

Issued September 1966

# SOIL SURVEY

## Love County, Oklahoma



UNITED STATES DEPARTMENT OF AGRICULTURE  
Soil Conservation Service  
In cooperation with  
OKLAHOMA AGRICULTURAL EXPERIMENT STATION

Major fieldwork for this survey was done in the period 1956 to 1961. Soil names and descriptions were approved in 1964. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1961. This survey was made cooperatively by the Soil Conservation Service and the Oklahoma Agricultural Experiment Station, as part of the technical assistance furnished to the Love County Soil Conservation District.

## HOW TO USE THIS SOIL SURVEY REPORT

**T**HIS SOIL SURVEY of Love County, Okla., contains information that can be applied in managing farms, ranches, and woodlands; in selecting sites for roads, ponds, buildings, or other structures; and in appraising the value of tracts of land for agriculture, industry, or recreation.

### Locating Soils

All the soils of Love County are shown on the detailed map at the back of this report. This map consists of many sheets that are made from aerial photographs. Each sheet is numbered to correspond with numbers shown on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbol. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

### Finding and Using Information

The "Guide to Mapping Units, Capability Units, and Range Sites" can be used to find information in the report. This guide lists all of the soils of the county in alphabetic order by map symbol. It shows the page where each soil is described, and the page for each group in which the soil has been placed.

Individual colored maps showing the relative suitability or limitations of soils for specific purposes can be developed by using the soil map and information in the text. Interpretations not included in the text can be developed by grouping the soils according to their suitability or limitations for a particular use. Translucent material can be used as an overlay over the

soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

*Farmers and those who work with farmers* can learn about use and management of the soils in the soil descriptions and in the discussions of the interpretative groupings.

*Foresters and others* can refer to the subsection "Management of Woodland for Windbreaks and Post Lots" where the soils are grouped according to their suitability for trees.

*Game managers, sportsmen, and others concerned with wildlife* will find information about soils and wildlife in the subsection "Management of Wildlife Areas."

*Ranchers and others* interested in range can find, under "Management of Range," groupings of the soils according to their suitability for range, and also the plants that grow on each range site.

*Engineers and builders* will find, under "Engineering Properties of Soils," tables that give engineering descriptions of the soils in the county and that name soil features that affect engineering practices and structures.

*Scientists and others* can read about how the soils were formed and how they are classified in the section "Genesis, Classification, and Morphology of Soils."

*Students, teachers, and others* will find information about soils and their management in various parts of the text.

*Newcomers in Love County* may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "General Nature of the County."

## Contents

	Page		Page
<b>How soils are mapped and classified</b> .....	1	<b>Descriptions of the soils—Continued</b>	
<b>General soil map</b> .....	2	Vanoss series.....	26
1. Dougherty-Eufaula association.....	2	Vernon series.....	27
2. Windthorst-Stephenville association.....	3	Waurika series.....	27
3. Teller-Minco association.....	3	Wet alluvial land.....	28
4. Vernon-Renfrow-Chickasha association.....	3	Windthorst series.....	28
5. Roebuck-Navasota association.....	5	Yahola series.....	29
6. Miller-Yahola association.....	5	Zaneis series.....	29
7. San Saba-Durant association.....	7	<b>Use and management of the soils</b> .....	30
<b>Descriptions of the soils</b> .....	7	General management practices for crops and tame	
Axtell series.....	8	pasture.....	30
Breaks-Alluvial land complex.....	8	Capability groups of soils.....	33
Brewer series.....	8	Predicted yields.....	43
Chickasha series.....	9	Management of range.....	45
Claremore series.....	9	Range sites.....	45
Clayey broken land.....	10	Range condition.....	45
Darnell series.....	10	Descriptions of range sites.....	46
Denton series.....	11	Range site productivity.....	49
Dougherty series.....	12	Principles of range management.....	50
Durant series.....	14	Management of pecan orchards.....	50
Eroded loamy land.....	14	Management of woodland for windbreaks and	
Eufaula series.....	15	post lots.....	51
Gowen series.....	16	Windbreaks.....	51
Labette series.....	16	Post lots.....	52
Lela series.....	17	Descriptions of woodland groups.....	52
Lincoln series.....	17	Management of wildlife areas.....	53
Loamy alluvial land.....	18	Engineering properties of soils.....	54
Miller series.....	18	Engineering classification systems.....	55
Minco series.....	18	Engineering interpretations of the soils.....	55
Navasota series.....	19	<b>Genesis, classification, and morphology of soils</b> .....	76
Norwood series.....	20	Factors of soil formation.....	76
Port series.....	20	Classification and morphology of soils.....	78
Pulaski series.....	21	Great soil groups.....	78
Renfrow series.....	21	Descriptions of the soil series.....	81
Rocky broken land.....	22	<b>General nature of the county</b> .....	91
Roebuck series.....	22	Climate.....	91
Sandy broken land.....	22	Water supply.....	93
San Saba series.....	23	Additional facts about the county.....	93
Slickspots and Saline land.....	23	<b>Glossary</b> .....	93
Stephenville series.....	23	<b>Guide to mapping units, capability units, and range</b>	
Tarrant series.....	25	sites.....	94
Teller series.....	25	Following	

### NOTICE TO LIBRARIANS

Series year and series number are no longer shown on soil surveys. See explanation on the next page.

Issued September 1966

## EXPLANATION

### Series Year and Series Number

Series year and number were dropped from all soil surveys sent to the printer after December 31, 1965. Many surveys, however, were then at such advanced stage of printing that it was not feasible to remove series year and number. Consequently, the last issues bearing series year and number will be as follows:

Series 1957, No. 23, Las Vegas-Eldorado Area, Nev.	Series 1961, No. 42, Camden County, N.J.
Series 1958, No. 34, Grand Traverse County, Mich.	Series 1962, No. 13, Chicot County, Ark.
Series 1959, No. 42, Judith Basin Area, Mont.	Series 1963, No. 1, Tippah County, Miss.
Series 1960, No. 31, Elbert County, Colo. (Eastern Part)	

Series numbers will be consecutive in each series year, up to and including the numbers shown in the foregoing list. The soil survey for Tippah County, Miss., will be the last to have a series year and series number.

# SOIL SURVEY OF LOVE COUNTY, OKLAHOMA

BY ARMINE J. MAXWELL AND ROBERT REASONER, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE IN COOPERATION WITH THE OKLAHOMA  
AGRICULTURAL EXPERIMENT STATION

**L**OVE COUNTY, in the south-central part of Oklahoma (fig. 1), has an area of about 488 square miles. The Red River forms its southern boundary. The county seat is Marietta, which has a population of about 1,900 people.

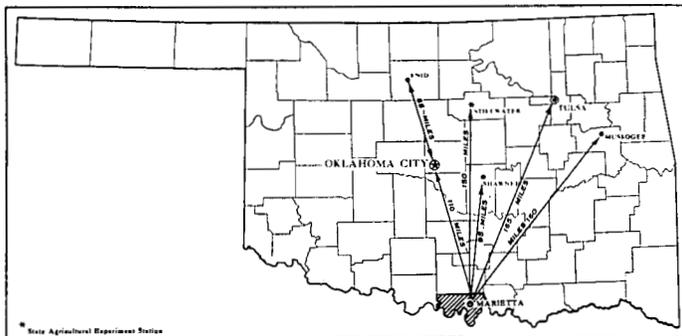


Figure 1.—Location of Love County in Oklahoma.

The county is mainly agricultural, and the raising of livestock is the main enterprise. Oil is produced in three widely separated areas. The population of the county decreased from 12,433 in 1920 to 5,862 in 1960. Many small communities that formerly depended on farm trade have been abandoned.

Much of the farmland in the county is in tame pasture or range, but in 1959 about 8 percent was land from which crops were harvested. Wooded areas occupy a much smaller acreage than they formerly did.

## *How Soils Are Mapped and Classified*

Soil scientists made this survey to learn what kinds of soils are in Love County, where they are located, and how they can be used.

They went into the county knowing they likely would find many soils they had already seen, and perhaps some they had not. As they traveled over the county, they observed steepness, length, and shape of slopes; size and speed of streams; kinds of native plants or crops; kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by roots of plants.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. To use this report efficiently, it is necessary to know the kinds of groupings most used in a local soil classification.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Dougherty and Teller, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that go with their behavior in the natural, untouched landscape. Soils of one series can differ somewhat in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man.

Many soil series contain soils that differ in texture of their surface layer. According to such differences in texture, separations called soil types are made. Within a series, all the soils having a surface layer of the same texture belong to one soil type. Teller fine sandy loam and Teller loam are two soil types in the Teller series. The difference in texture of their surface layers is apparent from their names.

Some soil types vary so much in slope, degree of erosion, number and size of stones, or some other feature affecting their use, that practical suggestions about their management could not be made if they were shown on the soil map as one unit. Such soil types are divided into phases. The name of a soil phase indicates a feature that affects management. For example, Teller fine sandy loam, 0 to 1 percent slopes, is one of two phases of Teller fine sandy loam, a soil type that is nearly level or gently sloping.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodland, buildings, field borders, trees, and other details that greatly help in drawing boundaries accurately. The soil map in the back of this report was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning management of farms and fields, a mapping unit is nearly equivalent to a soil type or a phase of a soil type. It is

not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil type or soil phase.

In preparing some detailed maps, the soil scientists have a problem of delineating areas where different kinds of soils are so intricately mixed, and so small in size, that it is not practical to show them separately on the map. Therefore, they show this mixture of soils as one mapping unit and call it a soil complex. Ordinarily, a soil complex is named for the major kinds of soil in it, for example, Windthorst-Darnell complex.

Also, two or more soils that normally do not occur with any regularity in pattern or in proportions may be mapped together. When this is done, the unit is called an undifferentiated mapping unit and is named for its major soils. Such groups of soils generally consist of two or more series. At least one of the component soils of the group occurs in every delineated area, but all of the component soils may occur in some delineated areas, and more than one, but not all, in others. The individual areas of component soils are large enough so that they could be set apart on a detailed map. For the most part, however, the soils of the group are similar enough in behavior that their separation is not important for the objectives of the survey. An example of an undifferentiated group is Chickasha and Zaneis loams, 1 to 3 percent slopes.

