastward through a number of Southern and Southeastern States.

In this county the light-colored soils of the forested areas are members of the Tabor, Norfolk, Kirvin, Ruston, Lufkin, Leaf, Cahaba, Kalmia, and Myatt series. Their profiles have many similarities. In general, the representative profile of the virgin soils consists of a brown or grayish-brown 2- or 3-inch surface layer containing considerable organic matter. This is underlain by a thick leached subsurface layer of pale-yellow or light-gray strongly acid sandy material. This passes into the subsoil of sandy clay or heavy clay, which, in turn, is underlain at a depth ranging from 3 to 5 feet by the somewhat less heavy and less intensely colored parent material. In the following descriptions of the series, the thin brown surface layer, which is common to all, is omitted.

The Tabor soils have pale-yellow surface soils and yellow plastic heavy clay subsoils, which may be mottled with some red in the topmost 6 to 12 inches and which are slightly mottled with light gray in the lower part. These soils are developed in smooth upland areas having slow but free drainage.

The Norfolk soils have pale-yellow surface soils and yellow friable subsoils.

The Kirvin series includes soils with pale-yellow or light reddish-yellow sandy surface soils, which are underlain by upper subsoil layers of red heavy clay, and these, in turn, by lower subsoil layers of mottled red, yellow, and gray clay. They occupy freely drained upland areas.

The Ruston series comprises soils with pale-yellow surface soils and reddish-yellow or yellowish-red very friable permeable subsoils. They occupy undulating to rolling upland.

The Lufkin series includes soils with light-gray surface soils resting on gray dense tough clay subsoils and underlain by clays of marine origin. The relief is, in general, nearly level, and drainage is slow.

The surface soils of members of the Leaf series are pale yellow or gray, and the subsoils are mottled red, yellow, and gray heavy plastic clay. These soils are developed in slowly drained positions on old stream terraces.

The Cahaba series includes soils that are developed from parent materials of alluvial origin and that have light-brown, light-red, or pale-yellow surface soils and reddish-yellow friable permeable subsoils. The characteristic profile is similar to but less thoroughly leached than that of the Ruston soils, and the relief is generally much smoother.

The Kalmia soils, also developed on stream terraces, have a soil profile very much like that of the Norfolk soils.

Soils of the Myatt series are developed on very flat old stream terraces, and their profile is almost like that of soils of the Lufkin series.

The light-colored sandy soils of the forested lands are included in three subgroups on the basis of relief and drainage, as these factors are related to, and to some extent determine, their profile characteristics, agricultural values, and capabilities for use. These groups are (1) smooth well-drained soils, (2) sloping soils, and (3) very slowly drained soils.

SMOOTH WELL-DRAINED SOILS

The subgroup of smooth well-drained soils includes Tabor fine sandy loam, mound phase, Leaf fine sandy loam, Cahaba fine sandy loam, Norfolk loamy fine sand, and Kalmia loamy sand. Owing to the smooth relief of these soils, erosion has not been serious. Surface and internal drainage are good. Probably nearly one-half of the areas of these soils is in cultivation, but about one-third of the land formerly cultivated is now used only for pasture. Cotton and corn are the principal crops. Fruit, truck crops, peas, and peanuts are also grown to a small extent.

Tabor fine sandy loam, mound phase.—This is a smooth forested sandy soil, the surface of which is dotted with small sand mounds. The surface soil in virgin areas to a depth of about 3 inches is brown fine sandy loam containing a small quantity of decomposed leafy material. In cultivated fields the surface soil, to a depth of about 6 inches, is grayish-brown or light grayish-brown acid fine sandy loam containing very little organic matter. This passes into pale-yellow strongly acid fine sandy loam, which, below a depth ranging from 12 to 24 inches, grades through a transitional layer of yellow sandy clay loam, about 1 inch thick, into yellow very heavy strongly acid clay. Yellowish-red spots, from one-sixteenth to one-fourth inch in diameter, are numerous in the upper 6 to 12 inches of the subsoil and decrease with depth. The subsoil is compact and only slowly pervious to moisture. Below a depth ranging from 24 to 30 inches, the subsoil material is olive-yellow dense noncalcareous clay slightly streaked with light gray. The parent material of pale grayish-yellow or gray compact noncalcareous slightly sandy clay is reached below a depth of about 45 inches.

The numerous low sand mounds have a 2- to 4-inch surface layer of light-brown fine sandy loam underlain by a 24- to 42-inch layer of pale-yellow loamy fine sand and, in turn, by a subsoil of yellow sandy clay more or less mottled with red spots and light-gray streaks. The mounds occupy from one-tenth to one-half of the surface in areas of this soil. The areas mapped as this soil also include small spots of many other light-colored sandy soils, especially Lufkin very fine sandy loam and Susquehanna fine sandy loam.

Tabor fine sandy loam, mound phase, occurs in many undulating forested upland areas in the eastern part of the county. A large typical area is 6 miles northeast of Terrell around Able Springs School. The surface slope ranges from about $\frac{1}{2}$ to 2 percent, and drainage is slow but adequate for good productivity. Soil erosion is not rapid in unprotected fields.

The fertility of Tabor fine sandy loam, mound phase, is only moderate, and it is lowered under the prevailing system of farming. From one-third to one-half of this land is in cultivation. About one-third is used for Bermuda grass and native-grass pasture, and the rest is woodland. The principal crops are cotton and corn, and cotton occupies about one-half of the land in cultivation. Small acreages are planted to cowpeas, peanuts, sweetpotatoes, sorgo for hay and sirup, and market vegetables for local use. Many of the farmers plant every third row in the cornfields to cowpeas. Acre yields are about 75 to 100 pounds of cotton lint and 10 bushels of corn. New land has produced about one-third to one-half bale of cotton and about 20 bushels of corn to the acre, and similar yields are obtained in old fields where green manure, barnyard manure, and commercial fertilizer are used. The soil is suited for the production of some fruits and vegetables, but in most places internal drainage is somewhat too slow for ideal growing conditions for these crops.

Leaf fine sandy loam.—Leaf fine sandy loam is a smooth sandy forested soil somewhat similar to Tabor fine sandy loam, mound phase, and it differs from that soil chiefly in having a somewhat thinner surface soil, being more gray in the subsoil, and occupying nearly flat old stream terraces.

Between mounds in cultivated areas, the 4- to 6-inch upper part of the surface soil is brownish-gray acid rather light fine sandy loam, which grades into yellowish-gray strongly acid light fine sandy loam. At a depth ranging from 6 to 18 inches and averaging about 12 inches, the sandy surface soil changes abruptly to an upper subsoil layer of mottled red and gray strongly acid compact slowly pervious dense clay. The red coloration of the subsoil decreases gradually with depth, and, at a depth of about 30 inches, this material gives way to gray noncalcareous tough heavy clay slightly mottled with yellow. This grades into the parent material, which lies at a depth ranging from 36 to 48 inches below the surface, consisting of gray compact noncalcareous slightly sandy clay interbedded with more sandy layers.

In virgin areas the topmost 3-inch layer of soil is grayish-brown fine sandy loam. In some places where water stands, especially where the surface soil is comparatively thin, the surface soil below a depth of 4 inches is light gray and is faintly splotched with brown.

In the sandy mounds the surface soil is pale-yellow loamy fine sand to a depth ranging from 18 to 30 inches, and it grades into a friable upper subsoil layer of reddish-yellow fine sandy clay, from 2 to 10 inches thick. This, in turn, grades into yellow dense clay mottled with red and gray. In some depressions, areas of Leaf fine sandy loam include small spots of Myatt loam. Small inclusions of Leaf loam and Leaf very fine sandy loam are also made in mapping, especially in the vicinity of Peeltown.

Leaf fine sandy loam occupies most of the high flat stream terrace in the southwestern corner of the county, known as Peeltown Flat.

Other areas occur on the point of highland between the Trinity River and the East Fork Trinity River. The soil is one of the most extensive light-colored sandy soils in the county. The relief is nearly level to gently undulating, surface drainage is very slow, and here and there water stands on the surface for a few days. Internal drainage also is slow. Erosion generally is not active in unprotected cultivated fields. The uncleared areas are occupied by a forest of rather small and slow-growing trees, mostly post oak and blackjack oak, the latter being confined largely to the sandy mounds, together with some red oak and hickory.

Inherently Leaf fine sandy loam is moderately fertile, but, under the prevailing system of agriculture in which crops are grown with little attempt at soil improvement, yields are very much reduced. About one-half of this land is cropland, one-half of which is devoted to cotton. Corn is next in importance; grain sorghums, sorgo, cowpeas, and truck and fruit crops are grown on small acreages. The present average productivity of the cultivated land is low. Cotton yields about 100 pounds of lint and corn 10 bushels to the acre. The productivity of new land exceeds considerably that of the old land, as is indicated by yields of about one-third bale of cotton and 15 to 20 bushels of corn. In places drainage is too slow for the best production of vegetable and fruit crops.

Cahaba fine sandy loam.—Cahaba fine sandy loam is a smooth soil developed on high flat terraces of old alluvium. In virgin areas the topmost 2 inches of the surface soil is grayish-brown fine sandy loam. In cultivated fields the surface soil is pale grayish-brown acid light fine sandy loam or loamy fine sand 6 inches thick. This is underlain by pale grayish-yellow acid loamy fine sand or fine sandy loam, which grades into the subsoil at a depth ranging from 12 to 24 inches. The subsoil is yellowish-red friable slightly acid sandy clay and, at a depth of about 60 inches, gives way to the parent material consisting of beds of yellow noncalcareous sands and sandy clays of alluvial origin. The soil has excellent tilth and is easily worked.

Cahaba fine sandy loam occupies small areas on the very high terraces in the southwestern part of the county and more extensive areas on the lower terraces. A typical area is 1 mile south of Rosser. Surface drainage is slow but free, and underdrainage is good. The soil is not subject to rapid soil erosion when cultivated. The relief is gently undulating, and the surface gradient ranges from $\frac{1}{2}$ to 2 percent. The uncleared areas support a cover of oak trees.

Cahaba fine sandy loam is potentially a very productive soil. It has excellent physical characteristics and, where fertilized and well managed, produces good yields of a wide variety of crops. Most of the soil under cultivation contains a small supply of organic matter and available plant nutrients. Under prevailing farm practice the yields are very low. About three-fourths of the land is in cultivation, most of which is devoted to general cotton farming. Corn is the principal feed crop. Small areas are utilized for the production of peaches, berries, sweetpotatoes, and other fruit and truck crops. The soil is an excellent site for garden and fruit crops, and these crops are more important on this soil than on any other soil in the county. Most of the fields have been farmed for about 50 years without the general use of manures or fertilizers, and the average acre yields are about 100 pounds of cotton lint and 10 bushels of corn. In the few small areas

that are manured, fertilized, and well managed, the average yields are at least one-third bale of cotton and 20 bushels of corn to the acre.

Norfolk loamy fine sand.—Norfolk loamy fine sand is a forested soil of the uplands, which differs from Tabor fine sandy loam, mound phase, in having a much thicker surface soil and a friable sandy clay subsoil. In cultivated fields it consists of the following layers: (1) A surface soil, ranging from 24 to 42 inches in thickness, of grayish-yellow slightly acid mellow slightly loamy fine sand; (2) a subsoil, about 18 inches thick, of yellow friable sandy clay mottled with red spots and a few gray streaks; and (3) a substratum of grayish-yellow noncalcareous fine sandy loam. The topmost 3- to 6-inch layer of the surface soil is light grayish brown.

This is a smooth well-drained soil occupying small areas in the southeastern part of the county. Typical areas lie on the upland plain, but a few areas border the flood plain of Lacy Creek. A representative body is 3 miles northwest of Mabank. Surface drainage is slow, underdrainage is free, and soil washing is not a serious problem. The surface slope ranges from about 1 to 4 percent.

Norfolk loamy fine sand is of low inherent productivity. It has rather favorable physical characteristics but is so loose that it is leached readily. It contains comparatively small quantities of available plant nutrients. Crops withstand droughts well on this soil, and it is productive when first placed in cultivation. The response to manure or fertilizers is good. About one-half of the land is in cultivation, and most of the rest is in native pasture. Cotton occupies about one-half of the cropland, and corn is grown on most of the rest. Small acreages are used for the production of sweetpotatoes, watermelons, sorgo for sirup, and other special crops. Areas that have been cultivated for a long time produce average acre yields of about 100 pounds of cotton lint and 10 bushels of corn.

Kalmia loamy sand.—The 6- to 10-inch surface layer of Kalmia loamy sand is light-brown loose slightly acid loamy sand. This material grades into brownish-yellow slightly acid loamy sand, which continues downward for several feet and in most places is underlain by sticky sandy loam at a depth ranging from 5 to 7 feet.

Kalmia loamy sand is a smooth soil occurring in small areas on low stream terraces. Two areas are at Rosser, and small bodies are close to the southeastern corner of Dallas County. The area 3 miles southeast of the corner of Dallas County consists of pale grayish-yellow fine sand to a depth of more than 6 feet. Hardwoods, mainly oaks, comprise the native vegetation. The relief is nearly level, and underdrainage is rapid. In the two areas about 2 miles northeast of the southeastern corner of Dallas County, the permanent water table lies from 8 to 20 feet below the surface.

The natural fertility of Kalmia loamy sand is low, but moderate yields of fruits, vegetables, cotton, and feed crops can be obtained with fertilization and the incorporation of organic matter. This soil is well suited to such special crops as watermelons, sweetpotatoes, peanuts, sorghums, berries, and various garden crops. Although all the land has been in cultivation, now only about one-half of it is used for crops. Without fertilization the productivity of old fields is low, and acre yields are about 75 pounds of cotton lint and from 5 to 10 bushels of corn.

SLOPING SOILS

The subgroup of sloping soils includes Kirvin fine sandy loam, Ruston fine sandy loam, Leaf fine sandy loam, slope phase, and Cahaba fine sandy loam, slope phase. These are forested sandy soils of naturally rather low fertility and are so sloping that erosion is rapid in cultivated fields unless protected. These soils generally are unsuited to the production of general field crops under present conditions, owing to low productivity as well as erodibility which necessitates expensive measures of control when the soil is cultivated. In places where erosion is not severe these soils are suitable for the production of fruit and truck crops, which yield high enough returns to warrant fertilization and terracing of the land. Although grasses make fair growth where well established, the value of these soils for pasture is comparatively low. Trees are native but make slow growth, and reforestation for the commercial production of lumber on these soils generally is not recommended.

Kirvin fine sandy loam.—Kirvin fine sandy loam is a rolling upland originally forested soil, which differs from Tabor fine sandy loam, mound phase, in being more sloping and eroded and in having a redder clay subsoil. In cultivated fields the 3- to 5-inch surface layer of Kirvin fine sandy loam is light-brown acid loamy fine sand or light fine sandy loam, grading into a subsurface layer, about 5 inches thick, of pale grayish-yellow very strongly acid loamy fine sand. This material grades abruptly into an upper subsoil layer, about 6 inches thick, of yellowish-red very strongly acid moderately plastic clay, which, in turn, grades into a lower subsoil layer of yellow moderately plastic cloddy sandy clay mottled with gray and yellowish red. The parent material of yellow noncalcareous friable sandy clay lies at a depth of about 30 inches. In many areas that have been cultivated much of the sandy surface soil has been lost through erosion. In uncleared areas of woodland the topmost 3-inch layer is light-brown light fine sandy loam, which grades into pale-yellow loamy fine sand or fine sandy loam.

Kirvin fine sandy loam in Kaufman County is not highly suitable for the production of crops, as it is sloping and thin. Most areas that have been cleared and cultivated during former years are now eroded, gullied, and used for native pasture. At least one-half of the area is uncleared woodland. The soil occurs as strips of rolling country adjacent to streams within the general region of sandy light-colored soils in the eastern part of the county. The surface gradient ranges from about 4 to 12 percent. Some of the smoother areas can be utilized for crops, but better land than this is available in the county. The best use of nearly all areas is for permanent pasture or woodland.

Ruston fine sandy loam.—Ruston fine sandy loam differs from Kirvin fine sandy loam in having a more sandy and more friable clay subsoil. The areas of Ruston fine sandy loam in this county are rolling and have thinner soil layers than is typical for the soil. In virgin areas the soil has the following profile: (1) A surface layer, about 3 inches thick, of light-brown acid fine sandy loam; (2) a subsurface layer, from 6 to 12 inches thick, of pale grayish-yellow strongly acid fine sandy loam; (3) a subsoil, from 18 to 24 inches thick, of reddish-yellow friable strongly acid sandy clay; and (4) a substratum of

banded yellow and reddish-yellow noncalcareous stratified fine sandy loam, which underlies the soil at a depth ranging from 30 to 36 inches below the surface. In most places the substrata are somewhat glauconitic. In areas that have been cultivated formerly the upper two layers have been mixed, the topmost 4- or 6-inch layer is grayish-brown, and considerable surface soil has been lost through erosion in places.

This soil is developed only on narrow slopes adjacent to small streams in the eastern part of the county. Surface drainage is rapid and excessive, underdrainage is free, and soil erosion is severe in cultivated fields. The surface slope ranges from about 4 to 10 percent and exceeds 7 percent in most of the area of this soil. The largest bodies are in the vicinity of Hiram in the east-central part of the county.

Ruston fine sandy loam is strongly rolling; otherwise the soil has physical characteristics favorable for plant growth. The natural content of organic matter and available plant nutrients in this soil are low, and its productivity is likewise low, except when first cropped or where fertilized. Where the control of erosion is feasible, it is an excellent soil for special fruit and garden crops, and with fertilization and the addition of organic matter it also produces good yields of the common crops, cotton and corn. On account of excessive slopes, however, most of this soil is best suited to pasture. Only about one-tenth of the land is in cultivation, and most of the area consists of eroded old fields used for pasture. A small proportion is uncleared woodland. Slightly over one-half of the cultivated acreage is devoted to cotton, about one-fourth to corn, and most of the rest to sorgho. Sudan grass, cowpeas, sweetpotatoes, peanuts, and special fruit and truck crops. The productivity varies widely with management and the length of time in cultivation. The average yields of crops are low, and about 100 pounds of cotton lint and 10 bushels of corn to the acre are obtained. New land yields at least one-third bale of cotton to the acre. Well-sodded Bermuda grass pastures have a carrying capacity of one cow to 5 acres for the duration of the growing season. Although trees are native, they are of slow growth and of poor quality for lumber; therefore reforestation for commercial production of lumber is not advocated on this land.

Leaf fine sandy loam, slope phase.—This soil is sloping forested sandy land with a reddish-brown subsoil of rather heavy clay. It occurs on slopes (escarpments of high stream terraces) adjacent to high flats in the southwestern part of the county.

In cultivated areas the 6- to 10-inch surface layer of Leaf fine sandy loam, slope phase, is light-brown acid fine sandy loam. The subsurface layer is pale-yellow fine sandy loam continuing to a depth of 12 or 14 inches. This material grades into an upper subsoil layer, about 6 inches thick, of yellowish-red strongly acid moderately heavy clay, which, in turn, passes into a lower subsoil layer of mottled gray and red or yellow noncalcareous rather dense clay. At a depth ranging from 24 to 50 inches is the parent material that consists of unconsolidated beds of gray or grayish-yellow sandy clays. In places, beds of sand and gravel occur beneath the parent material at a depth of several feet below the surface.

This soil occurs only in narrow belts of rolling country, which are terrace escarpments, in the southwestern part of the county.

The surface gradient ranges from about 4 to 12 percent, and nearly all of the areas are too rolling, considering the inherently low productivity of this land, for profitable cultivation. Practically none of the land is cropped. Nearly all of it is uncleared woodland used for pasture and firewood.

Cahaba fine sandy loam, slope phase.—This soil is almost identical with Ruston fine sandy loam, from which it differs in origin of the parent material. The gradient of the surface ranges from about 4 to 12 percent, and nearly all of the areas are too sloping to be suitable for cropland. In the virgin soil the surface soil is acid fine sandy loam, ranging from 10 to 20 inches in thickness, which is light brown in the topmost 4-inch layer and pale grayish yellow below. The subsoil is reddish-yellow friable almost massive sandy clay, which grades at a depth of about 3 feet into the parent material of yellow non-calcareous sands or sandy clays. In areas that have been cultivated the upper two layers have been mixed by plowing, and much of the sandy surface soil has been lost through erosion. In the few places where the substrata are very sandy the subsoil is red sandy clay loam rather than reddish-yellow sandy clay. As mapped, the areas include a few small spots of Leaf fine sandy loam, slope phase.

Cahaba fine sandy loam, slope phase, is developed only on narrow slopes, which are terrace escarpments, in the extreme southwest part of the county. All areas have a surface gradient in excess of 3 percent, and many have a gradient exceeding 7 percent. Practically none of the land is cultivated; about one-half of it is eroded, gullied, and abandoned-field pasture; and the rest is woodland. The productivity and adaptations of this soil are the same as those of Ruston fine sandy loam; that is, most of the land should continue to be utilized as pasture.

VERY SLOWLY DRAINED SOILS

The subgroup of very slowly drained soils includes Lufkin very fine sandy loam, mound phase, Tabor-Lufkin complex, Myatt silt loam, and Myatt clay loam. The gray surface soils contain a larger proportion of silt and very fine sand than do the surface soils of other light-colored sandy soils. Myatt clay loam and to less extent Myatt silt loam are heavy soils and included within the group of light-colored sandy soils because of similarities in many characteristics other than texture of the surface soil. These very slowly drained soils are of low to fair productivity for general field crops and are not especially well suited to truck crops or fruits.

The land is flat, level, or nearly level, the dense clay subsoils are compact, and internal drainage is very slow. Natural drainage has been improved somewhat by the construction of graded roads and a few small shallow drainage ditches. During rainy seasons water stands on the surface in places for short periods and in slight depressions within the uncleared woodland areas for periods of a month or longer. According to farmers, drainage improves with clearing and cultivation of the land, and with better aeration the productivity increases slowly during the first 5 to 10 years in cultivation. These soils are extremely tight and crusty and are somewhat difficult to work.

These soils are used for general cotton farming and some feed crops. In general, the productivity of these soils is slightly higher than that of the somewhat more loose and sandy soils of the subgroup of smooth well-drained light-colored soils.

The native vegetation on these soils is characterized by more post oak and elm trees and fewer blackjack oaks than grow on the better drained and more sandy soils. Grassy glades are very numerous on the Myatt soils, especially on Myatt clay loam, and are present in places on Lufkin very fine sandy loam, mound phase. Pasture grasses form a denser sod and apparently make a somewhat more vigorous growth on these soils than on the other light-colored sandy soils. During wet seasons these soils are so wet and soggy for considerable periods that livestock cannot be pastured on them.

Lufkin very fine sandy loam, mound phase.—This soil is commonly known as gray post oak flats. It differs from the somewhat similar appearing Wilson very fine sandy loam, mound phase, into which the areas grade through broad transitional zones, in being forested, and in being of a lighter gray color. It is tight slowly drained gray land with a compact subsoil of gray heavy clay. The productivity ranges from low to fair for general field crops. Many small mounds are scattered over the surface.

Between the mounds in cultivated fields the surface soil ranges from 6 to 10 inches in thickness and consists of strongly acid tight crusty very fine sandy loam. The topmost 3- to 5-inch layer of this material is gray, and it grades into pale-gray material containing a few faint brown specks. The surface soil grades through a transitional layer, not more than 2 inches thick, into a very dense and compact subsoil consisting of gray strongly acid heavy clay. With depth the acidity decreases, and the color fades slightly. Below a depth ranging from 20 to 30 inches is the noncalcareous compact pale-gray clay parent material.

The numerous sandy mounds range from 1 to 2½ feet in height, and they occupy from one-tenth to one-third of the land. In virgin areas the surface soil of these mounds is light very fine sandy loam or loamy fine sand, which is light brown to a depth of 3 inches and pale yellow below. The subsoil, beginning at a depth ranging from 18 to 36 inches, is mottled yellow and red or yellow and gray rather sandy clay and grades into compact dense gray and yellow clay with depth. In old fields the mounds are partly leveled and their former locations are indicated by yellow spots on which crop growth is poor.

The three areas on the east side of Walnut Creek, which are from 1 to 3 miles north of Flat Rock Church and about 10 miles southeast of Kaufman, the two areas about one-half mile northeast of Lone Oak School and about 4 miles northeast of Kemp, and the large area at Ola about 6 miles east of Kaufman are included bodies of a similar soil with a dense subsoil of mottled dark-gray and red heavy clay. The 12-inch surface soil in these areas is fine sandy loam that is gray or grayish brown in the upper 6 inches and lighter gray below. It rests abruptly on the dense subsoil. These included areas are undulating and freely drained where cultivated but very slowly drained where uncleared and forested. Their productivity and use are apparently about the same as for the normal soil of Lufkin very fine sandy loam, mound phase.