Other areas shown on most soil maps are so rocky, so shallow, or so frequently worked by wind and water that they scarcely can be called soils. These areas are shown on a soil map like other mapping units, but they are given descriptive names, such as Wet alluvial land or Eroded loamy land, and are called land types rather than soils.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soils. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in a way that it is readily useful to different groups of readers, among them farmers, ranchers, engineers, and homeowners. Grouping soils that are similar in suitability for each specified use is the method of organization commonly used in the soil survey reports. Based on the yield and practice tables and other data, the soil scientists set up trial groups, and test them by further study and by consultation with farmers, agronomists, engineers, and others. Then, the scientists adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

## General Soil Map

The general soil map at the back of this report shows, in color, the soil associations in Love County, Okla. A soil

association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of farming or other land use. Such a map is not suitable for planning the management of a farm or field, because the soils in any one association ordinarily differ in pattern of occurrence, depth, stoniness, drainage, and other characteristics that affect management.

Seven soil associations are in Love County. Two are in timbered areas of the uplands, two on bottom lands along the Red River, one on high benches along the Red River, and still another on areas of prairie called blackland. The one remaining association, in the extreme northwestern corner of the county, consists of loamy and clayey soils underlain by red beds.

## 1. Dougherty-Eufaula Association

*Deep, sandy soils on nearly level to gently rolling uplands*

This soil association occupies one large area between the towns of Rubottom and Burneyville, and another area near Thackerville. Smaller areas are in other parts of the county. The large areas are rolling along their borders, but they are nearly level to gently rolling in most places (fig. 2); the small areas are also rolling (fig. 3). This association occupies slightly more than 23 percent of the county.

The Dougherty soils have a light-brown or brown, sandy surface layer and a reddish, loamy subsoil. The Eufaula soils have a light-brown or brown, sandy surface layer that is thicker than the one in the Dougherty soils and a reddish or pinkish loamy subsoil.

Minor soils of this association are the Windthorst, Stephenville, Pulaski, Teller, and Minco. These soils occupy only a small acreage.

The soils of this association are used mainly for woods pasture. Only about 15 percent of their acreage is in cultivated crops, chiefly peanuts, cotton, and small grains.



Figure 2.—Nearly level soils of association 1. A large part of this association is used for woods pasture, and some areas are suitable for wildlife.

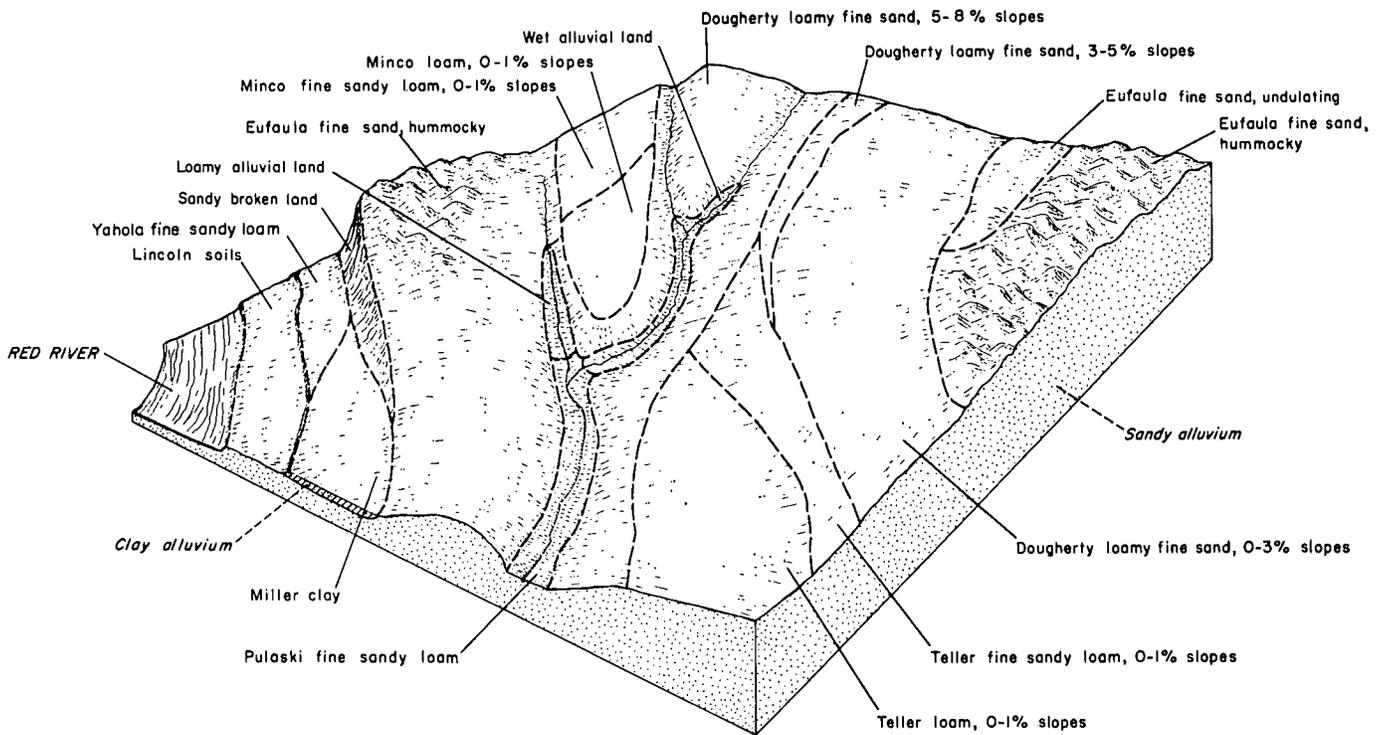


Figure 3.—A diagram showing typical relief in the southern part of Love County and the relative position of the soils in associations 1, 3, and 6.

These soils are sandy and susceptible to wind erosion if they are cultivated. They have low natural fertility and require moderately large applications of fertilizer to obtain satisfactory yields.

## 2. Windthorst-Stephenville Association

*Deep, loamy soils on nearly level and gently rolling uplands*

This soil association consists mostly of rolling timbered areas in the northern part of the county (fig. 4), but small areas are scattered throughout the county. This association covers nearly 34 percent of the county.

The Windthorst and Stephenville soils have a light-brown or brown loamy surface layer. The subsoil of the Windthorst soils is reddish or brownish and clayey, and that of the Stephenville soils is reddish and loamy.

Minor soils in this association are the Dougherty, Eufaula, Darnell, Pulaski, and Vernon. These soils occupy many small areas.

Most of the acreage in this association is used for range and pasture. Only about 40 percent has been cultivated, but the areas that were formerly cultivated are now used for pasture in most places. The soils in this association are subject to severe gully erosion. They are fairly fertile, but fertilizer is required for economical yields.

## 3. Teller-Minco Association

*Deep, loamy soils on nearly level uplands*

This soil association occupies high benches, mainly along the Red River. Most of the areas are nearly level or

gently sloping, but some areas along drainageways are moderately sloping. The typical relief and relative position of the soils in association 3 are shown in figure 3. The association occupies slightly more than 9 percent of the county.

The Teller and Minco soils have a brownish loamy surface layer. The subsoil of the Teller soils is yellowish red, but that of the Minco soils is brownish.

Minor soils in this association are the Vanoss and Brewer. The Vanoss soils have a brownish loamy surface layer and subsoil. The surface layer of the Brewer soils is grayish brown, but the subsoil is gray and clayey. The Brewer soils are in the more poorly drained areas of the association.

The soils of this association are used mainly for cultivated crops, chiefly cotton, peanuts, small grains, and sorghum. The soils are fertile, but fertilizer is required for favorable yields. The more sandy soils are susceptible to wind erosion, and the gently sloping and moderately sloping areas are susceptible to water erosion. In many places deep gullies occur where water has accumulated and has run off the benches.

## 4. Vernon-Renfrow-Chickasha Association

*Deep to shallow, clayey and loamy soils on rolling uplands*

This soil association is made up of rolling areas underlain by red beds. It is in the extreme northwestern corner of the county (fig. 5) and covers slightly more than 1 percent of the county.

The Vernon soils are shallow over red beds and have a brownish loamy surface layer and a reddish or brownish clayey subsoil. The Renfrow soils are deep and have a

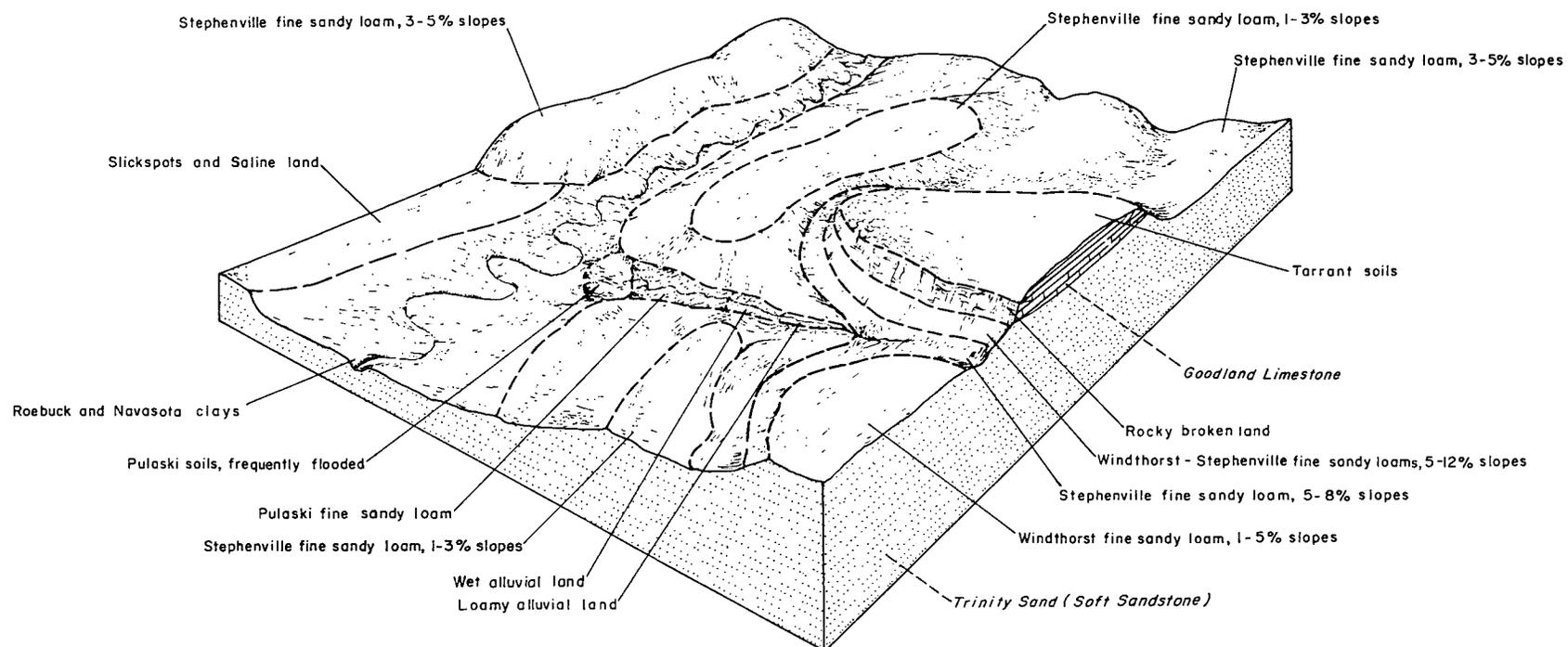


Figure 4.—Diagram showing typical relief and relative positions of the soils in associations 2 and 5 in the north-central part of Love County.