Lufkin very fine sandy loam, mound phase, occupies large and small nearly level areas within the forested upland belt of the eastern part of the county. A large typical area is 2 miles south of Cedarvale in the east-central part. Both surface drainage and under-drainage are very slow. Most of the rainfall in excess of that which can be absorbed by the thin soil layers collects in slight depressions and stands until removed by evaporation. The subsoil is nearly impervious, and dry soil material was reached at a depth of less than 3 feet below the surface in some places where surface water had stood for a month or longer. The soil is farmed mostly without artificial drainage, but it is cold and alternately too wet or too dry. It dries and bakes extremely hard and is difficult to work.

Despite its rather unfavorable physical characteristics this soil produces fair yields of general field crops when well managed. About one-half of the total area is in cultivation, less than one-tenth is in pasture, and the rest is uncleared woodland. Cotton occupies between one-half and two-thirds of the cultivated acreage; corn, about one-fourth; and sorgo, oats, cowpeas, and grain sorghums, most of the rest. The prevailing acre yields are about 100 pounds of cotton lint, from 5 to 10 bushels of corn, 15 bushels of oats, and from 1 to 2 tons of sorgo hay. Adequate drainage and some increase of organic matter by plowing under green manures results in good yields of cotton. The soil is not highly productive for corn, as the subsoil is too compact and tough.

Tabor-Lufkin complex.—The Tabor-Lufkin complex consists of flat slowly drained areas of Lufkin fine sandy loam, on which in most places small sandy mounds occupy as much as one-half or more of the land. On these mounds and adjacent to them the soil is chiefly Tabor fine sandy loam, but other soils, of such small extent in this county that they are not mapped separately, are present. The intimate association of these soils is shown in figure 3, a very detailed soil map of a small area of the Tabor-Lufkin complex.

Following is a description of a profile of the Lufkin fine sandy loam areas shown in figure 3:

- 0 to 2 inches, gray moderately acid platy heavy fine sandy loam.
- 2 to 7 inches, light-gray strongly acid vesicular cloddy heavy fine sandy loam.
- 7 to 48 inches+, gray very tough and compact cuboidal nearly impervious clay, which is strongly acid in the upper 12 inches but grades with depth into neutral material.

A profile of Tabor fine sandy loam shows the following characteristics:

- 0 to 12 inches, light grayish-brown acid faintly cloddy loamy fine sand or light fine sandy loam.
- 12 to 24 inches, yellow plastic strongly acid cloddy clay splotched with yellowish red.
- 24 to 48 inches+, yellow plastic noncalcareous slightly sandy clay, which is somewhat less compact than the material in the layer above.

A description of a profile of Tabor loamy fine sand, shallow phase, follows:

- 0 to 12 inches, light-brown acid to faintly acid loamy fine sand.
- 12 to 24 inches, grayish-yellow strongly acid loamy fine sand.
- 24 to 32 inches, yellow strongly acid friable fine sandy clay splotched with some yellowish red.
- 32 to 48 inches+, yellow noncalcareous plastic slightly sandy clay.

The areas of Tabor fine sand, shallow phase, show the following profile characteristics:

- 0 to 3 inches, light-brown moderately acid slightly coherent fine sand.
- 3 to 24 inches, pale grayish-yellow strongly acid slightly coherent fine sand.
- 24 to 34 inches, yellow rather friable acid fine sandy clay with yellowish-red spots in the interiors of the 1-inch cuboidal breakage fragments and gray films on the exteriors.
- 34 to 48 inches+, yellow noncalcareous stiff slightly sandy clay with gray films coating the natural breakage surfaces.

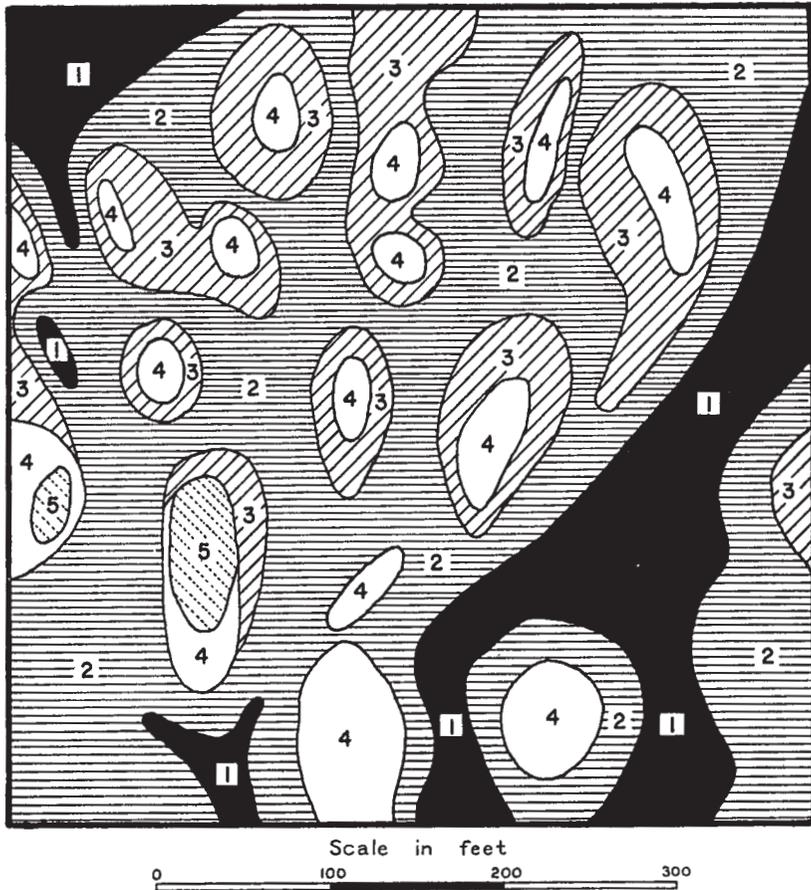


FIGURE 3.—Large-scale map of 5 acres of the Tabor-Lufkin complex: 1, Lufkin fine sandy loam; 2, Tabor fine sandy loam; 3, Tabor loamy fine sand, shallow phase; 4, Tabor fine sand, shallow phase; 5, Tabor loamy fine sand.

Tabor loamy fine sand is characterized by the following layers:

- 0 to 3 inches, light-brown moderately acid slightly coherent loamy fine sand.
- 3 to 36 inches, pale grayish-yellow strongly acid faintly coherent loamy fine sand.
- 36 to 42 inches+, yellow noncalcareous rather stiff fine sandy clay strongly splotted with yellowish red in almost round spots about one-half inch in diameter.

On the smooth flat areas between the mounds a profile of the dominant soil, Lufkin fine sandy loam, is as follows in cultivated fields: A dark-gray surface soil of fine sandy loam about 10 inches thick, resting on or grading through a short transitional layer into gray dense clay with more or less yellow mottlings in the lower part. This material continues to a depth of about 30 inches where it grades into dense yellow and gray mottled clay that continues to a depth of more than 40 inches.

On most of the sandy mounds, which, in places, occupy more than one-half of the land, the soil profile in a cultivated field is as follows: Light-brown loamy fine sand to a depth of 15 inches, grading into mottled yellow and gray heavy sandy clay that contains a few reddish-yellow or yellowish-red spots and continues to a depth of more than 30 inches. This is Tabor loamy fine sand.

In places where the mounds lie very close together the soil between them on the smooth surface is light-brown fine sandy loam to a depth of 12 inches. This grades into yellow very heavy fine sandy clay of about the texture and consistence of the subsoil beneath normal Tabor fine sandy loam.

On the center or crests of some of the sandy mounds a layer of grayish-brown loamy fine sand several inches thick is underlain by yellow loamy fine sand to a depth ranging from 2 to 3 feet. This is much the same as Norfolk loamy fine sand, but below a depth of about 3 feet the clay subsoil is dense and mottled and, therefore, in such places is Tabor loamy fine sand.

The Tabor-Lufkin complex areas occur in the belts of forested upland in the eastern part of the county, and one of the largest is at Cedarvale. As the surface is flat, this soil material has very slow drainage and, as the dense subsoil allows water to drain downward very slowly, water stands in places for some time after rains. The general surface slope is, for the most part, less than 1 percent.

This complex of soils, like the Lufkin and Tabor soils elsewhere, has developed from beds of unconsolidated noncalcareous sandy clay or shaly clay of the older Coastal Plain formations.

The native forest consists chiefly of post oak, with some blackjack oak and hickory. A considerable acreage of this land, probably one-third, is in cultivation. Inherently, the land is only moderately fertile, but it responds to soil-improvement practices, including the use of commercial fertilizers, manures, and applications of organic matter. It has about the same value and capacity for the production of farm and truck crops as has Tabor fine sandy loam, mound phase. Much of the land has been cleared and is in pasture, and some of it supports a growth of Bermuda grass. Average acre yields of cotton are about 100 pounds of lint and of corn about 10 bushels.

Myatt silt loam.—Myatt silt loam is gray, poorly drained, and occupies high post oak flats on old stream terraces in the southwestern part of the county. The profile in virgin areas shows a 2-inch surface layer of dark-gray strongly acid silt loam grading into light-gray strongly acid silt loam. This rests on or passes through a short transitional layer into dark-gray dense very strongly acid heavy clay. Below a depth of about 20 inches, the clay continues downward with little change in texture or consistence, but it becomes light gray, compact, noncalcareous, and slightly mottled with yellow. In cultivated fields the dry surface soil is ash gray, and when thoroughly dried

without cultivation it becomes very hard and crusted, at times preventing the emergence of germinating crops.

Myatt silt loam occurs in several areas within the Peeltown Flat in the southwestern part of the county. Both surface drainage and underdrainage are very slow. Rainfall in excess of that which can be absorbed by the thin soil layers stands on the surface until removed by evaporation. During winter and spring the soil is wet and soggy; during dry late summer it becomes dense and tight. The land is farmed without artificial drainage, although drainage would enable more successful cultivation.

The physical characteristics of Myatt silt loam are unfavorable for growing many crops, but fair yields of cotton are produced under favorable conditions of climate and with proper cultivation. About one-third of the soil is in cultivation, and the rest is in woodland pasture with a very low carrying capacity, as the native grasses make a scant growth and are not highly nutritious. Cotton occupies about one-half of the cropland; corn, about one-third; and oats, cowpeas, sorgo, and grain sorghums, the rest. The normal acre yields are about 100 pounds of cotton lint, 15 bushels of oats, from 5 to 10 bushels of corn, 15 bushels of grain sorghums, and from 1 to 2 tons of sorgo hay.

Myatt clay loam.—Myatt clay loam occupies poorly drained flat areas of the old high stream terraces in the southern part of the county. The surface soil is gray strongly acid clay loam, about 8 inches thick. Rusty-brown and yellow spots, about one-half inch in diameter, are present in this material, which grades rather abruptly into light-gray dense tough clay that gradually becomes lighter colored with depth. In places, this material is slightly mottled with yellow. Small black concretions occur throughout the soil. The light-gray clay subsoil grades, at a depth of about 6 feet, into gray slightly calcareous compact clay.

This soil occurs in small areas on the old terraces along Trinity River. The surface is very flat, surface drainage is slow, and water stands on the surface for some time after rains. Underdrainage is very deficient. The water table lies near the surface during some seasons. Some areas have been drained incidentally in grading roads and providing roadside ditches.

Although oak trees, largely post oak, grow on this soil, some of the land seems to have been almost free of trees. Four miles southeast of Rosser is an area known as Crawfish Prairie.

Myatt clay loam is fair land for crops; where adequately drained its productivity seems to be about the same as that of Wilson clay loam. In such locations the average yield of cotton is about 165 pounds of lint to the acre. Few areas are adequately drained, however, and the yield of all the land in cultivation is about 125 to 150 pounds of lint cotton and 20 to 30 bushels of oats to the acre. About two-thirds of the total area of this soil is in cultivation, and even some of this lies idle during wet years. The principal crop is cotton, with oats and sorghums as the commonly grown feed crops.

SOILS OF THE BOTTOM LANDS

The soils of the bottom lands occupy the flat flood plains of the streams that pass through the county. These soils consist of soil

materials washed from the surfaces of soils of the uplands that are drained by the streams. They have no definite characteristics other than those retained in part from the original place of development, and the soils consist simply of deep deposits of fine earth placed in accordance with the laws of sedimentation of soil material from water. These soils, as a rule, contain comparatively large quantities of plant nutrients and have such physical properties that crops readily withstand long-continued periods of dry weather. Where drainage conditions are favorable, most of these soils are highly productive and are suited to a number of valuable farm crops, including some that are not grown very successfully on most of the soils of the uplands.

Although cotton on these soils is, as a rule, free from infestation with cotton root rot, it makes a rank growth of stalk, which promotes more severe injury by insects than occurs on the soils of the uplands.

The soils of this group are included in the Trinity, Catalpa, Kaufman, and Ochlockonee series.

The soils of the Trinity series are black or very dark gray deep calcareous crumbly soils composed of soil materials transported chiefly from the calcareous soils of the prairies. They have slow drainage in places but are very productive.

The Catalpa soils are brown deep calcareous crumbly soils composed of materials also transported from calcareous soils of the prairies. They are rather productive and have somewhat better natural drainage than the Trinity soils.

The Kaufman series includes dark noncalcareous soils consisting of dark soil materials transported largely from the surfaces of non-calcareous soils of the prairies. They are grayish brown, dark brown, or nearly black and range from neutral to slightly acid. Drainage ranges from very slow to moderately good. Wherever the flood hazard is not severe, the productivity is high.

The Ochlockonee soils are light-brown or grayish-brown acid soils composed mainly of sediments transported from light-colored sandy forested soils of the uplands. They are moderately productive.

The chief obstacle preventing the more generally successful use of the alluvial soils is their subjection to overflow at various times, and this sometimes causes complete loss of crops or considerable injury to them.

On some of the larger bottom-land areas of these soils, especially along the Trinity River, the East Fork Trinity River, and Cedar Creek, levees have been built to prevent overflows. These have afforded valuable protection at times, although their cost has been so high as to be considered unprofitable in some districts. Some of the levees are still holding, some have broken at times, and others have been abandoned after they became greatly damaged by floods.

Trinity clay.—Trinity clay consists of black or very dark gray calcareous crumbly very heavy clay which grades, at a depth of about 6 feet, into gray compact calcareous nearly impervious clay. The surface soil is crumbly in cultivated fields, and the soil has the same tilth as Houston Black clay. The soil is very heavy and dries out slowly. All areas that are not leveed are subject to overflow.

Trinity clay occupies the flood plains of the Trinity River, the East Fork Trinity River, Brushy Creek, and the small branches

draining heavy calcareous soils of the prairies. It is the most extensive soil in the county. The large areas on the flood plains of the two rivers are subjected to such injurious overflows that they are farmed only where protected by levees. The areas along Brushy Creek and the small branches are inundated for shorter periods and produce good crops without artificial drainage.

Adequately drained Trinity clay is probably the most productive land in the county for cotton. The highest average yield of cotton during the 5-year period 1928-32, as reported to the office of the county agricultural agent in connection with the Agricultural Adjustment Administration, was 276 pounds of lint to the acre. This was obtained on Trinity clay in the upper and better drained part of one of the levee districts. The average yield of cotton throughout all levee districts is about 200 pounds of lint to the acre, the average yield being lower on account of incomplete drainage in some areas. About 28,000 acres of Trinity clay are protected by levees, and at least 80 percent of the land thus protected is in cultivation. About 1,500 acres of protected Trinity clay near Rosser are utilized for the production of alfalfa, which produces annually an average of about 3 tons of hay to the acre. The soil is good but not excellent land for corn, as it is too wet and cold in the early spring. The average yield of corn in all areas cropped is probably about 20 bushels to the acre. Grain sorghums, which are more tolerant of poor drainage, will survive longer inundation, and they produce as much or slightly more grain than does corn. The acre yield of sorgho is between 2 and 4 tons of hay, and small meadows of Johnson grass produce about 3 tons of hay to the acre.

Of the unleveed part, at least 5,000 acres are included within floodways and are almost worthless for farming, although they have a slight value for pasture and forest. About 60 percent of the area of Trinity clay occurring in the bottoms of Brushy Creek and smaller creeks is in cultivation. These areas produce an average yield of about 175 pounds of cotton lint to the acre. Cotton occupies at least three-fourths of the land in cultivation; corn, sorghums, and alfalfa, most of the remainder. The permanent pastures on Trinity clay, other than those within the flood plain of the Trinity River and the East Fork Trinity River, have a carrying capacity of one cow to about 5 acres.

In places the original forest growth remains. It consists chiefly of elm, hackberry, ash, and some species of oak, with some pecan trees in exceptionally well drained places.

Catalpa clay.—A few areas of Catalpa clay within the flood plain of the Trinity River and the East Fork Trinity River are underlain by sandy permeable substrata within 4 feet of the surface and accordingly have excellent internal drainage. In these areas the soil consists of dark-brown calcareous crumbly heavy clay underlain, at a depth of about 4 feet, by brown calcareous permeable fine sand or fine sandy clay. Most of the areas lie a foot or so higher than the general level of the surrounding Trinity clay, but before the construction of levees all the areas were overflowed several times each year. They are underlain by a permanent water table within the reach of plant roots. The original forest is said to have been much more thrifty than that on Trinity clay, and it included ash, pecan,

red oak, bur oak, white oak, and other trees. Many of the areas of Catalpa clay at one time were known as ash ridges. Most of them were largely in cultivation prior to the construction of levees. This soil occupies one large area 5 miles south of Rosser and four small areas 4 miles northwest of Crandall.

Catalpa clay is excellent for general field crops, and all the land is protected from overflow. It is outstanding as affording good sites for pecan orchards. It is the most productive soil for corn in the county and is all in cultivation. About three-fourths of the area is planted to cotton and most of the rest to corn. This soil is at least a week earlier than Trinity clay. The average yields are about 250 pounds of lint cotton, 35 bushels of corn, and 3 tons of alfalfa to the acre.

Kaufman clay.—Kaufman clay is a dark soil, similar in some respects to Trinity clay. The soil material is black or very dark gray crumbly noncalcareous clay, which ranges from neutral to slightly acid and continues to a depth of about 4 feet where it grades into gray noncalcareous compact heavy clay. In some areas where especially poorly drained the material below a depth of 12 inches is gray clay containing fine mottlings of yellow and brown. The darkest areas are those along Kings Creek, where in surface appearance the soil resembles Trinity clay. Considerable areas of the Kaufman soil occur along Cedar Creek and along smaller creeks which largely drain the noncalcareous soils of the prairies. This soil is fairly extensive and occurs mainly in the central and southern parts of the county.

The areas of Kaufman clay are almost flat; in fact, in places, the slope is so slight that water stands on the surface for some time after overflows and rains. The soil materials comprise chiefly the transported dark surface soil materials of the black and dark-gray soils of the prairies, chiefly those that are not calcareous.

The land is subject to occasional overflows. Along some streams overflows are so frequent and injurious and the soil remains wet for so long that cultivation is not feasible. In places some of the land is protected by levees, thus allowing successful cultivation. The water table lies within a few feet of the surface.

The native vegetation consists of a heavy forest growth of hardwood trees, chiefly elm, hackberry, and bois d'arc, certain species of oak, largely willow and water oak, and other trees.

Probably about 60 percent of the large areas along Kings Creek and its tributaries is in cultivation, some of it being protected by levees. Little of the soil is cultivated in the more poorly drained areas, such as those along Cedar Creek.

The principal crops grown are cotton, which is planted on about three-fourths of the cropland, corn, and sorghums. Cotton yields from 175 to 200 pounds of lint; corn and grain sorghums, 20 to 25 bushels; and sorgo, 3 to 5 tons of forage to the acre. These yields are obtained from crops planted in locations best situated with reference to protection from overflows and having the best drainage conditions. Bermuda grass and Johnson grass grow well and afford good grazing for livestock. Johnson grass is cut for hay in places and yields from 1 to 3 tons to the acre.

Kaufman clay loam.—Kaufman clay loam is dark-gray or dark grayish-brown noncalcareous neutral friable silty clay loam or clay

loam, which continues without apparent change to a depth ranging from 4 to 6 feet where it grades into grayish-brown noncalcareous clay loam. The soil is friable and readily worked throughout a considerable range of moisture. When properly cultivated it crumbles to an excellent seedbed. It is not tight or crusty when dry.

Kaufman clay loam occurs in the flood plains of streams that drain areas of the Wilson and the Crockett soils. The surface is very nearly level, and drainage is slow, although internal drainage is fairly good. Overflows occur, but in most areas they are of short duration and do not prevent good yields of crops. The areas of this soil dry out ready for cultivation more rapidly than do similarly overflowed areas of Kaufman clay, and the yields of corn are generally higher than on that soil. The aggregate extent of this soil is 23.7 square miles. Some of the areas along the southern reaches of Cedar Creek are flooded too frequently for the successful production of crops.

About two-thirds of the total area is cultivated. The largest uncultivated areas are those on the flood plain of Cedar Creek in the southeastern part of the county. About two-thirds of the cultivated land is devoted to cotton, one-fourth to corn, and most of the rest to grain sorghums and sorgo. This or some other Kaufman soil generally is selected for cornfields on most farms including these soils. Where adequately drained, alfalfa grows well. The productivity for all crops varies widely in accordance with drainage conditions. The usual acre yields are probably about 175 or 200 pounds of cotton lint and 25 bushels of corn, although the better drained areas produce about 250 pounds of lint cotton and 35 bushels of corn.

Kaufman clay loam, high-bottom phase.—Some areas of Kaufman clay loam are gently sloping and lie above normal overflow. These are colluvial fans or high bottoms and constitute the high-bottom phase of this soil. Soil of this phase is about the same as the typical soil except that it has better drainage and, therefore, higher productivity. The total area of this soil is much less than that of the typical soil. This high-bottom soil, to a depth of about 30 inches, consists of dark-gray or grayish-brown noncalcareous clay loam. This material is somewhat lighter colored below a depth of 15 inches than above that depth. The largest bodies are 5 miles south of Kaufman, 4 miles south of Terrell, 2 miles east of Terrell, 2 miles southwest of Elmo, and on the north side of Duck Creek in the northeastern corner of the county.

All the land is cultivated. Cotton occupies about two-thirds of the area and corn most of the rest. The average yields are probably about 225 pounds of lint cotton and between 30 and 35 bushels of corn to the acre.

Kaufman fine sandy loam.—Kaufman fine sandy loam is brown faintly acid or neutral mellow fine sandy loam, about 20 inches thick, underlain by light-brown faintly acid or neutral friable fine sandy loam. The soil, as mapped, includes areas of Kaufman very fine sandy loam. All areas are subject to overflow, but the floodwaters recede quickly. Underdrainage is free, and crops seldom are injured greatly by overflows. The soil contains a very good supply of organic matter and available plant nutrients, and it is fertile. Crops withstand dry periods well. The soil consists largely of unaltered surface soil material washed from areas of acid soils of the prairies,

together with some admixture of materials from light-colored sandy soils.

Most of Kaufman fine sandy loam occurs as narrow bottoms along small streams. The largest areas are on the bottoms of Williams, Rocky Cedar, and Muddy Cedar Creeks in the eastern part of the county.

Kaufman fine sandy loam is very productive and well adapted to all the crops generally grown. Only about one-half of the total area is cultivated, however, because of the occurrence of the soil in small bodies surrounded by soils of low productivity, most of which are not cultivated. The principal crops are corn and cotton, each of which occupies nearly one-half of the cropland. Cotton yields from 160 to 225 pounds of lint, and corn from 30 to 35 bushels to the acre. Small acreages are used for the production of sorghums for grain, forage, and sirup. Most of the area not in cultivation is former cropland, which was abandoned at the same time as were the surrounding eroded sloping fields of the adjacent upland. These areas are covered with a good stand of Bermuda grass, which makes some of the best pastures in the county. They have a year-round carrying capacity of one cow to about 3 acres. A few areas are utilized as Bermuda grass meadow and produce about 2 tons of hay to the acre.

Kaufman fine sandy loam, high-bottom phase.—Some areas of Kaufman fine sandy loam that lie above overflow are gently sloping flats along the margins of the creek bottoms. These are colluvial fans or high bottoms and constitute the high-bottom phase. This soil is much like the typical Kaufman soil, but drainage is better than in that soil. Soil of this phase consists of a 10-inch layer of brown or grayish-brown noncalcareous fine sandy loam, underlain by brown or dark-gray clay loam, which in places is mottled with gray and yellow below a depth of 30 inches. Although the soil lies above overflow of the stream it receives some local run-off water from adjacent slopes.

The largest area of this soil is along Duck Creek in the extreme northeastern part of the county, an area including about 700 acres is about 3 miles south of Elmo, and small areas border the stream bottoms throughout the eastern part.

The productivity of this soil is very high, and good yields of all the general farm crops are produced. About nine-tenths of the soil is devoted to crops, chiefly cotton and corn, of which the average acre yields are about 200 pounds of lint and between 30 and 35 bushels, respectively. Although this land is still very productive, continuous production of cotton and corn has reduced the yields somewhat.