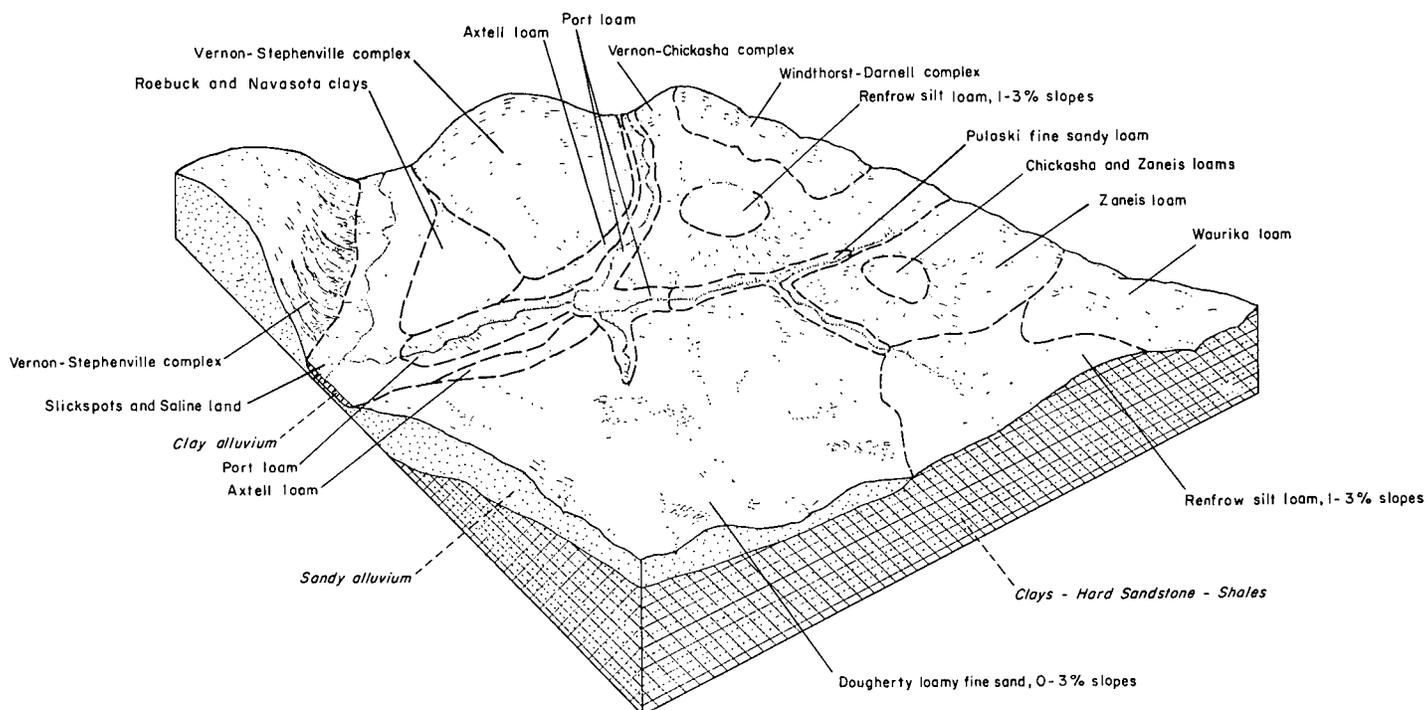


Figure 5.—Diagram showing typical relief in the northwestern corner of the county and the relative positions of the soils in association 4.

dark reddish-brown loamy surface layer and a reddish clayey subsoil. The Chickasha soils are deep or moderately deep. They have a dark grayish-brown loamy surface layer and a brownish loamy subsoil.

Minor soils in this association are mainly the Zaneis and Port. Windthorst, Stephenville, and Darnell soils, however, also occupy small areas.

All of the acreage of the Vernon soils and most of the acreage of the Renfrow and Chickasha soils is in range. In cultivated areas the chief crops are cotton and small grains. The soils in this association are somewhat droughty and are susceptible to water erosion.

## 5. Roebuck-Navasota Association

*Deep, clayey soils on bottom lands subject to frequent flooding*

This soil association occupies the wide flat bottom lands along Walnut Bayou, and Simon, Clear, and Mud Creeks. The areas are subject to frequent flooding. The typical relief and relative position of the soils in association 5 are shown in figure 4. The association covers nearly 4 percent of the county.

The Roebuck and Navasota soils have a dark reddish-gray clayey surface layer and a clayey subsoil. The subsoil of the Roebuck soils is reddish, however, and that of the Navasota soils is dark gray and mottled.

Minor soils that occur mainly in this association are the Axtell soils and Slickspots and Saline land. Small areas of Port and Pulaski soils are also included.

This association is chiefly in range, even though there is not much desirable vegetation for forage in most places. The soils contain a large amount of clay, do not take in water readily, and are droughty.

## 6. Miller-Yahola Association

*Deep, clayey and loamy soils on bottom lands above normal overflow*

This soil association occupies the nearly level bottom lands along the Red River. The areas are above the level normally reached by floodwaters. The typical relief and relative position of the soils in association 6 are shown in figure 3. This association makes up nearly 3 percent of the county.

The Miller soils have a dark-colored, reddish or brownish, clayey surface layer and a dark-red clayey subsoil. The Yahola soils have a reddish loamy or sandy surface layer and a loamy subsoil.

Minor soils of this association are the Norwood and Lincoln. The Norwood soils have a surface layer of clay loam and a loamy subsoil. The Lincoln soils have a loamy or sandy surface layer and a sandy subsoil. They are generally near a stream.

The Yahola, Miller, and Norwood soils are used mainly for cultivated crops, chiefly alfalfa, corn, cotton, and small grains. The Lincoln soils are droughty and are used mostly for range and pasture. These soils have moderate natural fertility, but fertilizer is required for sustained satisfactory yields. The soils are frequently wet.

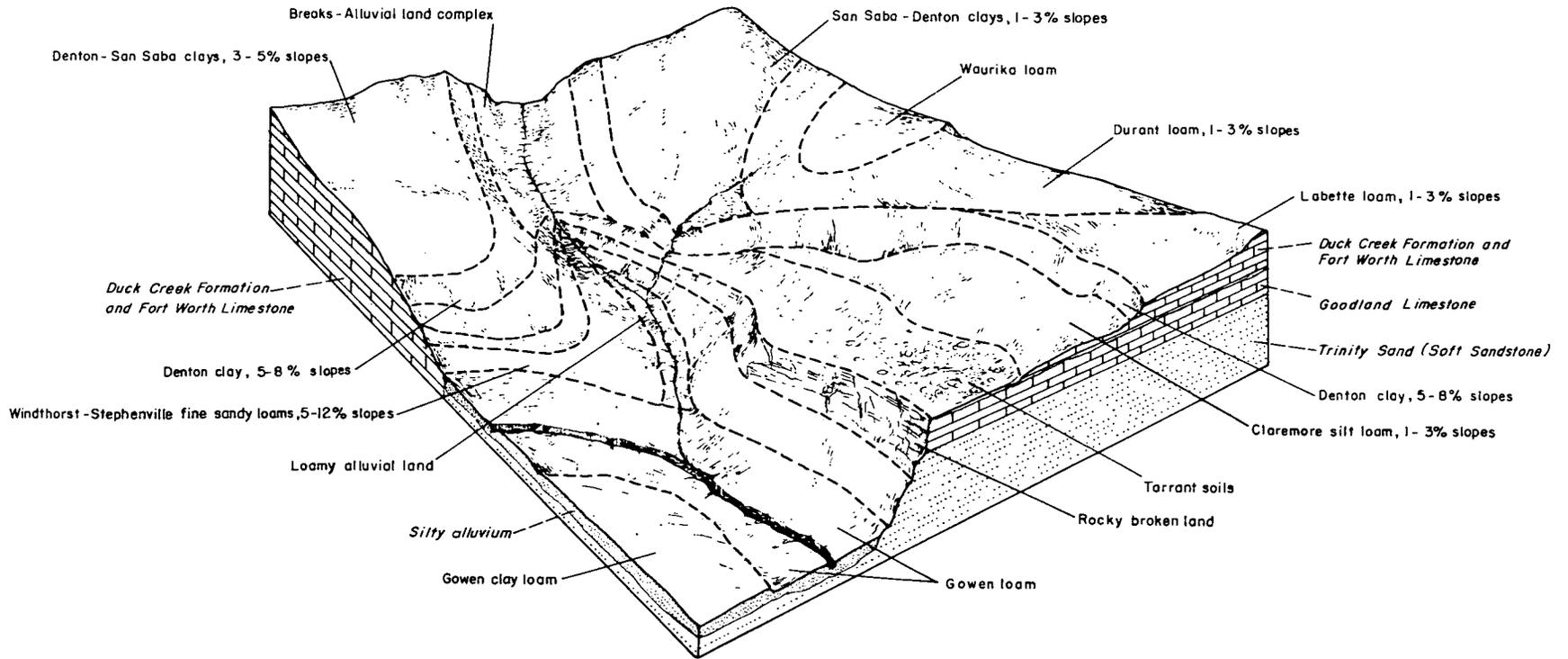


Figure 6.—Diagram showing relief typical of the central part of the county and the relative positions of the soils in association 7.

## 7. San Saba-Durant Association

*Deep, clayey soils on gently sloping uplands*

This soil association occupies one large area of gently sloping to rolling prairie around Marietta (fig. 6) and small areas in the northeastern part of the county. It covers about 18 percent of the county.

The San Saba soils have a dark-gray clayey surface layer and a nearly black clayey subsoil that has granular structure. They are gently sloping and are at the foot of slopes in most places. The Durant soils have a dark-brown loamy surface layer and a subsoil of brownish, plastic clay. They are also gently sloping.

Small areas of Denton and Waurika soils are included in this association. The Denton soils have a dark-gray loamy surface layer and a dark-brown clayey subsoil. They are generally on the tops and upper side slopes of ridges and occur with the San Saba soils. The Waurika soils have a dark-colored, grayish, loamy surface layer and a grayish clayey subsoil. They are droughty. In most places they occupy nearly level areas near the Durant soils.