Ochlockonee loamy fine sand.—Ochlockonee loamy fine sand consists of grayish-brown mellow slightly acid loamy fine sand, ranging from 12 to 24 inches in thickness, underlain by gray or yellowish-brown slightly acid loamy fine sand. The low flood plain on which it occurs is subject to frequent overflows, although the floodwaters recede quickly. As the soil drains very rapidly, in general the overflows are not detrimental. This soil consists of sediments washed from light-colored sandy soils of the uplands. The natural content of organic matter is small. The supply of plant nutrients, however, is for the most part in available form, and the productivity of new

land is almost as high as that of Kaufman fine sandy loam. On the other hand, the fertility is more rapidly depleted by continuous cropping of corn or cotton, and the productivity is somewhat lower in most fields than on the Kaufman soil. The physical properties enable plants to grow for a long time without rain.

The principal areas of this soil lie along the headwaters of Williams, Rocky Cedar, and Muddy Cedar Creeks in the eastern part of the county. One of the larger areas is 2 miles north of Cobbs.

Ochlockonee loamy fine sand is very productive, and all the crops commonly grown do well on it. About one-half of the land is in cultivation. The only important crops are cotton and corn, which yield an average of about 150 pounds of lint and 25 bushels, respectively, to the acre. Average yields of 250 pounds of lint cotton and 35 bushels of corn are obtained on newly cultivated land. Pastures on this soil, most of which are well sodded with Bermuda grass, are reported to produce sufficient grass for 3 acres to support one cow for the larger part of the year.

LAND USES AND AGRICULTURAL METHODS

Cotton has always been the chief cash crop of Kaufman County, owing to the favorable climate and large areas of soils suited to its production. A system of farming has developed which is well suited to the smooth deep highly productive soils but which has led to widespread use of all the soils for cotton regardless of their suitability for that crop. Although cotton farming, on the whole, has been profitable on the better soils, it has been so unprofitable on some soils that it would be better to change the cropping systems on such soils to conform to their adaptations and to bring about crop adjustments which may be more generally satisfactory. Possibilities of such changes are contemplated also for the soils better suited to cotton because of lowered yields, due to ravages of insects, plant diseases, and dissipation of soil materials and plant nutrients by erosion. These conditions have become a matter of especial consideration because of the low price of cotton in the last few years which has resulted in little profit, or even a loss in some years. The realization of the need for controlling the total output of cotton, together with the importance of producing a higher standard of quality of cotton that will bring better prices, makes it imperative that the soils selected for cotton should be the best suited and most productive for that crop.

The smooth heavy soils of both the calcareous and noncalcareous sections of the prairies are well suited to cotton. These are the heavy soils of these groups, mainly clays of the Houston Black, Hunt, Bell, Lewisville, Wilson, and Irving series. The productivity of these soils is naturally high, and their smooth surface enables the use of improved farm machinery, although the heavy texture and plastic consistence of the soils requires considerable power for the operation of such machinery.

These soils are very largely utilized for cotton, and yields generally are good under normal conditions. The soils are deep and have a large water-holding capacity, which provides a reserve for the use of crops in very dry seasons. Stored water is not, however,

given up so readily or so completely to growing plants as in the more sandy soils, and crops suffer during some of the more extended dry seasons.

On the smooth heavy soils of the prairies generally, and on the calcareous soils particularly, cotton is injuriously affected by cotton root rot. The infestation is worse when considerable rain falls in early summer.

These soils are smooth or only moderately sloping and are subject to severe erosion only under conditions of clean tillage. By the use of terraces and the practice of contour tillage and, in places, by a system of strip cropping, injury by erosion can be reduced to a minimum.

Corn is an important feed crop grown on the smooth calcareous soils. It grows well but suffers considerably in dry periods in early summer.

Wheat is sometimes grown in small fields but is not a generally important crop. It grows well on these soils, and good yields are obtained.

Grain sorghums, sorgo, Sudan grass, and other crops do well. Alfalfa has been grown successfully on the smoother calcareous soils, on Houston Black clay and Bell clay especially, but this crop suffers in summer droughts and also is affected adversely by cotton root rot.

The smooth calcareous soils of the prairies are for the most part heavy textured and are not well suited to vegetables, truck crops, or fruits. Onions, however, have been grown successfully on some of the soils, especially Houston Black clay, and in some sections considerable quantities are grown for the market. Vegetables and fruits, mainly peaches and plums, are grown successfully in the small home gardens and orchards where care is taken to produce these foods, and they afford a valuable adjunct to the subsistence of the farm family.

These smooth soils produce good pasture crops, but on most farms little land is in pasture because the practice of growing all the cotton possible leaves little land for other crops. The native grasses, the tall prairie bunchgrasses and buffalo and grama grasses, afford excellent grazing. Grasses can be introduced also which will produce good grazing for livestock.

It is possible, and it is the practice on a few farms, to produce crops other than cotton in larger proportions than is customary in a cotton-farming system. The inherent fertility of these rich smooth soils on which cotton has been grown for many years has not been greatly reduced, and these soils may be used for more balanced types of farming than are currently practiced.

The smooth sandy soils of the prairies, comprising Wilson very fine sandy loam, Wilson very fine sandy loam, mound phase, Crockett very fine sandy loam, and Irving fine sandy loam, occur in fairly large areas throughout the eastern part of the county. Their productivity is less than that of the smooth heavy soils and their compact heavy subsoils cause them to be somewhat droughty. These soils are used largely for cotton, and the other crops of the general region are grown also, oats being relatively more important and corn relatively less important than on the heavy calcareous soils of the prairies. On drying a tight crust forms on these soils, and the subsoils are

rather dense and absorb water slowly. The relief is so smooth that erosion can be readily controlled and that all types of agricultural machinery can be used with ease. These soils are less infested with cotton root rot than the heavier soils of the prairies. These moderately productive soils can feasibly be built up to a considerably higher level of productivity.

Fruits and vegetables grow only moderately well unless especial attention is given to maintaining the soils of the farm orchard and garden in good physical condition. Only small quantities of these products are grown, mainly for consumption in the home. These soils are capable of affording excellent grazing, but they are too valuable as cropland for general use as pasture.

The soils of the alluvial bottom lands are highly productive where adequately drained and are well suited to many kinds of crops. The most important crops under the present type of farming are cotton, corn, and certain feed crops, including alfalfa. The chief hindrance to the more complete utilization of these soils is damage from overflows and poor drainage. Although cotton root rot is present in practically no areas of these soils, injury by insects is often severe.

Small grains are not generally grown. These soils are not especially well suited to fruit and vegetable crops owing to slow drainage, consequent lateness, and location in places where damage from late freezes is most severe. Some of the better drained areas, which are underlain by a permanent water table within reach of tree roots, are well suited for pecan orchards.

The inherent fertility of the smooth light-colored soils of the forested lands is low to moderate. The soil reaction is acid, the organic-matter content is low, and the supply of some of the essential plant nutrients is very low.

These soils are easily cultivated and are well suited to many special crops, especially to vegetables, many truck crops, fruits, and berries, and are moderately well suited to cotton, corn, sorghums, and grasses. They respond well to fertilization and other methods of improving soil fertility. They are largely in use for general field crops, chiefly cotton and corn, but considerable areas are abandoned fields, and there are many tracts of uncleared woodland. Owing to their smooth relief, these soils are not subject to rapid erosion, and, where necessary, control of erosion can be effected at low cost.

These soils furnish a considerable supply of foods from the home gardens and orchards. Where marketing facilities are near, truck and fruit crops and such special crops as berries, grapes, watermelons, flowers, nursery stock, and others can be produced commercially and are fairly profitable. Although these soils are not highly esteemed for the production of general commercial crops, such as cotton and small grains, they are of such character that a very satisfactory type of subsistence and cash-crop farming can be established. Feed crops, such as sorghums and grasses, produce moderately well, and pastures of Bermuda grass and other grasses can be easily established. Most of the associated areas of sloping soils can be used more successfully for pasture or woodland than for cultivated crops.

Soils that are so sloping or eroded as to have little value for cultivated crops include Leaf fine sandy loam, slope phase; Cahaba fine

sandy loam, slope phase; Wilson clay loam, slope phase; Wilson clay, slope phase; Crockett clay loam, eroded phase; Crockett very fine sandy loam, rolling phase; Crockett fine sandy loam, steep phase; Lewisville clay, slope phase; and Sumter clay.

These soils are widely separated in many small and large areas throughout most parts of the county on the prairies, on the margins of the old stream terraces, and in the sandy forested lands. Many areas are not cultivated, although some are included in fields with better soils. They are used largely for pasture but afford scant grazing, although they are inherently capable, when well managed, of producing large supplies of forage. For the most part, especially in the large proportion composed of abandoned fields, the stand of desirable forage plants is thin and subsidiary to the large quantity of unpalatable weeds. The carrying capacity of nearly all of the pastures can be very greatly increased by such methods of management as mowing to control weeds, contouring to hold water and soil in place, and seeding or sodding to establish thick stands of nutritious and palatable plants.

Systematic crop rotations are not practiced, as a rule, on the soils of this county, although the crops are changed from time to time in accordance with the judgment and convenience of the farmer. The general experience of farmers in Kaufman County is that alternation of crops, where these are legumes, has not strongly affected the yields of common field crops except so far as the injury from plant diseases, insects, and soil erosion has been modified. Experiments made at the Texas Agricultural Experiment Substation at Temple on tracts of smooth crumbly blackland, which were severely infested with cotton root rot, resulted in materially lessened injury from cotton root rot and materially larger yields of cotton in some of the rotated plots than in those continuously planted to cotton.¹² Experiments in crop rotations at College Station made on Lufkin fine sandy loam, a light-colored forested soil, indicated a considerable increase in yields of cotton and corn when some commercial fertilizers and manure were used. Results seem to indicate, however, that the increases in yields of both cotton and corn were largely the result of the fertilizers and manure used.¹³

Not very much commercial fertilizer is used. Small quantities have been used on the sandy light-colored forested soils, which show a response clearly indicating certain deficiencies in plant nutrients in these soils. On soils of the prairies the responses to the applications of commercial fertilizers have been irregular and indicate that average increases in crop yields for a long period of years would not be profitable unless the price of the crop were high.

Results of experiments made at Troup and Nacogdoches on soils of characteristics similar to those of the light-colored sandy soils of the forested lands of Kaufman County indicate that these soils are deficient in nitrogen and phosphoric acid and that a complete fertilizer is needed for best results. It is suggested that for cotton on these

¹² REYNOLDS, E. B., and KILLOUGH, D. T. CROP ROTATION IN THE BLACKLAND REGION OF CENTRAL TEXAS. *Tex. Agr. Expt. Sta. Bul.* 365, 21 pp. 1927.

¹³ REYNOLDS, E. B. EXPERIMENTS WITH FERTILIZERS ON ROTATED AND NON-ROTATED CROPS. *Tex. Agr. Expt. Sta. Bul.* 390, 39 pp., illus. 1928.

soils a 4-8-4¹⁴ or 4-6-4 fertilizer at the rate of 200 to 400 pounds to the acre be used.¹⁵

In experiments made on Houston Black clay on the Texas Agricultural Experiment Substation at Temple increased yields of cotton obtained with commercial fertilizers were not sufficient to be profitable throughout a period of several years.

The prevailing method of preparing land for cotton and other intertilled field crops is listing at some time during the winter. Fields which were in oats or sorgo the preceding season are either flat broken or listed. Listing requires only about one-third as much labor as flat breaking, and, where the preceding crop was intertilled, farmers report that the yields are as good on land so prepared as where plowed. On the heavier soils flat-broken land tends to be too loose for a good seedbed until settled by rains. Land is commonly listed or plowed to a depth of 3 or 4 inches. Small grains commonly are planted following cotton without any preliminary preparation of the seedbed.

Cotton is planted generally on the bed between March 15 and June 15. Farmers report that moderately early plantings are generally most productive on account of less damage from insects. The cottonfields are cultivated with duckfoot, shovel, or sweep-equipped implements sufficiently often to control weeds. The cotton is chopped or thinned with a hoe as soon as possible after the plants are 1 or 2 inches high. The general practice of farmers is to leave stands of about two plants to the hill spaced from 8 to 12 inches apart. Poison is used when cotton leaf worms are abundant but generally is not used for any other insect.

Corn is planted in late February and early March. Some corn is planted, especially on bottom-land soils, as late as June, but early corn is more productive. Farmers attempt to obtain stands of one stalk to the hill about 3 feet apart. The cornfields are not kept as clean as the cottonfields, and most of them are not hoed. The grain is harvested by snapping the ears in the husk, and livestock are allowed to graze on the standing stalks. Winter oats are planted from October to December, spring oats in February. Oats are cut with a binder before they are thoroughly ripe. Grain sorghums are planted between April 1 and the middle of July. They are harvested either in the head or in the bundle. Hay crops, principally sorgo, are planted broadcast, generally during May and June but sometimes as late as the middle of July. They are harvested by curing in the windrow and baling in the field.