The more nearly level areas of this association are extensively used for cultivated crops, chiefly cotton, small grains, and sorghum. The rolling areas are used for range. The surface layer of these soils is likely to be re-

moved by severe sheet erosion, and the soils are susceptible to slight gully erosion. Fertilizer is required for sustained favorable yields.

## Descriptions of the Soils

In this section the soil series in Love County are described in alphabetic order and a typical profile is described for each series. Each soil is then discussed, and those characteristics of its profile that are different from those of the typical profile are pointed out. Unless otherwise indicated colors described are those for a dry soil. The present use and some of the hazards that limit use are also indicated.

A detailed description of a profile that is typical for each series is given in the section "Genesis, Classification, and Morphology of Soils." Terms that are used to describe the soils and that may not be familiar to the reader are defined in the Glossary at the back of the report.

The approximate acreage and proportionate extent of the soils are shown in table 1, and their location is shown on the detailed soil map at the back of the report. The "Guide to Mapping Units, Capability Units, and Range Sites" at the back of the report gives a list of the soils in the county and the capability unit and range site for each.

TABLE 1.—Approximate acreage and proportionate extent of the soils

Soil	Area		Soil	Area	
	Acres	Percent		Acres	Percent
Axtell loam.....	515	0.2	Pulaski fine sandy loam.....	5,555	1.8
Breaks-Alluvial land complex.....	10,340	3.3	Pulaski soils, frequently flooded.....	1,607	.5
Brewer-Vanoss complex.....	2,104	.7	Renfrow silt loam, 1 to 3 percent slopes.....	878	.3
Chickasha and Zaneis loams, 1 to 3 percent slopes.....	810	.3	Rocky broken land.....	6,440	2.1
Claremore silt loam, 1 to 3 percent slopes.....	789	.3	Roebeck and Navasota clays.....	4,050	1.3
Clayey broken land.....	2,121	.7	Sandy broken land.....	2,150	.7
Denton clay, 5 to 8 percent slopes.....	3,947	1.3	San Saba-Denton clays, 1 to 3 percent slopes.....	4,163	1.3
Denton-San Saba clays, 3 to 5 percent slopes.....	7,319	2.3	Slickspots and Saline land.....	1,617	.5
Denton-Tarrant complex.....	3,364	1.1	Stephenville fine sandy loam, 1 to 3 percent slopes.....	4,948	1.6
Dougherty loamy fine sand, 0 to 3 percent slopes.....	16,024	5.1	Stephenville fine sandy loam, 3 to 5 percent slopes.....	3,250	1.0
Dougherty loamy fine sand, 3 to 5 percent slopes.....	4,754	1.5	Stephenville fine sandy loam, 5 to 8 percent slopes.....	15,627	5.0
Dougherty loamy fine sand, 5 to 8 percent slopes.....	21,829	7.0	Stephenville fine sandy loam, 1 to 5 percent slopes, eroded.....	3,844	1.2
Dougherty soils, 0 to 3 percent slopes, eroded.....	735	.2	Stephenville-Windthorst complex, severely eroded.....	20,984	6.7
Dougherty soils, 3 to 5 percent slopes, eroded.....	3,407	1.1	Tarrant soils.....	3,294	1.0
Durant clay loam, 1 to 3 percent slopes, eroded.....	1,160	.4	Teller fine sandy loam, 0 to 1 percent slopes.....	3,450	1.1
Durant loam, 1 to 3 percent slopes.....	6,175	2.0	Teller fine sandy loam, 1 to 3 percent slopes.....	6,724	2.1
Eroded loamy land.....	2,022	.6	Teller loam, 0 to 1 percent slopes.....	2,395	.8
Eufaula fine sand, hummocky.....	14,429	4.6	Teller loam, 1 to 3 percent slopes.....	2,613	.8
Eufaula fine sand, undulating.....	9,390	3.0	Vanoss loam, 0 to 1 percent slopes.....	1,150	.4
Gowen clay loam.....	1,094	.3	Vernon-Chickasha complex.....	3,090	1.0
Gowen loam.....	2,422	.8	Vernon-Stephenville complex.....	936	.3
Gowen soils, frequently flooded.....	3,909	1.3	Waurika loam.....	1,266	.4
Labette clay loam, 1 to 3 percent slopes, eroded.....	241	.1	Wet alluvial land.....	2,300	.7
Labette loam, 1 to 3 percent slopes.....	3,666	1.2	Windthorst-Darnell complex.....	5,400	1.7
Lela clay.....	542	.2	Windthorst fine sandy loam, 1 to 5 percent slopes.....	2,479	.8
Lincoln soils.....	4,486	1.4	Windthorst fine sandy loam, 1 to 5 percent slopes, eroded.....	1,588	.5
Loamy alluvial land.....	8,647	2.8	Windthorst-Stephenville fine sandy loams, 5 to 12 percent slopes.....	25,096	8.0
Miller clay.....	572	.2	Yahola fine sandy loam.....	1,852	.6
Minco fine sandy loam, 0 to 1 percent slopes.....	4,104	1.3	Zaneis loam, 3 to 5 percent slopes.....	463	.1
Minco fine sandy loam, 1 to 3 percent slopes.....	2,778	.9	Red River and lakes.....	22,136	7.1
Minco fine sandy loam, 3 to 5 percent slopes.....	2,093	.7			
Minco loam, 0 to 1 percent slopes.....	2,163	.7			
Norwood clay loam.....	1,700	.5			
Port loam.....	494	.2			
Port soils, frequently flooded.....	830	.3			
			Total.....	312,320	100.0

## Axtell Series

In the Axtell series are deep, light-colored soils that have a medium-textured surface layer and a fine-textured subsoil. These soils are in the western part of the county. They occupy only a small acreage on low benches along Clear and Mud Creeks and are subject to occasional flooding. The native vegetation is mainly post oak with mid and tall grasses growing between the trees, but there are a few other kinds of oaks and a few elms.

The upper part of the surface layer is grayish to brownish and has granular structure. It is loam about 4 inches thick. The lower part is light brown and is structureless. It is loamy and is about 6 inches thick in most places. The subsoil is reddish and is about 4 feet thick. The upper part is light clay that breaks to well-formed irregular blocks  $\frac{1}{2}$  to 1 inch in diameter. The lower part is light-red light silty clay. It breaks to weakly formed blocks,  $\frac{1}{4}$  to  $\frac{3}{4}$  inch in diameter, but the structure ranges to massive. The subsoil is underlain by reddish material that is generally stratified sandy and clayey alluvium derived from the red beds.

The surface layer is 3 to 18 inches thick and ranges from loam to fine sandy loam in texture. The texture of the underlying alluvium ranges from clay to stratified fine sandy loam and clay.

The Axtell soils are similar to the Windthorst soils, but they are on low stream benches rather than on uplands. They occur with Slickspots and Saline land, but they are less clayey and are lighter colored near the surface.

The Axtell soils take in water slowly. Only a small amount of water is held available to plants.

These soils are mainly in woods pasture. They produce only a small amount of palatable forage.

**Axtell loam** (0 to 1 percent slopes) (Ax).—This is the only Axtell soil mapped in the county. It is on low alluvial benches along Clear and Mud Creeks in the western part of the county. It occupies only a small acreage and is dissected by a few small drainageways. In some places the surface layer is fine sandy loam instead of loam, as in the surface layer of the profile described for the Axtell series. Some erosion has taken place, mainly in the surface layer. In a few small areas, much of the surface layer has been removed, and those areas are bare of vegetation.

Included in the areas mapped as this soil are areas of Roebuck and Navasota soils, mostly along small drainageways. Roebuck and Navasota soils make up about 1 percent of this soil. Also included are a few small areas where Slickspot soils are numerous and a few small areas of soils that are more clayey than the Axtell soils. The Slickspot and clayey soils make up about 2 percent of the acreage mapped as this soil.

This soil is used for grazing in most areas. It is not suitable for cultivation, but it is cultivated in some places. Crop yields are low and stands are poor because the soil is droughty and crusts over so badly that many seedlings cannot emerge. Most of the water is lost as runoff. Areas in range produce only a small amount of desirable vegetation, which should be grazed lightly to protect it. (Capability unit Vs-2; Claypan Savannah range site)

## Breaks-Alluvial Land Complex

**Breaks-Alluvial land complex** (Bc).—Is made up of land types that are deep or moderately deep and are medium textured to fine textured. These land types are along drainageways in most places, but they are on the sides of hills in an area southeast of Marietta. They occupy the moderately steep to steep sides and the enclosed valley floors of drainageways in the central part of the county.

In the valleys the distance from the crest on one side to the crest on the other side ranges from 50 to 1,000 feet. The valley floors are 10 to 25 feet wide in most places, but none are more than 100 feet wide. Small pieces of limestone are scattered on most of the side slopes, and some large, partly submerged limestone boulders occur in a few places (fig. 7). Most areas of these soils consist of clayey material that has weathered from calcareous shale.

The thickness of the soil material varies widely. The thickness depends on the steepness of the slopes and on the kind of underlying material. In most places drainage is somewhat excessive. In some places areas of Denton soils are mapped with this complex. The included Denton soils are on side slopes.

These land types are more stony than Denton clay, 5 to 8 percent slopes. In many places they are steeper than that soil, and they are also steeper than the soils of the Denton-Tarrant complex. Shale or limestone are nearer the surface than in the soils of the Denton-Tarrant complex, and the stones on the surface are larger.

These land types are not suitable for cultivation, and all of the acreage is in range. Good range management, including controlled grazing and deferred grazing, help to keep the range productive and provide protection from erosion. (Capability unit VIe-4; Blackclay Prairie range site)

## Brewer Series

In the Brewer series are dark-colored soils that have a medium-textured surface layer and a fine-textured subsoil. These soils are generally somewhat poorly drained. They are mainly along the Red River. In some places areas of



Figure 7.—Area of Breaks-Alluvial land complex where partly submerged limestone boulders occur.

Slickspot soils are numerous, but there are only a few in other places. The Brewer soils formed in alluvium on benches along the Red River that normally are not flooded. The alluvium is light brown and clayey, and it is distinctly mottled with gray and brown in many places. The native vegetation was mostly short and some mid grasses.

In most places the surface layer is brownish loam about 8 inches thick. It is massive and is friable when moist and hard when dry. The subsoil is grayish and clayey and is about 4 feet thick. In many areas it is faintly mottled with brown and yellow. It breaks to moderately well formed blocks  $\frac{1}{4}$  to  $\frac{1}{2}$  inch in diameter.