The common practice is to cut all row-crop residues with a stalk cutter and turn the stalks under. The cornstalks and cotton stalks are raked and burned on a few farms. Livestock are allowed to feed on the strawstacks; practically none of the straw is returned to the fields. A few farmers haul cotton burs from the cotton gins and spread them on the fields. No regular crop rotation is followed, and the crops commonly grown do not include a legume. On the sandy soils many farmers plant every third row of the cornfields to cow-

¹⁴ Percentages, respectively, of nitrogen, phosphoric acid, and potash.

¹⁵ REYNOLDS, E. B., MCNEISS, G. T., HALL, R. A., JOHNSON, P. R., STANSEL, R. H., DUNLAVY, HENRY, DUNKLE, P. B., and MORRIS, H. F. FERTILIZER EXPERIMENTS WITH COTTON. Tex. Agr. Expt. Sta. Bul. 469, 31 pp. 1932

peas. Few livestock are kept, little barnyard manure is produced, and the small quantities available are applied largely to gardens. Green-manure crops, cover crops, or commercial fertilizers are not generally used. The prevailing farm practices do not maintain soil productivity.

According to farmers the insects affecting cotton most in this county are the cotton boll weevil, the cotton flea hopper, and the cotton leaf worm. Damage from boll weevil infestation is most severe on late and rank-growing cotton, especially on the bottom-land soils. Farmers report that in the heavier blackland sections the cotton flea hopper probably causes as much damage on the blackland soils as does the boll weevil. The cotton leaf worm causes severe damage during some years, and poisoning for its control is common practice. The greater insect damage on cotton which is making good growth explains, in part, the erratic results obtained from soil-improvement practices. In the cotton program of 1933 a heavy growth of cotton was plowed under on many fields. In 1934 most of these green-manured fields produced considerably larger cotton plants but a smaller cotton yield than in 1933 on account of more severe damage from the flea hopper.

Cotton root rot, miscalled "alkali" by some farmers, is a fungus disease that is confined over in the soil. According to plant pathologists, it attacks cotton, legumes, many weeds, and many cultivated plants other than grasses. The occurrence of cotton root rot is related to the character of the soil. Probably between 10 and 15 percent of the area of calcareous soils of the prairies in Kaufman County is infested, and practically none of the area of the strongly acid and of the bottom-land soils is infested. It is confined largely to calcareous or only slightly acid soils of the upland.

PRODUCTIVITY RATINGS

The soils of Kaufman County are rated in table 4 according to their productivity for the more important crops. The soil types and phases are listed in the order of their general productivity under the prevailing farming practices, the most productive soils being at the head of the table.

The rating compares the productivity of each of the soils for each crop to a standard—100. This standard index represents the inherent productivity of the most productive soil or soils of significant extent in the United States for that crop. The inherent productivity of a soil has been defined as the productivity the soil possessed for crop plants, without the use of amendments, at the time it apparently became adjusted to the usual tillage practices and before practices of management had altered significantly this level of production. The productivity is expressed as the percentage, to the nearest 10 percent, of the standard. Accordingly, a soil with a rating of 50 for cotton produces an average yield of 200 pounds (50 percent of 400 pounds) of lint cotton per acre. Soils given amendments, such as lime, commercial fertilizers, and irrigation, or unusually productive soils of small extent, have productivity indexes of more than 100 for some crops.

TABLE 4.—Productivity ratings of soils in Kaufman County, Tex.

Soil ²	Crop productivity index ¹ for—							
	Cotton		Corn for grain		Oats, under current practices	Grain sorghums, under current practices	Sorghums for forage under current practices	Permanent pasture under current practices ⁴
	Under current practices	Inherent productivity ³	Under current practices	Inherent productivity ³				
Catalpa clay ⁵	70	70	80	80	-----	80	90	-----
Kaufman clay loam, high-bottom phase.....	60	70	70	80	70	80	80	100
Bell clay.....	60	70	60	70	70	70	80	80
Houston Black clay.....	50	70	60	70	70	70	80	80
Hunt clay.....	50	70	60	70	70	70	80	80
Kaufman fine sandy loam, high-bottom phase.....	50	70	60	80	60	70	80	100
Lewisville clay loam.....	50	70	60	80	70	70	80	-----
Trinity clay, protected by levees.....	50	50	40	40	70	70	90	-----
Kaufman clay, protected by levees.....	50	50	40	40	70	70	90	-----
Kaufman clay loam.....	45	45	60	60	60	80	90	80
Kaufman fine sandy loam.....	45	70	60	70	-----	70	90	100
Ochlockonee loamy fine sand.....	45	70	50	80	-----	70	80	100
Wilson clay.....	45	60	40	50	70	60	70	80
Irving clay.....	45	60	40	50	70	60	70	-----
Trinity clay, unprotected ⁶	40	40	40	40	-----	70	90	80
Kaufman clay, unprotected ⁶	40	40	40	40	-----	70	90	80
Houston clay ⁷	40	70	35	70	70	50	60	80
Wilson clay loam.....	40	60	30	40	70	50	60	80
Irving clay loam.....	40	60	30	40	70	50	60	-----
Lewisville clay, slope phase ⁷	35	70	35	70	60	40	50	80
Wilson very fine sandy loam.....	35	60	20	40	60	40	50	80
Irving fine sandy loam.....	35	50	20	40	60	40	50	-----
Wilson clay, slope phase ⁷	35	60	20	60	60	40	50	80
Crockett very fine sandy loam.....	30	60	20	40	50	30	40	70
Wilson clay loam, slope phase ⁷	30	60	20	40	50	30	40	70
Wilson very fine sandy loam, mound phase.....	30	50	20	30	40	30	40	60
Myatt clay loam.....	30	30	20	20	40	30	40	60
Crockett fine sandy loam.....	30	50	20	30	40	30	30	60
Tabor-Lufkin complex.....	25	50	20	40	20	20	30	50
Tabor fine sandy loam, mound phase.....	25	50	20	40	20	20	20	40
Leaf fine sandy loam.....	25	50	20	40	20	20	20	40
Cahaba fine sandy loam.....	25	60	20	60	-----	20	20	40
Crockett very fine sandy loam, rolling phase ⁷	25	60	10	50	30	20	30	50
Kalmia loamy sand.....	20	50	20	60	-----	20	20	30
Norfolk loamy fine sand.....	20	50	20	60	-----	-----	-----	30
Lufkin very fine sandy loam, mound phase.....	25	40	20	30	30	20	30	50
Myatt silt loam.....	25	40	20	30	30	20	30	50
Sumter clay ⁸	25	-----	10	-----	30	30	40	50
Cahaba fine sandy loam, slope phase ⁸	20	60	10	50	-----	-----	-----	40
Ruston fine sandy loam ⁸	20	60	10	50	-----	-----	-----	40
Crockett clay loam, eroded phase ⁸	20	50	-----	-----	20	-----	30	40
Kirvin fine sandy loam ⁸	10	50	10	40	-----	10	-----	30
Leaf fine sandy loam, slope phase ⁸	10	50	10	40	-----	-----	-----	30
Crockett fine sandy loam, steep phase ⁸	-----	-----	-----	-----	-----	-----	-----	30

¹ The productivity of each of the various soil types for each specific crop is compared to a standard, 100, which stands for the inherent productivity of the most productive soil or soils of significant acreage in the United States for that crop. This productivity rating of the soils of Kaufman County is based on their productivity under the prevailing farming practices.

² Soils are listed in the approximate order of their general productivity, the most productive first.

³ The indexes in this column are ratings of the productivity of the soil when first placed in cultivation.

⁴ Average productivity for pasture in present unimproved condition.

⁵ All areas are protected by levees

⁶ Excluding areas in floodways of levee districts, which are of very low value for agriculture. The un-leveed areas occur mostly along small streams and are naturally better drained than the leveed areas. The productivity is highly variable, depending on drainage conditions.

⁷ Soils with rolling surfaces, nearly all areas of which have been moderately to severely eroded.

⁸ Soils with strongly sloping surfaces and generally unsuitable for field crops.

NOTE.—A blank space indicates that the crop is not commonly grown on the particular soil type.

The following tabulation sets forth some of the acre yields that have been set up as standards of 100. They represent long-time average yields of crops of satisfactory quality on the better soils without the use of amendments.

Crop:	
Cotton-----	pounds of lint-- 400
Corn-----	bushels-- 50
Oats-----	do-- 50
Grain sorghum-----	do-- 40
Sorgo (forage)-----	tons of air-dry hay-- 4
Pasture-----	cow-acre-days ¹ -- 100

¹"Cow-acre-days" is a term used to express the carrying capacity of pasture land. As employed here, it is the product of the number of animal units carried per acre multiplied by the number of days the animals are grazed without injury to the pasture. For example, a soil capable of supporting 1 animal unit per acre for 360 days of the year rates 360, whereas another soil capable of supporting 1 animal unit per 2 acres for 180 days of the year rates 90. Again, if 4 acres of pasture support 1 animal unit for 100 days the rating is 25.

The crop indexes in table 4 refer to the productivity of the soils under the prevailing farming practices in this county. These indexes may differ from county to county inasmuch as practices of management and certain characteristics of soil types may differ from county to county. In this county little commercial fertilizer is used. Inasmuch as current farm practices do not maintain soil fertility, the present productivity is largely an expression of how slowly or how rapidly the yields have decreased with continued cultivation—in other words, how strong the soil is. The soils of higher rating are almost as fertile as when they were first placed in cultivation; whereas, in general, the productivity of the soils with the lower ratings decreases rapidly with continued cultivation under the present farm practices. The estimated productivity of new land under present conditions for cotton and corn is shown in the columns headed Inherent productivity. For cotton the productivity of new land is much lower, owing to greater prevalence of insects and diseases, than it was when most of the land was first placed in cultivation from 30 to 70 years ago. For other crops the original productivity is almost the same as it was when the country was first settled.

The natural factors influencing the productivity of land are mainly climate, soil, and relief, or lay of the land. In addition to these are the factors of management and amendments. A low index for a particular crop may be due to some local condition of unfavorable relief, drainage, or climate rather than to a lack of fertility in the soil. Relief is an important factor, mainly on account of its influence on erosion. The productivity indexes as estimated apply to the average conditions of erosion on a given soil.

Crop yields over a long period of years furnish the best available summation of those factors contributing to productivity. The crop-productivity indexes are the relative yields actually obtained under present management as closely as could be estimated. The estimates of productivity for cotton are reasonably accurate and are within 25 pounds of the true average. The estimates for other crops are based on less complete data. The estimates of productivity for pasture have a large probable error.

Two sets of indexes are given for Trinity clay and Kaufman clay, which are subject to periodic overflow. The higher index applies to

the average drainage conditions of these soils within levee districts; the other applies to the areas in cultivation outside levee districts.

It will be seen from the note at the foot of the table that no rating is given if the crop is not commonly grown on the particular soil.

It should be understood that these productivity ratings are not to be interpreted directly into specific land values. They are based on the essentially permanent factors of productivity of the soils and their responsiveness to management, and little attention is given to the more transitory economic conditions affecting land values.

MORPHOLOGY AND GENESIS OF SOILS

Kaufman County lies within the Red and Yellow soils region which embraces the southeastern part of the United States. The county lies, however, at the western and dry limit of this region. There are extensive areas of soils developed from heavy parent materials under prairie vegetation which are dark colored and not representative of the region as a whole. Mature soils possessing all those characteristics which are normally produced by the climatic environment, such as Ruston fine sandy loam, are not extensive and have developed only on permeable very easily modified parent materials, namely, sands and sandy clays which contain little or no calcium carbonate.

The county is situated on the eastern margin of the Blackland Prairies (Rendzina soils) of Texas, an intrazonal soil belt that includes about 9,000,000 acres. This intrazonal belt is the consequence of the impervious and highly calcareous character of the parent materials which has modified soil development both directly by impeding leaching and indirectly through its influence on vegetation.