Brewer soils are similar to the Waurika soils, but they do not have a lighter colored layer just above the subsoil. They occur with the Vanoss soils, but they are less friable than those soils and have a more grayish subsoil. The Brewer soils are less red, but more gray, than the Renfrow soils.

Most of the acreage of Brewer soils is cultivated, and the crops are mainly small grains, cotton, and sorghum. If rainfall is adequate, yields of crops that grow in spring are fairly good, but most of the acreage is too doughy for crops that grow in summer.

**Brewer-Vanoss complex** (0 to 1 percent slopes) (Bv).—Most areas of these soils are along the Red River, but some areas are along Mud, Clear, and Hickory Creeks. The soils formed in alluvium. Brewer soils make up 75 to 90 percent of the acreage.

Included in the areas mapped as these soils are some areas of Slickspot soils. Also included are a few other small areas of Slickspots and Saline land, where the areas of Slickspot soils are numerous.

The soils of this complex are generally droughty because they have a firm, clayey subsoil. Most of the acreage is cultivated, and the crops are mainly small grains and vetch, cotton, and sorghum. In most areas crop yields are not high. Because these soils crust over badly, stands of crops are generally poor. Seeding crops that mature early and that produce a large amount of residue, and leaving the residue on or near the surface, will help to control crusting. (Capability unit IIs-1; Brewer soils in Claypan Prairie range site, and Vanoss soils in Loamy Prairie range site)

### Chickasha Series

In the Chickasha series are dark-colored soils that have a medium-textured surface layer and a moderately fine textured subsoil. These soils are on the prairie in the extreme northwestern part of the county. They formed in material weathered from sandy shale of the red beds. The native vegetation was tall and mid grasses.

In most places the surface layer is brownish, friable loam about 12 inches thick. It is easily worked and breaks to weakly formed blocks of irregular shape that are  $\frac{1}{4}$  to 1 inch in diameter.

The upper part of the subsoil is brownish, friable clay loam about 10 inches thick. It breaks to weakly formed blocks of irregular shape that are about  $\frac{1}{2}$  to 1 inch in diameter. The lower part of the subsoil is yellowish, friable clay loam that is mottled with red and is about 20 inches thick. It breaks to weakly or moderately well formed blocks of irregular shape that are about  $\frac{1}{2}$  to 1 inch in diameter.

The thickness of the surface layer ranges from about 8 to about 15 inches. The surface layer is thinnest where these soils are mapped with Vernon soils and thickest where they are mapped with Zaneis soils. The texture of the surface layer ranges to fine sandy loam in cultivated fields where these soils have been winnowed by wind, but the texture is loam in areas that have not been plowed.

The Chickasha soils occur with and are somewhat similar to the Zaneis soils, but they are more brownish and less reddish than the Zaneis soils. They also occur with the Vernon and Renfrow soils, but they have a less clayey subsoil and are less reddish than those soils. Where the Chickasha soils are mapped with Vernon soils, the slopes range from 3 to 8 percent and the surface layer is 4 to 6 inches thinner than in less sloping areas.

The Chickasha soils are well drained and have medium internal drainage. They absorb water well, and the loamy texture throughout the profile allows them to store a large amount of water for plants.

These soils are highly productive if they are properly fertilized and well managed. The more sloping areas are used mainly for grazing and are highly productive under good management. Most of the less sloping areas are cultivated, and the crops are chiefly small grains, sorghum, and cotton.

**Chickasha and Zaneis loams, 1 to 3 percent slopes** (ChB).—In this undifferentiated unit are gently sloping soils of the prairie near the town of Orr. The areas are dissected by small drainageways. Chickasha loam makes up about 80 percent of the acreage, and Zaneis loam makes up the rest. The Zaneis soil has a surface layer that is 2 to 4 inches thicker than that in the profile described for the Zaneis series.

Included in some areas mapped as these soils are small areas of Renfrow soils. These included soils are along the small drainageways.

The Chickasha and Zaneis soils are highly productive if they are properly fertilized and are well managed. Small grains and vetch, sorghum, and cotton are the principal crops. Erosion is the principal management problem. If row crops are grown, the soils should be terraced and farmed on the contour. Crop residue ought to be left on or near the surface. (Capability unit IIe-1; Loamy Prairie range site)

### Claremore Series

In the Claremore series are dark-colored soils that have a medium-textured surface layer and a moderately fine textured subsoil. These soils are in the central part of the county. They are shallow over limestone and formed mainly in material weathered from limestone. This limestone is reddish because it contains a large amount of iron oxide. The native vegetation was mid and tall grasses.

The surface layer is reddish silt loam about 9 inches thick. It has moderately well defined granular structure and is friable when moist. The subsoil is reddish heavy clay loam that breaks to moderately well formed irregular blocks about  $\frac{1}{4}$  to 1 inch in diameter. It is friable when moist and very hard when dry, is about 10 inches thick, and directly overlies limestone.

Depth of the limestone from the surface ranges from 12 to 30 inches. In most places the depth is about 19 inches.

Claremore soils occur with the Tarrant soils, but they are thicker over bedrock than those soils. They have a surface layer that is similar to that of the Labette soils, but they are less clayey and more friable than the Labette soils. Also their profile is less deep.

The Claremore soils are well drained. Runoff is rapid and internal drainage is medium.

Some of the acreage has been cultivated and then abandoned; it is now used for grazing. Because they are droughty, these soils are better suited to small grains, vetch, and other crops that grow in spring than they are to crops that grow in any other season. Some areas have been improved for tame pasture by planting bermudagrass or King Ranch bluestem as the base sod.

**Claremore silt loam, 1 to 3 percent slopes (CmB).**—This is the only Claremore soil mapped in the county. It is in the central part of the county.

Included in some areas mapped as this soil are areas of Tarrant soils. The Tarrant soils are along drainageways in areas where much of the surface layer has been removed by erosion. The Tarrant soils make up about 5 percent of the acreage mapped as this soil.

Most of the acreage has been cultivated and then abandoned; it is now used mainly for grazing. A few areas have been improved for tame pasture by planting bermudagrass or King Ranch bluestem as the base sod. In areas that are still cultivated, the chief crops are small grains, small grains and vetch, and sorghum. Crop yields are improved if fertilizer is added, but the yields are not high, because this soil is shallow over limestone and is droughty. Cultivated areas ought to be seeded to crops that grow in spring. (Capability unit IIIe-1; Loamy Prairie range site)

## Clayey Broken Land

**Clayey broken land (Cn)** is a moderately fine textured or fine textured land type that is moderately sloping to steep. It occupies two widely separated areas, one south of Lake Murray State Park, and the other northeast of the town of Orr. The slopes range from 3 to 30 percent. The area south of Lake Murray State Park is moderately steep or steep. As much as 20 percent of its surface is covered by limestone boulders (fig. 8). The vegetation in that area is mainly short and mid grasses, but there are also many oaks and elms. The area northeast of Orr is mostly moderately to strongly sloping and has only a few stones on the surface. Only a few oaks or elms grow in that area.

The soil material varies greatly in color and in thickness. In most places, however, it is 3 to 15 inches thick and is calcareous. The underlying material ranges from reddish to grayish in color.

Clayey broken land has a more grayish and less reddish color than the Vernon soil of the Vernon-Chickasha complex. It is more grayish and less brownish than the Denton soil that has slopes of 5 to 8 percent, and it is shallower over the underlying material.

Included in the areas mapped as Clayey broken land are small areas of Windthorst, Darnell, Vernon, and Chickasha soils. All of these soils occur in the area northeast of Orr, where sandstone and shale are near the sur-



Figure 8.—An area of Clayey broken land where much of the surface is covered by limestone boulders.

face. The Windthorst and Darnell soils are in the area south of Lake Murray State Park, where sandstone is near the surface.

This land type is somewhat excessively drained. Runoff is rapid, and internal drainage is medium. Erosion is a hazard because this land type is steep and shallow.

This land type is not suitable for cultivation, and all of the acreage is in range. The vegetation is mostly short grasses that do not produce much forage. The areas need protection from overgrazing. (Capability unit VIIs-4; Shallow Prairie range site)

## Darnell Series

In the Darnell series are steep, light-colored, moderately coarse textured soils that are shallow over sandstone. These soils are near Lake Murray State Park. They are also in the northwestern part of the county, generally where rocks crop out on the crowns of hills or near the tops of slopes. These soils formed in material weathered from coarse-textured sandstone (fig. 9). The native vegetation is post oak, blackjack oak, tall grasses, and mid grasses.

In most places the upper part of the surface layer is light-brown fine sandy loam about 5 inches thick. It has granular structure, but the aggregates are weakly formed. The lower part is generally light-brown fine sandy loam about 6 inches thick. It is structureless and contains many fragments of sandstone.

The surface layer of these soils ranges from 2 to 18 inches in thickness. Its texture is fairly uniform fine sandy loam.

Darnell soils occur with the Windthorst and Stephenville soils, and they are mapped in a complex with the Windthorst soils. They are more stony and are shallower over bedrock than either the Windthorst or Stephenville soils.

The Darnell soils are somewhat excessively drained. Runoff is rapid, and internal drainage is medium. These soils absorb water well, but because they are shallow, their



Figure 9.—Profile of shallow Darnell soils of the Windthorst-Darnell complex, underlain by sandstone.

water-holding capacity is low. Therefore, not much water is available to plants.

Most of the acreage is in woods pasture. Even under good range management, however, not much forage is produced.

### Denton Series

The Denton series consists of dark-colored soils that have a moderately fine textured or fine textured surface layer and a fine textured subsoil. These soils formed in beds of clay weathered from marl and are in the central part of the county. They are among the most important soils for agriculture in the county. The native vegetation was tall and mid grasses.

The surface layer is clay about 12 inches thick in most places. It is very dark gray and is calcareous, has granular structure, and is plastic when wet and hard when dry. It shrinks and swells as the content of moisture varies. The upper part of the subsoil is generally about 5 inches thick and is plastic when wet and hard when dry. It breaks to moderately well formed irregular blocks  $\frac{1}{2}$  to

1 inch in diameter. Generally the upper part of the subsoil is dark-brown clay, but about 20 percent, by volume, is grayish, highly calcareous clay. The lower part is highly calcareous, light-brown clay that is generally about 15 inches thick. It is friable when moist and sticky when wet, and it breaks to granules or to moderately well formed blocks  $\frac{1}{4}$  to  $\frac{1}{2}$  inch in diameter.

The texture of the surface layer ranges from clay to silty clay loam. In a few areas there are small pieces of limestone on the surface. The profile of these soils is 5 to 8 inches thinner in strongly sloping areas than in gently sloping areas.

Denton soils occur with the San Saba, Durant, Waurika, and Labette soils, and they are all somewhat similar. The Denton soils have a more granular structure than the San Saba soils, are less clayey, and have a thinner surface layer. They have a darker colored, more clayey surface layer than the Durant and Waurika soils.

The Denton soils are moderately well drained, but their internal drainage is slow. They absorb water well and have high water-holding capacity. Natural fertility and the content of organic matter are also high.

The gently sloping areas of these soils are cultivated, and the crops are mainly cotton and small grains. Although the soils are sticky when wet and are difficult to till, crop yields are good under good management. The moderately sloping or strongly sloping areas are used for grazing in most places. Good range management, including controlled grazing and deferred grazing, helps to keep these soils productive.

**Denton clay, 5 to 8 percent slopes (DcD).**—This soil is along drainageways. In most places it has a surface layer of clay, but the surface layer is clay loam in some areas. The surface layer is generally 5 to 8 inches thinner in the steeper areas than it is in other areas. It is thickest at the lower edges of the slopes.

Included in the areas mapped as this soil are small areas of Loamy alluvial land and a few areas of San Saba soils. The San Saba soils are less steep than these soils.

Only a small acreage is cultivated, and the crops are mainly small grains, small grains and vetch, and sorghum used mostly for hay or for supplemental pasture. The cultivated areas ought to be used only for close-growing crops. A good cover maintained at all times will protect those areas from erosion. This soil is well suited to range if controlled grazing, deferred grazing, and other good range management is used to maintain a vigorous stand of mid and tall grasses. (Capability unit IVE-1; Blackclay Prairie range site)

**Denton-San Saba clays, 3 to 5 percent slopes (DdC).**—These soils are mapped as a complex because they occur in such an intricate pattern that it is not practical to map them separately. They are in the central part of the county.

Denton soils, mainly on the upper parts of slopes in gently rolling areas, make up about 65 percent of the acreage. They are underlain by partly weathered calcareous clay. Generally the San Saba soils are near the bottom of the slopes, where material that has washed down from higher areas has accumulated. In most places the surface layer of the San Saba soils in this complex is 3 to 6 inches thinner than that of the San Saba soils in San Saba-Denton clays, 1 to 3 percent slopes.

Included in the areas mapped as these soils are a few areas of steeper soils along small drainageways. Also included are small areas of Loamy alluvial land along drainageways.

About two-thirds of the acreage has been cultivated, but most of this acreage is now abandoned. Part of it has been reseeded and used for range or pasture, and part is still cultivated. In the cultivated areas the chief crops are small grains, small grains and vetch, cotton, and sorghum. In the acreage that has been cultivated for long periods, sheet erosion has removed much of the surface layer, but not many gullies have formed. Where there has been little or no erosion, small grains, cotton, and sorghum produce good yields. Terracing and farming on the contour will help to protect the cultivated soils. Crop residue left on or near the surface also protects the soils from sheet erosion. (Capability unit IIIe-5; Blackclay Prairie range site)

**Denton-Tarrant complex** (1 to 5 percent slopes) (De).—The soils of this complex are mainly near the crowns of rolling divides on the prairies in the central part of the county. They occupy areas only 5 to 10 acres in size. Fractured limestone underlies these soils at a depth of only 5 to 15 inches, but the roots of grass grow through the fractured limestone into the underlying soil material.

Denton soils make up about 80 percent of the acreage in most areas, but the proportion of Denton soils ranges from as little as 40 percent to as much as 95. In most places the Denton soils are on slopes above the Tarrant soils. The Tarrant soils generally consist of a layer of soil material that is shallow over fractured limestone. A few small areas of the soils of San Saba-Denton complex, 1 to 3 percent slopes, are included in the areas mapped as this complex.

About half of the acreage has been cultivated and then abandoned. Most of the acreage is now grazed and is highly productive under good range management. Such management consists of controlling grazing so that the maximum amount of forage is obtained and the more desirable range plants can reproduce. (Capability unit IVe-1; Denton soils in Blackclay Prairie range site, and Tarrant soils in Very Shallow range site)

## Dougherty Series

The Dougherty series consists of light-colored soils that have a coarse-textured surface layer and a moderately fine textured subsoil. These soils are mainly in the southern part of the county, but a smaller acreage is in the northeastern part near Lake Murray State Park. These soils in the southern part of the county are near Thackerville and near Burneyville, Rubottom, and Leon. Many of the areas are on high benches along the Red River, but some are on rolling terrain underlain by pack sand. The soils are extensive and are important to the agriculture of this county. In the southern part of the county these soils formed mainly in old alluvium, and in the northern part they formed mostly in pack sand. The native vegetation was mainly dwarf oaks and other oaks and tall and mid grasses between the trees.

In most places the upper part of the surface layer is brownish loamy fine sand about 5 inches thick. It is very friable when moist and soft when dry and is structureless. The lower part is slightly lighter colored than the upper



Figure 10.—Profile of Dougherty loamy fine sand. This soil has a thick surface layer as indicated by the spade, which is entirely within the surface layer.

part and is generally about 20 inches thick (fig. 10). It is also very friable when moist and is strongly acid. The subsoil is reddish sandy clay loam about 2 feet thick. It is friable when moist. The soil material in the subsoil breaks to weakly formed, elongated blocks, 1 to 2 inches in diameter. These blocks, in turn, break to weakly formed blocks, of irregular shape, about  $\frac{1}{2}$  to 1 inch in diameter.

The thickness of the surface layer ranges from about 5 inches in eroded areas to about 30 inches in some of the areas that are not eroded. In cultivated areas the surface layer is light brown. This is because of the reduction in organic matter and the mixing of the underlying light-colored soil material with the surface soil. Where erosion has occurred, the surface layer is reddish in many places because of the mixing of the subsoil material into the surface layer. Where these soils formed in pack sand, the subsoil is generally less reddish and more yellowish than where they formed in old alluvium.

The Dougherty soils occur with the Eufaula soils. Their profile is similar to that of the Eufaula soils, but they have a thinner surface layer and a more clayey subsoil.

The Dougherty soils are well drained. Runoff is slow, and internal drainage is medium.

Most of the acreage is grazed. In many areas, however, the amount of desirable forage produced is small because of the growth of woody plants. Many other areas, where the woody plants have been killed by spraying, are now

fairly productive. Some of the nearly level areas are cultivated, and the crops are mainly peanuts, cotton, and small grains. Crops grown on these soils respond well to fertilizer, but the soils require protection from wind erosion. Some areas have been improved for tame pasture and the pasture plants also respond well to fertilization and proper management.

**Dougherty loamy fine sand, 0 to 3 percent slopes (DoB).**—This soil is mostly on high benches along the Red River. It is mainly north and east of Leon and near Thackerville. In cultivated areas wind erosion has caused the formation of hummocks in some places. Included in the areas mapped as this soil are areas of a soil that has a surface layer as thick as that of the Eufaula soils.

Only about 40 percent of the acreage has been cleared and tilled; the rest is still in stands of blackjack oak, post oak, and hickory trees. In cultivated areas the main crops are peanuts and small grains and vetch. Some areas have been improved for tame pasture by planting weeping lovegrass and bermudagrass. Spraying has been used to kill the trees in some areas.

Natural fertility is low, and crop yields are low unless fertilizer is applied. This soil needs to be protected from wind erosion by leaving a large amount of crop residue on or near the surface. (Capability unit IIIe-3; Deep Sand Savannah range site)

**Dougherty loamy fine sand, 3 to 5 percent slopes (DoC).**—This soil is on the side slopes of shallow drainageways that run through the high benches along the Red River. It is mainly north and east of Leon and near Thackerville. In most places the surface layer is thicker where this soil is on the lower part of the slopes than where it is near the top.

Included in the areas mapped as this soil are areas of Pulaski soils. These included soils are on the bottoms of small drainageways.

Most of the acreage is in woods pasture or range, but part of it is cultivated. The principal crops are small grains and vetch and sorghum. Many of the cultivated areas consist of this soil on the lower part of the side slopes and of included Pulaski soils on the bottoms of shallow drainageways. In those areas extra moisture is received as the result of runoff from the upper part of the slopes. Where large areas have been cultivated, some gullies have formed but only a small part of the surface layer has been removed. Because this soil has low fertility, fertilizer is necessary to obtain satisfactory crop yields. This soil is too sandy for successful terracing. It needs protection from wind erosion. Therefore, it ought to be kept in close-growing crops and the crop residue left on or near the surface. Some areas have been improved for tame pasture by planting lovegrass and bermudagrass. Some areas have been sprayed to kill the trees. (Capability unit IVe-3; Deep Sand Savannah range site)

**Dougherty loamy fine sand, 5 to 8 percent slopes (DoD).**—This soil is on high benches along the Red River, mainly along deep drainageways. It is extensive north and east of the town of Leon and near Thackerville. The surface layer is thicker where this soil is on the lower part of the slopes than where it is in higher areas.

Included in the areas mapped as this soil are areas of Stephenville soils and areas of soils that have a surface layer as thick as that of the Eufaula soils. These included

soils make up about 10 percent of the acreage mapped as this soil.

Most of the acreage is in woods pasture or range. Part of the range and pasture has been sprayed to kill the trees, and some areas have been improved for tame pasture by planting lovegrass and bermudagrass. Some areas are cultivated, and the crops are mainly small grains and vetch and sorghum. Crop yields are generally low.

A few large areas have been cultivated, but many cultivated areas consist of long, narrow strips of bottom land adjacent to small areas of Pulaski fine sandy loam. Generally, in the areas of bottom land the farmer has expanded his field to take in the lower part of a hillside. In the large cultivated areas, some gullies have formed but only a small part of the surface layer has been removed. All the cultivated areas need protection from wind erosion. This soil is too sandy for terraces to be successful, but erosion can be controlled by planting close-growing crops and leaving the crop residue on the surface. Because this soil has low natural fertility, fertilizer is needed. (Capability unit IVe-3; Deep Sand Savannah range site)

**Dougherty soils, 0 to 3 percent slopes, eroded (DuB2).**—These soils are mainly east and a little south of Lake Murray State Park. Some areas are on high benches along the Red River.

The surface layer is 5 to 12 inches thick. In places part of the subsoil has been mixed with the surface layer by tillage, and the present surface layer in those areas is reddish fine sandy loam.

Included in the areas mapped as these soils are areas of soils that have an uneroded surface layer. These inclusions make up about 10 percent of the acreage mapped as these soils.