The parent materials of the soils in this county are marls, less highly calcareous clays, and sands. Essentially, they are various mixtures of quartz sand, finely divided calcium carbonate, and thoroughly weathered clay minerals. Most of the parent materials are marine formations which were laid down in late Cretaceous and early Eocene times. The outcrop of these in north-south belts has given rise to the north-south belts of general soil areas shown in figure 2 (p. 14). Continental or alluvial deposits, old stream terraces, occupy the southwestern one-third of the county. In order of outcrop from east to west, corresponding to ascent in the geological column, the marine formations are as follows:¹⁰ (1) Taylor marls, impervious originally bluish-gray marls that contain 75 percent or more of calcium carbonate; (2) lower Navarro clays (Neylandville), gray slightly to moderately calcareous impervious clays; (3) medial Navarro sands (Nacatoch), yellow slightly calcareous or noncalcareous sands and sandy clays; (4) upper Navarro clays (Kemp), gray slightly calcareous clays with some marl; (5) lower Midway sands (Kincaid), yellow noncalcareous to slightly calcareous glauconitic sands with a vagrant limestone lentil; and (6) upper Midway clays (Wills Point), gray or yellow noncalcareous to slightly calcareous nearly impervious clays. The stream terraces are underlain by sands and more or less highly calcareous clays. These terraces are sufficiently old (accord-

¹⁰ SELLARDS, E. W., ADKINS, W. S., and PLUMMER, F. B. GEOLOGY OF TEXAS, V. I., STRATIGRAPHY. Tex. Univ., Bur. Econ. Geol. Bul. 3232. 1007 pp., illus, 1932.

ing to geologists the age of the highest terraces is probably old Pleistocene) that the soils of the terraces are as fully developed as the upland soils. The marls and highly calcareous clays underlie the calcareous prairie soils; the slightly calcareous clays underlie the acid prairie soils; and the sands underlie light-colored sandy soils.

In about two-thirds of the upland part of the county the soils were developed under a tall prairie grass vegetation, and in the rest of the upland were developed under oak forest. The occurrence of prairies corresponded to the outcrop of heavy impervious formations, and the prairie vegetation was a climax plant community. It was the result of the impermeability of the substrata and the absence of a permanent ground-water table within the reach of tree roots. The soils become very dry during late summer, and trees planted on the prairie do not thrive well as they suffer from lack of available moisture.

There were two associations of prairie vegetation, namely, dominant bluestems and coarse grasses on the calcareous soils of the prairies and smaller species with some bluestems on the acid soils. In the virgin prairie, soils such as Crockett very fine sandy loam have a distinctly darker surface layer in the spots occupied dominantly by bluestems and a browner surface layer in the spots occupied dominantly by three-awn grasses.

Six kinds of soil occur, namely, (1) mature, normal Red and Yellow soils—Cahaba, Ruston, Norfolk, and Tabor fine sandy loams; (2) acid soils of the prairies—the typical Wilson and Crockett soils; (3) Rendzina soils (calcareous soils of the prairies)—Houston, Sumter, Hunt, and Lewisville clays; (4) soils developed under alternating water-logging and desiccation—the Lufkin and Myatt soils; (5) intrazonal sands—Kalmia loamy sand and Norfolk loamy fine sand; and (6) essentially unaltered material of recent deposition—the Trinity, Kaufman, Catalpa, and Ochlockonee soils. The other soils are gradations between these kinds.

The normal regional soil profile is well expressed in the following description of a profile of Cahaba fine sandy loam, as observed 6 miles southwest of Crandall, in a smooth well-drained area of open forest of post oak and blackjack oak:

- A₀. A loose layer, about one-half inch thick, of dry partly broken oak leaves.
- A₁. 0 to 4 inches, light-brown mellow loamy fine sand with a pH value of 6.5.
- A₂. 4 to 15 inches, pale grayish-yellow slightly acid slightly loamy fine sand. The material breaks out as fragile clods with nodular surfaces and contains numerous worm casts.
- B. 15 to 40 inches, yellowish-red friable acid sandy clay. At a depth of 24 inches the pH value is about 5.0. Between depths of 15 and 21 inches the material has an angular nut structure, with the fragments about three-fourths inch in diameter, below which the material is massive.
- C. 40 to 80 inches, yellow permeable noncalcareous sticky fine sandy loam grading into yellow loamy sand at a depth of 60 inches. At a depth of 48 inches the pH value is 5.7. The geological formation is a stream terrace.

The smooth acid soils of the prairies are normal or near-normal soils of the southern prairies. They are in equilibrium with their environment, and the abnormal feature of environment, prairie vegetation, is permanent. They occupy smooth well-drained surfaces and have developed from parent materials that are less highly calcareous and slightly more sandy or silty than those underlying such black-

land soils as Houston Black clay. Part of the area of Wilson soils is very slowly drained; but the only apparent differences between the Wilson soils as developed in slowly drained and in freely drained locations are slightly more numerous iron concretions in all horizons and gray (rather than olive-yellow) substrata in the nearly level areas.

The acid soils of the prairies have a distinct texture profile, but the A horizon is less thoroughly eluviated than in the forested mature Red and Yellow soils. Apparently translocation of finely divided materials from the A horizon into the B horizon proceeded until the B horizon became so dense as to slow down the process greatly. The surface horizons are acid, and the acidity greatly decreases with depth. The substrata are calcareous. A very few black, spheroidal, pitted crystalline concretions, apparently of iron oxide, occur in all horizons below the immediate surface. They are moderately abundant and associated with brown films coating crevices in the upper C horizons of all the acid soils of the prairies other than the slope phases of the Wilson soils. They are especially abundant in slick spots. Slick spots are few and unimportant except in Crockett clay loam, eroded phase, and they constitute less than one-fourth of the total area mapped of that soil. Undisturbed slick spots have a 2- or 3-inch surface layer of light grayish-brown fine sandy loam resting abruptly on extremely dense brownish-yellow noncalcareous very compact clay. This breaks out, when pressure is applied, as irregular very hard clods 2 to 3 inches in diameter, which are coated with brown or dark-brown films. The upper B horizon of the slick spots does not have a prismatic structure. In many areas the thin A horizon has been removed by wind or water erosion, either before or subsequent to cultivation, exposing the underlying clay. The exposed material shows a trace of nearly white very fine sand or silt on the surface. Between depths of one-eighth inch and 2 inches the material is very vesicular, the vesicles being nearly round, as much as one-tenth inch in diameter, and sufficiently abundant to constitute at least one-third of the volume.

The following description of a profile of Wilson clay loam is representative of the general characteristics of the acid soils of the prairies. It was observed $5\frac{1}{2}$ miles east of Kaufman, 1.6 miles east of the west corner of the Susannah Dorsett survey, in a smooth well-drained flat, with a surface gradient of about 1 percent, covered with three-awn, bluestem, and associated grasses.

- A. 0 to 6 inches, dark-gray friable silty clay loam, which is porous-massive in place, breaks out when dry as moderately hard clods, and crushes when moist to crumbs. The cut surface shows a few rusty-brown specks. The pH value, according to field test, is 5.0.
- B₁. 6 to 12 inches, grayish-black friable slightly granular clay. In place the material is arranged in large vertical columns, from 3 to 5 inches in diameter, with nodular cleavage planes. It crushes when dry to coarse granules and some fine crumbs, and when moist to finer crumbs. When crushed the color is dark gray with a faint brown cast. The granules are sprinkled with an inconspicuous film of gray. The reaction is the same as in the overlying material.
- B₂. 12 to 48 inches, very dark gray extremely plastic and compact very hard blocky noncalcareous very heavy clay. The material breaks out as large clods, from 3 to 8 inches in diameter, with irregular angular fracture. The material will not crush to a crumb; it either crushes to powder

and fragments or rolls like a wire. Field test at a depth of 24 inches gave a pH value of 6.0.

- B_s. 48 to 66 inches, gray slightly calcareous very plastic very compact blocky clay containing a few concretions of calcium carbonate and gypsum. The material is faintly less compact than in the overlying horizon.
- C. 66 to 80 inches+, yellowish-gray calcareous very compact clay, slightly mottled with yellow surrounding black centers (apparently iron oxide) and containing white concretions of calcium carbonate.

As seen in other locations, the calcium carbonate concretions occur down to but not below a depth of about 10 feet. The Wilson profile is most characteristically developed in medium-heavy textures in smooth, nearly level or very gently sloping, slowly drained areas. It does not occur on sloping areas in textures lighter than clay loam. Sloping acid soils of the prairies with surface soils that are lighter textured than clay loam have dark-brown surface soils and reddish-brown upper sub-soil layers mottled with red. Such soils are members of the Crockett series. The red color apparently is an expression of less hydration of the iron compounds than occurs in the Wilson soils; the red mottlings have practically no relationship to structure.

The different textures of the Wilson soils correspond, for the most part, with differences in the parent material, although in places they are the result of differences in stage of development. Many flat areas of Wilson clay loam are surrounded by narrow rims of Wilson very fine sandy loam. These sandy margins cross the strike of the geological formations and accordingly represent different developments from the same parent material. The flattest and most slowly drained areas of Wilson very fine sandy loam, especially those of the mound phase, are gradations toward the Lufkin soils and have more or less of a gray layer at the base of the A horizon.

The only apparent soil development in the blackland soils, which are typified by Houston Black clay, is some leaching of carbonates out of the surface horizons and the accumulation of organic matter. These soils are underlain by a slight zone of carbonate accumulation or at least by a zone of translocated carbonates. No texture profile and no true B horizon are developed. The topography and profile

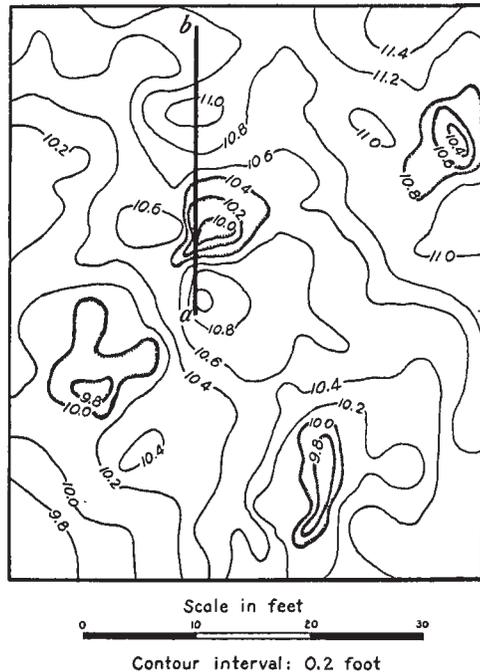


FIGURE 4.—Topographic map showing micro-relief of hog wallows in Houston Black clay. Line *ab* is the site of figure 5.

of the virgin soil of Houston Black clay, shown in figures 4 and 5, are characteristic of the group of blackland soils.

The relationship between the thickness of the soil layers and the microrelief also is illustrated in figures 4 and 5. The cross section diagrammed in figure 5, which was sketched to scale, represents the extreme variation; it crosses one of the deepest hog wallows that could be found. The solid black line 17 feet to the right of the left side of the diagram is a small fault exhibiting well-expressed slicken-side. The bulge at the 10-foot distance on the horizontal scale is typical, though thick, Houston clay. The thickness of the granular horizon is uniform both over microridge and hog wallow. The average thickness of the black horizons in Houston Black clay, including the shallower spots under the microridges, is about 35 inches. The wavy thickness of the black horizons characteristic of Houston Black clay throughout Kaufman County is not exhibited in many areas of typical Houston Black clay in other counties.

The blackland soils, which are Rendzina soils, as typified by Houston Black clay, are confined to the outcrop of highly calcareous geo-

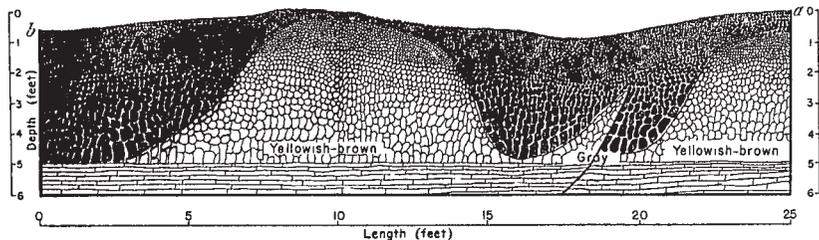


FIGURE 5.—Profile of a cross section of Houston Black clay.

logical formations of very fine texture. They are intrazonal soils caused by the resistance of the parent materials to the normal processes of soil development in this region. Carbonates are leached to some extent from the surface horizons, and organic matter is accumulated to a depth of 4 or 5 feet in smooth areas. A slight zone of carbonate segregation is developed in the substratum between depths of about 4 and 10 feet, in which soft white concretions of calcium carbonate, with a maximum diameter of 2 inches, are more or less numerous. The deeper and less altered parent materials, although very highly calcareous, contain no segregated masses of calcium carbonate.

The following description of a profile of Houston Black clay, which is shown diagrammatically at the left end of the cross section (fig. 5), is characteristic of the group of Rendzina soils. This profile was observed 2½ miles north of Forney, where the surface is smooth, gently undulating, and well drained, under a virgin prairie vegetation dominantly of bluestem grasses.

0 to 1½ inches, a loose mass (dry) of very fine (about one thirty-second inch in diameter) subangular hard grains of black calcareous clay.

1½ to 18 inches, black calcareous crumbly coarse-granular very heavy clay.