Most of the acreage is cultivated, and the crops are mainly peanuts, small grains and vetch, and cotton. Some areas have been improved for pasture by planting bermudagrass and weeping lovegrass. If the soils are managed well and fertilizer is added, they are highly productive. In cultivated areas wind erosion can be controlled by leaving a large amount of crop residue on or near the surface. (Capability unit IIIe-2; Sandy Savannah range site)

**Dougherty soils, 3 to 5 percent slopes, eroded (DuC2).**—These are sandy soils that occur mainly north and east of Leon and near Thackerville. In most places they are on the side slopes of high benches along the Red River, above the valley floors. They receive runoff from the higher areas. On the upper part of the slopes, erosion has removed much of the surface layer, but on the lower part and on the valley floors, soil material has accumulated. The surface layer of these soils on the upper part of the slopes is only 6 to 12 inches thick, but it is about 8 inches thick in most places. The soil material that was lost from the upper part of the slopes has accumulated on the lower part. Gullying has occurred in some places, but most of the gullies can be crossed by light farm equipment.

Included in the areas mapped as these soils are a few areas of soils that have not been eroded and some areas of Eufaula soils where windblown sand has accumulated. These inclusions make up about 10 percent of the acreage mapped as these soils.

Most of the acreage has been cultivated, but much of it was later abandoned for cultivated crops. The areas that were abandoned are now used mainly for grazing. A few

areas have been improved for tame pasture by planting lovegrass and bermudagrass. Part of the acreage is still cultivated, and the crops are mainly small grains and vetch and sorghum. Crop yields are low, however, unless a large amount of fertilizer is added. The soils are susceptible to both wind and water erosion. They are too sandy for terraces. Erosion can be controlled by planting close-growing crops and leaving the crop residue on or near the surface. (Capability unit IVE-3; Sandy Savannah range site)

### Durant Series

The Durant series consists of deep, dark-colored soils that have a medium-textured or moderately fine textured surface layer and a fine-textured subsoil. These soils are near the town of Marietta. They formed in material weathered from clayey shale that contains a large amount of lime. In places the shale is underlain by thin layers of limestone. The native vegetation was tall and mid grasses.

In most places the surface layer is dark-brown loam about 8 inches thick. It is massive and does not break to blocks, is slightly plastic when wet, and tends to crust after a rain. The subsoil is brownish and clayey and is mottled with red in many places. It is extremely hard when dry. Generally it is about 5 feet thick. The upper part breaks to weakly formed blocks about a fourth of an inch in diameter, and the lower part breaks to weakly or moderately formed blocks about  $\frac{1}{2}$  to 1 inch in diameter. Roots cannot penetrate the lower part easily.

The texture of the surface layer ranges from light silt loam to light clay loam, and the thickness of that layer ranges from 5 to 10 inches. The thickness of the subsoil ranges from 3 to 6 feet.

Durant soils occur with and are somewhat similar to the San Saba, Denton, Labette, and Waurika soils. Their surface layer is more loamy and lighter colored than that of the San Saba and Denton soils, and their subsoil is more clayey and more blocky than that of the Labette soils. The upper part of their subsoil is more friable than that of the Waurika soils, and it is also less clayey and less blocky.

The Durant soils are moderately well drained and have slow internal drainage. They are fertile, but because they are droughty, they do not produce high yields. Most areas of these soils have been cultivated, but are now used for grazing. In the remaining cultivated areas, small grains, cotton, and sorghum are the main crops. Crop yields are favorable if the soils are properly fertilized. Much of the acreage has been improved for tame pasture.

**Durant clay loam, 1 to 3 percent slopes, eroded (DB2).**—Most areas of this soil are near the town of Marietta. The soil consists of areas that were formerly Durant loam, 1 to 3 percent slopes, but that lost much of their original surface layer after they were cultivated. Part of the clayey subsoil has been mixed with the loamy surface layer in more than half of the acreage of this soil, and there are a few shallow gullies. This soil contains a claypan.

Included in the areas mapped as this soil are a few areas of a nearly level Waurika soil, mainly at the heads of drainageways. In the more severely eroded areas where most of the original surface layer has been lost, many areas of Slickspot soils are included. The included soils

make up about 3 percent of the acreage mapped as this soil.

This Durant soil is droughty, and it crusts badly after rains. Because of the crusting, only close-growing crops or crops that do not require much cultivation should be grown. All of the acreage has been cultivated, but much of it is now idle or is used for grazing. In the cultivated areas the crops are chiefly small grains and vetch, grazed in winter and in spring. Large applications of fertilizer are needed for field crops, and a large amount of crop residue should be left on or near the surface. Many areas have been improved for tame pasture by planting bermudagrass or King Ranch bluestem. (Capability unit IVE-4; Loamy Prairie range site)

**Durant loam, 1 to 3 percent slopes (DB).**—This soil is on the prairie near the town of Marietta. Some erosion has taken place, mainly in the surface layer, and there are a few shallow gullies. This soil contains a claypan.

Included in the areas mapped as this soil are small areas of Waurika loam. The Waurika soil is generally near the heads of drainageways or in nearly level areas near small drainageways. In the more nearly level areas where much of the original surface layer has been removed by erosion, some areas of Slickspot soils are included. Also included are small areas of Labette, San Saba, and Denton soils on the tops of low ridges.

This Durant soil is droughty, and much of the water from rainfall runs off. The large amount of runoff increases the hazard of erosion. The soil crusts so badly that it is difficult for seedlings to emerge.

About half of the acreage has been cultivated, but much of the acreage that was formerly cultivated has been abandoned. Some areas have been improved for tame pasture by planting bermudagrass or King Ranch bluestem. In areas that are now cultivated, the crops are chiefly small grains, cotton, and sorghum.

If row crops are grown, erosion should be controlled by terracing, farming on the contour, and leaving a large amount of crop residue on or near the surface. Fertilizer is needed to obtain favorable production of crops and pasture. (Capability unit IIIe-4; Loamy Prairie range site)

### Eroded Loamy Land

**Eroded loamy land (Et)** is a deep, dark-colored, medium-textured or fine-textured land type that is mostly on prairies in all parts of the county. It is made up of the remains of soils so severely eroded that the soil type can no longer be identified. These eroded soils formed in material that ranges from sediment weathered from calcareous shale to loamy material weathered from shaly red beds. They have a moderately fine textured or fine textured subsoil. In some places most of their surface layer has been removed by erosion, but there are not many gullies. In other places deep gullies are common, but the surface layer of the soils between the gullies is only slightly eroded.

Part of the original surface layer remains in some areas. In those areas the texture of the remaining surface layer is loam to clay. The present surface layer is generally not more than 4 inches thick. It is as much as 12 inches thick, however, in the areas where deep gullies are numerous and where there has been only slight erosion between the gullies.

Included in the areas mapped as this land type are severely eroded Durant, Zaneis, Renfrow, Chickasha, Waurika, and Denton soils, and small areas of uneroded soils. The included soils that have a fine-textured subsoil have lost most of their surface layer through erosion, but there are only a few gullies. Gullies are numerous in the more loamy included soils; those soils have lost only a small part of their surface layer in the areas between the gullies.

Much of this land type is droughty because many of the areas contain a claypan. Erosion is a serious hazard.

All of this land type has been cultivated, but most of the acreage is now grazed. Annual three-awn, other annual grasses, and weeds are the principal vegetation, and they produce only a small amount of forage. Tame pastures have been established in some places by planting bermudagrass or King Ranch bluestem. These pastures are highly productive if they are properly fertilized. In the areas that have not been improved for pasture, a good cover needs to be established by planting grass and fertilizing properly. Grazing should be controlled to permit the growth of grass. (Capability unit VIe-1; Loamy Prairie range site)

### Eufaula Series

Soils that are light colored make up the Eufaula series. These soils generally have a coarse-textured surface layer and a moderately coarse textured to moderately fine textured subsoil at a depth of more than 30 inches. Some of the areas are in the northern part of the county, but these soils are mainly north of Jimtown and near Thackerville. They are mostly on benches along the Red River. The areas on benches are high above the level reached by overflow. These soils formed mainly in sandy alluvium, but the areas in the northern part of the county formed in soft unconsolidated sand. The soils are undulating to hummocky (fig. 11). The native vegetation is mainly dwarf oaks and other oaks, but tall grasses and mid grasses grow between the trees.

The upper part of the surface layer is brownish fine sand that is about 6 inches thick, and it breaks to very weak granular structure. The lower part is lighter brown than the upper part and is about 30 to 55 inches thick. It is



Figure 11.—Eufaula fine sand, hummocky, in a cultivated field where wind erosion has been active.

loose when dry or moist, and is structureless (single grain). In most places these soils have a subsoil of reddish sandy clay loam that ranges from 10 inches to several feet in thickness. A well-defined B horizon is lacking in about 20 to 30 percent of the acreage, or the B horizon is represented by streaks and splotches of fine sandy loam. Where a B horizon is present, it is structureless and is very friable when moist and slightly hard when dry.

The subsoil is more sandy in most hummocky areas than in undulating areas. It is more pink and less red on the lower benches along the Red River than on the higher benches.

The Eufaula soils occur with the Dougherty soils. Their profile is similar to that of the Dougherty soils, but their surface layer is thicker than 30 inches. Also, they have a more sandy subsoil.

The Eufaula soils are somewhat excessively drained or excessively drained. Internal drainage is rapid.

Most of the acreage is used for grazing. A large amount of desirable forage is produced in places where the woody plants have been killed by spraying. Only a small amount of desirable forage grows where trees and shrubs shade the ground.

**Eufaula fine sand, hummocky** (3 to 12 percent slopes) (EuC).—This soil is on moderately steep escarpments along the Red River and on hummocky benches high above the river. It is mainly near Thackerville and north of Jimtown, but some areas are in the northern part of the county.

Included in the areas mapped as this soil are some areas that are undulating. This included soil is generally in the valleys between the hummocks. A few areas are used for truck crops, mainly watermelons. In the cultivated areas fertilizer is leached out rapidly, and therefore, a small amount should be added frequently. In general this Eufaula soil is unsuitable for cultivation, and most of the acreage is in woods pasture. In the pastures only a small amount of desirable vegetation grows under the thickets of dwarf oak. These thickets make grazing difficult. In some areas that have been sprayed to kill the woody plants, tall and mid grasses produce much desirable forage. Some areas have been improved for tame pasture by planting bermudagrass and weeping lovegrass. These areas are highly productive if they are well managed and if fertilizer is added. (Capability unit VIe-1; Deep Sand Savannah range site)

**Eufaula fine sand, undulating** (0 to 3 percent slopes) (EuB).—This soil is on benches high above the Red River. It is mainly north of Jimtown and near Thackerville.