When very dry the material in this horizon is a porous mass of subangular to somewhat rounded hard pellets, about one-half inch in diameter, which are loosely bound together by plant roots. When wet the material is practically impervious, extremely plastic, and extremely sticky. Earthworm casts are moderately numerous. With increasing

depth the structure fragments gradually become larger and more angular.

- 18 to 48 inches, black or grayish-black highly calcareous hard cloddy very heavy clay. When wet the material is practically impervious to water, extremely plastic, and extremely sticky; when dry it is fissured by large irregular contraction cracks into very hard clods. Water readily passes downward along these cracks until they are closed by swelling, and plant roots permeate throughout the horizon.
- 48 to 120 inches, yellow or olive-yellow very highly calcareous clay with shaly structure and smooth fracture. Soft white spots of calcium carbonate, with a maximum diameter of 2 inches, are numerous. With depth the color gradually changes to bluish gray. The bluish-gray color occupies the middles of shaly plates and is surrounded with limonite yellow along the horizontal cleavage planes. Some of the cleavage planes have a slight film of rusty-black material.
- 120 to 144 inches+, bluish-gray very highly calcareous clay (marl) of thick platy or shale-like structure, with some yellow streaks along the partings. No segregated white spots are present. Geologically, this parent material is the Taylor marl—a marine formation of Cretaceous age.

Table 5 gives the chemical analyses of samples from a typical profile of Houston Black clay, taken 2 miles south of Temple, Tex., and table 6 gives the chemical analyses of the colloidal fraction of these same samples.¹⁷ Although Temple lies some distance from Kaufman County, the analyses are considered sufficiently representative of Houston Black clay as mapped in this county.

¹⁷MIDDLETON, H. E., SLATER, C. S., and BYERS, HORACE G. PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE SOILS FROM THE EROSION EXPERIMENT STATIONS. U. S. Dept. Agr. Tech. Bul. 316, 51 pp. 1932.

TABLE 5.—*Chemical analyses of a typical profile of Houston Black clay from Temple, Tex.*

Sample No.	Depth	SiO ₂	TiO ₂	Fe ₂ O ₃	Al ₂ O ₃	MnO	CaO	MgO	K ₂ O	Na ₂ O	P ₂ O ₅	SO ₃	Igni- tion loss	Total	N ₂	CO ₂ from carbon- ates	Organic matter ¹	Ratio of organic matter to nitrogen
	<i>Inches</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	
6096.....	0-3	24.74	0.34	2.68	6.69	0.03	32.81	1.23	0.65	0.21	0.34	0.31	30.30	100.33	0.18	25.09	2.94	16.3
6097.....	14-20	22.80	.32	2.84	6.96	.05	34.34	1.13	.50	.27	.36	.25	30.52	100.34	.11	25.82	1.88	17.1
6098.....	24-36	19.91	.32	2.65	6.06	.05	37.25	.95	.48	.19	.40	.25	31.72	100.23	.06	29.16	1.10	18.3
6099.....	36-50	13.17	.24	2.55	4.48	.04	42.52	.94	.39	.29	.44	.28	34.90	100.24	.04	33.88	.51	12.8

¹ CO₂ times factor of 0.471.

TABLE 6.—Chemical analyses of colloids in a typical profile of Houston Black clay from Temple, Tex.

Sample No.	Depth	Colloid extracted	SiO ₂	TiO ₂	Fe ₂ O ₃	Al ₂ O ₃	MnO	CaO	MgO	K ₂ O	Na ₂ O	P ₂ O ₅
	<i>Inches</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>
6096.....	0-3	55	43.55	0.53	5.92	18.94	0.07	9.28	2.50	1.13	0.27	0.22
6097.....	14-20	55	41.72	.54	5.92	18.08	.07	11.73	2.41	1.11	.27	.21
6098.....	24-36	57	42.25	.54	5.95	18.33	.09	12.35	2.25	.99	.25	.22
6099.....	36-50	48	43.30	.58	6.25	18.53	.07	12.00	2.63	1.07	.27	.22

Sample No.	Depth	SO ₃	Ignition loss	Total	Nitrogen	CO ₂ from carbonates	Organic matter	Ratio of organic matter to nitrogen in colloid	Mols SiO ₂ / Fe ₂ O ₃	Mols SiO ₂ / Al ₂ O ₃	Mols Fe ₂ O ₃ / Al ₂ O ₃	Mols SiO ₂ / R ₂ O ₃
	<i>Inches</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>					
6096.....	0-3	0.19	18.09	100.69	0.38	4.91	3.86	10.2	19.56	3.90	-0.200	3.26
6097.....	14-20	.11	18.25	100.42	.22	6.16	3.13	14.2	18.75	3.92	.209	3.24
6098.....	24-36	.11	16.85	100.18	.18	7.05	1.67	9.3	18.88	3.91	.207	3.25
6099.....	36-50	.09	16.10	101.11	.14	6.69	1.12	8.0	18.45	3.97	.215	3.25

The following description of a profile of Lufkin very fine sandy loam, mound phase, is characteristic of the soils developed under alternating waterlogging and desiccation. This profile was observed 12 miles east of Kaufman, one-fifth mile southwest of the northeast corner of the Peter Stephenson survey. The almost level surface is dotted with a few sand mounds composed of Susquehanna fine sandy loam. The areas are covered with water for several weeks after heavy rains, but the soil becomes dry throughout in late summer. The vegetation is an open post oak forest free from underbrush and with only a sparse undergrowth of grass.

- A₁. 0 to 1½ inches, dark-gray platy medium-acid fine sandy loam. In places the mineral soil is covered by a thin layer of partly disintegrated oak leaves. The pH value according to field test is 5.7.
- A₂. 1½ to 6 inches, ash-gray massive (vesicular in the lower 3 inches), very strongly acid fine sandy loam containing a few black pitted spheroidal concretions of iron oxide. The material is faintly mottled by light-brown spots about one-half inch in diameter, which are conspicuous only when the material is moist. According to field test the pH value is below 4.9.
- B₁. 6 to 14 inches, dark-gray or gray very strongly acid extremely plastic extremely compact clay. The material breaks out when dry as very hard clods, from 1 to 2 inches in diameter. This is the horizon of most abundant plant roots, and the material stands up in a recently cut roadside ditch as an overhanging shelf.
- B₂ (or C₁). 14 to 48 inches, gray noncalcareous very compact clay, which breaks out as very hard clods, from 2 to 4 inches in diameter, with smooth fracture. The material contains a few very fine tubes which appear to be abandoned root channels.
- C. 48 to 144 inches +, pale-gray noncalcareous compact clay containing yellow spots, about one-half inch in diameter, surrounding soft black crystalline concretions of iron oxide. The crevices are coated with dark-gray and some rusty-brown films. A few tree roots extend below a depth of 12 feet.

The waterlogging is caused by the impermeability of the subsoil and the substrata. Surface water collects and remains until removed by evaporation.

Mechanical analyses of Lufkin very fine sandy loam, mound phase, are given in table 7.

TABLE 7.—*Mechanical analyses of Lufkin very fine sandy loam, mound phase, in Kaufman County, Tex.*

Sample No.	Depth	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay ¹
		Percent	Percent	Percent	Percent	Percent	Percent	Percent
449551.....	0 - 1½	0.1	0.2	0.3	8.4	28.8	45.4	16.9
449552.....	1½ - 6	.2	.1	.3	10.3	35.8	42.9	10.4
449553.....	6 - 14	.1	.1	.3	9.5	31.4	20.9	28.6
449554.....	14 - 48	.0	.0	.2	11.1	35.8	26.6	26.2
449555.....	48 - 144+	.1	.1	.1	7.3	30.4	30.5	31.4

¹ Clay includes particles less than 0.005 millimeter in diameter.

SUMMARY

Kaufman County, embracing an area of 808 square miles in northeastern Texas, lies on the eastern margin of the Blackland Prairie of Texas. It is a smooth, low, undulating, well-drained upland plain. About one-half of the county originally was prairie, about

one-fourth was upland oak forest, and the remainder was flood-plain mixed hardwood forest. The climate is warm, humid, and continental. The mean annual precipitation is about 42 inches, and the mean annual temperature is about 66° F.

Nearly one-half of the land is cultivated and utilized for cotton farming. Until very recently, cotton occupied about three-fourths of the cropland; corn, about one-eighth; and oats, sorgo, and grain sorghums, most of the rest. Cotton is the dominant crop because it is better adapted to the climate than any other general crop. The prevailing type of farming does not maintain the inherent fertility of the soils. The average acre yield of cotton in the 5-year period 1928-32 was 146 pounds of lint. Corn yields average about 17 bushels and oats 25 bushels to the acre.

The differences in soils, which materially affect land utilization and land value in the county, are differences in their productivity for cotton. These are reflections of the varying rapidity of decreasing fertility under clean cultivation without the application of any amendments to the land, and the varying steepness of slope which influences the rate of erosion. The fertility of the smooth crumbly heavy soils of the prairies has decreased least, and that of the rolling originally forested sandy light-colored soils has decreased most.

Smooth acid soils of the prairies, principally Wilson clay loam, Wilson clay, and Wilson very fine sandy loam, occupy about one-fifth of the county. These are dark-gray moderately acid soils with dark-gray or very dark gray very compact heavy clay subsoils. Where fertility has been maintained they are very productive, but the average acre yield of cotton on these soils is less than one-third bale.

Sloping acid sandy soils of the prairies, principally Crockett very fine sandy loam, rolling phase, occupy about one-tenth of the county. The Crockett soils are dark-brown moderately acid soils with reddish-brown compact subsoils. They are fairly productive where smooth, but the extensive soils of the series are sloping, eroded, shallow, and of low productivity.

Smooth crumbly heavy soils of the prairies, principally Houston Black clay and Hunt clay, occupy about one-tenth of the county. These are black crumbly thick clays with highly calcareous substrata of yellow clay. They are excellent soils for growing all general farm crops and produce yields of about 225 pounds of lint cotton, 30 to 35 bushels of corn, 25 bushels of oats, and 2 to 4 tons of sorghum forage to the acre. Their fertility has decreased not more than one-fourth during 30 to 50 years of clean cultivation. In those few places where the surface foot of soil has been removed by erosion the soils are still moderately productive.

Smooth well-drained light-colored sandy soils of the forested lands, principally Tabor fine sandy loam, mound phase, and Leaf fine sandy loam, occupy about one-tenth of the county. The surface soils are gray or light-brown acid loamy fine sand or fine sandy loam underlain by friable to compact clay subsoils. The originally small store of available plant nutrients has been so depleted by continuous cropping that considerable areas have been taken out of cultivation. The average acre yield of cotton on these soils is about 100 pounds of lint.

The sloping light-colored sandy soils occupy about one-twentieth of the county. These are areas with pale grayish-brown acid surface

soils of loamy fine sand or fine sandy loam underlain by yellowish-red friable or moderately compact clay. They are not well suited for cropland owing to low productivity and high erodibility.

Soils of the bottom lands, mainly Trinity clay and Kaufman clay, occupy about one-fifth of the county. Their productivity ranges from very high to very low, with drainage conditions as the determining factor. Where adequately drained, acre yields between 250 and 300 pounds of lint cotton have been obtained. The heavier soils where well drained can be utilized almost continuously for growing cotton and other crops with little appreciable diminution of soil fertility.

Various other soils of slight extent and of no great agricultural value occur in many small scattered areas that add little to the total of the agricultural products produced in the county.

Accessibility Statement

This document is not accessible by screen-reader software. The U.S. Department of Agriculture is committed to making its electronic and information technologies accessible to individuals with disabilities by meeting or exceeding the requirements of Section 508 of the Rehabilitation Act (29 U.S.C. 794d), as amended in 1998. Section 508 is a federal law that requires agencies to provide individuals with disabilities equal access to electronic information and data comparable to those who do not have disabilities, unless an undue burden would be imposed on the agency. The Section 508 standards are the technical requirements and criteria that are used to measure conformance within this law. More information on Section 508 and the technical standards can be found at www.section508.gov.

If you require assistance or wish to report an issue related to the accessibility of any content on this website, please email Section508@oc.usda.gov. If applicable, please include the web address or URL and the specific problems you have encountered. You may also contact a representative from the [USDA Section 508 Coordination Team](#).

Nondiscrimination Statement

In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident.

Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the

Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English.

To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at http://www.ascr.usda.gov/complaint_filing_cust.html and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by:

- (1) mail: U.S. Department of Agriculture
Office of the Assistant Secretary for Civil Rights
1400 Independence Avenue, SW
Washington, D.C. 20250-9410;
- (2) fax: (202) 690-7442; or
- (3) email: program.intake@usda.gov.

USDA is an equal opportunity provider, employer, and lender.