Included in the areas mapped as this soil are small areas of Dougherty soils, generally in swales or in other low places. Also included are some hummocky areas where windblown sand has accumulated.

Wind erosion is a hazard. The moisture-holding capacity and natural fertility are low.

This soil is used mostly for grazing, but a small acreage is cultivated. The crops are mainly small grains and vetch, peanuts, and watermelons and other truck crops. In areas of range only a small amount of grass is produced because of the thickets of dwarf oak. In cultivated areas wind erosion must be controlled. This can be done by growing crops that produce a large amount of residue and by leaving the crop residue on the surface. Fertilizer rapidly leaches beyond the depth where it is available to plants. Therefore, fertilizer is more effective if it is ap-

plied frequently in small amounts. (Capability unit IVs-1; Deep Sand Savannah range site)

## Gowen Series

In the Gowen series are dark-colored, medium-textured or moderately fine textured soils of the bottom lands. These soils are along small streams. They formed in a mixture of sandy sediments from the timbered uplands and clayey sediments from the prairies. In most places the native vegetation was bottom-land hardwoods and some tall and mid grasses between the trees.

In most places the surface layer is grayish to brownish loam to silty clay loam and is about 15 inches thick. It is friable when moist and hard when dry, and it has granular structure. The subsoil is grayish to brownish and is faintly mottled with brown in many places. It is generally slightly more clayey than the surface layer and is about 30 inches thick. The subsoil is firm when moist and hard when dry, and it breaks to moderately well developed blocks of irregular shape that are  $\frac{1}{4}$  to  $\frac{1}{2}$  inch in diameter.

The texture of the surface layer ranges from silty clay loam to light loam. It is silty clay loam along some of the larger streams that drain the prairies and light loam along streams that drain the more sandy areas. In a few places these soils are calcareous.

The Gowen soils are less red and are more grayish and brownish than the Port soils. They are lighter colored than the Lela soils and are more friable. Also, they are generally on bottom lands instead of on benches, above the level reached by overflow.

The Gowen soils are moderately well drained and have medium internal drainage. Their water-holding capacity is good.

Most areas of these soils that are large enough are cultivated. The crops are mainly alfalfa, cotton, small grains, and sorghum. These soils are highly productive if they are properly fertilized and well managed.

**Gowen clay loam** (0 to 1 percent slopes) (Go).—In most places this soil is on bottom lands along small streams. The streams drain chiefly the soils of prairies in the central part of the county.

Included in the areas mapped as this soil are small areas that are along meandering stream channels and are similar to Loamy alluvial land. These small areas are not suitable for cultivation. They make up about 8 percent of the mapped areas of this soil. Included in some areas are soils that are more loamy than this Gowen soil and generally are near a stream channel or small tributaries.

Most of this soil is cultivated, and the main crops are alfalfa, small grains, and sorghum. Crop yields are favorable under proper management. Crop residue should be left on the surface or worked into the surface layer. (Capability unit I-2; Loamy Bottomland range site)

**Gowen loam** (0 to 1 percent slopes) (Gm).—This soil is mainly on bottom lands. It is generally along small streams that drain both the soils of the prairies and of the timbered uplands.

Included in the areas mapped as this soil are areas of soils near stream channels that are dissected by meandering streams. These included soils are similar to Loamy alluvial land and are not suitable for cultivation. They make up about 10 percent of the mapped areas of this soil.

In most places this Gowen soil is cultivated and is used mainly for alfalfa, cotton, and small grains and vetch. Also, pecan trees, which are a part of the native vegetation, are culled, thinned, and cultivated as a crop in many places. This soil is highly productive if it is fertilized and properly managed. Crop residue should be left on the surface or worked into the surface layer. This soil is naturally fertile, but crop yields are higher if fertilizer is added. (Capability unit I-1; Loamy Bottomland range site)

**Gowen soils, frequently flooded** (0 to 1 percent slopes) (Gw).—These soils are mostly along the lower part of Simon Creek. Generally, they are in areas where the stream channel is too narrow and shallow to carry the streamflow.

Included in the areas mapped as these soils are areas of Pulaski soils. The Pulaski soils are generally in places where the alluvial fans of small tributaries cover the bottom lands along a larger stream.

Most of the acreage has been tilled, but it is now mainly in johnsongrass meadows. In some cultivated areas cotton, sudangrass, and other late-planted summer crops grow. Some areas have been improved for tame pasture by planting bermudagrass. In those areas control of brush and weeds, proper control of grazing, and applications of fertilizer are necessary. In many places the native pecan trees have been thinned and developed into pecan orchards. The major problem in managing these soils is flooding. After the spring rains are over, the hazard of flooding decreases and crops are less likely to be damaged by flooding. (Capability unit Vw-1; Loamy Bottomland range site)

## Labette Series

In the Labette series are dark-colored soils that have a medium-textured surface layer and a fine-textured subsoil. Generally these soils are on the tops or crowns of low ridges on the prairies near the town of Marietta. They formed mainly in material weathered from calcareous shale or soft limestone that contains a large amount of iron, but they are underlain by thin limestone in most places. In a few places they formed in alluvium high above the level now reached by overflow. In those places they are in rolling areas and generally are not underlain by limestone. The native vegetation was mid and tall grasses.

The surface layer is brownish loam to light clay loam about 8 inches thick. It is friable when moist and hard when dry, and it has granular structure. The subsoil is brownish to reddish heavy clay loam to clay about 48 inches thick. It is firm when moist and hard when dry. The subsoil breaks to weakly formed to moderately well formed blocks of irregular shape,  $\frac{1}{4}$  to  $\frac{1}{2}$  inch in diameter.

The Labette soils are less red and less sandy than the Zaneis soils, and their subsoil has more blocky structure than that of the Zaneis soils. Also they formed in material weathered from iron-bearing limestone rather than in material weathered from the red beds. Their subsoil is more clayey and has more blocky structure than that of the Teller soils, and the Labette soils are mainly on the tops of low ridges instead of on alluvial benches.

The Labette soils are well drained. They have medium internal drainage. About 80 percent of the acreage has been cultivated, and the chief crops now grown are small grains, cotton, and sorghum. Some areas have been improved for tame pasture and are used for grazing. These

soils respond well if they are properly managed and are fertilized properly. As a rule, crop yields on these soils are higher than average for this county.

**Labette clay loam, 1 to 3 percent slopes, eroded** (lcB2).—This soil is on low hills near the town of Marietta. Its profile is much like the one described for the Labette series. The surface layer is more clayey, however, because part of the subsoil has been mixed into it by tillage. It is less than 5 inches thick in about half the acreage of this soil.

Included in the areas mapped as this soil are small areas of San Saba and Denton soils in areas where drainage is good. Included also are small areas of Waurika soils in small depressions.

This Labette soil is mainly in old fields that now support only annual grasses and weeds. Nearly all of the acreage has been cultivated, but at present the areas are used mostly for pasture. Some areas have been improved for tame pasture. In the few cultivated areas, this soil is generally used for small grains, small grains and vetch, cotton, and sorghum. Crop yields are not favorable, because this soil is droughty and low in natural fertility. Practices needed to produce satisfactory crops are terracing, farming on the contour, applying fertilizer as needed, and seeding crops that produce a large amount of residue. (Capability unit IIIe-1; Loamy Prairie range site)

**Labette loam, 1 to 3 percent slopes** (lbB).—This soil is on the crowns of low hills. It is near the town of Marietta.

Included in the areas mapped as this soil are areas of Labette soils that formed in alluvium and have a slightly thicker surface layer than this soil. These included soils are in areas southwest of Marietta. Also included are small areas of Waurika and Durant soils. Surface drainage in these areas is slow. These included soils make up about 2 percent of the areas mapped as this soil.

Most of the acreage is used for small grains, small grains and vetch, cotton, and sorghum. In cultivated areas erosion is the chief problem. Water erosion removes the surface layer if this soil is not protected by a cover of plants. Not many gullies have formed. In areas where row crops are grown, terracing and farming on the contour are necessary to control erosion. Also, crops that produce a large amount of residue should be seeded and the residue left on the surface or worked into the surface layer. Some areas have been improved for tame pasture by planting bermudagrass or King Ranch bluestem. (Capability unit IIe-1; Loamy Prairie range site)

## Lela Series

The Lela series consists of soils that are deep, nearly black, and fine textured. These soils are mainly on benches along small streams that drain into the Red River and are above the level normally reached by overflow. They formed in gray, clayey alluvium that is several feet thick in many places. Because the acreage is small, these soils are not important to the agriculture of this county. The native vegetation was chiefly tall and mid grasses.

The surface layer is dark-grayish clay about 18 inches thick. It is hard when dry and very plastic when wet, and it breaks to weakly formed blocks  $\frac{1}{4}$  to  $\frac{1}{2}$  inch in diameter. These blocks, in turn, break to granules. The subsoil is slightly lighter colored than the surface layer and is about 15 inches thick. It is extremely hard when dry and very

plastic when wet, and it breaks to well-formed blocks  $\frac{1}{2}$  to 1 inch in diameter.

In some places loamy material has accumulated on the surface, and there are areas of Slickspot soils in a few places. Otherwise, the profile varies only slightly from the one described for the Lela series.

The Lela soils are similar to the San Saba soils in color and texture, but they are generally more nearly level than those soils. Their subsoil has a more blocky structure. They occur with the soils of the Brewer-Vanoss complex, but they have a more clayey, darker colored surface layer than those soils.

The Lela soils are somewhat poorly drained. They are wet in spring and are droughty in summer and fall. Internal drainage is slow or very slow.

These soils are generally cultivated. The chief crops are cotton, small grains and vetch, sorghum, and alfalfa.

**Lela clay** (0 to 1 percent slopes) (ld).—This is the only Lela soil mapped in the county. It is mainly on low benches along streams that drain the soils of prairies in the central part of the county. In a few places loamy material has accumulated on the surface and the texture of the surface layer is clay loam.

Included in the areas mapped as this soil are small areas of Gowen soils near small drainageways. Included also are a few areas of Slickspot soils.

Most of the acreage has been cultivated, but this soil is difficult to farm because it is too wet in spring and too dry in summer and fall. It is now used mainly for small grains and vetch, sorghum, alfalfa, and corn. Drainage is needed for favorable crop yields. Also, fertility must be maintained and the tilth improved. (Capability unit IIIw-1; Heavy Bottomland range site)

## Lincoln Series

In the Lincoln series are dark-colored soils that have a fine-textured to coarse-textured surface layer and a moderately coarse textured subsoil. These soils are somewhat excessively drained or excessively drained. They are on bottom lands along the Red River and formed in alluvium derived chiefly from red beds. In some places they are underlain by material that is similar to the alluvium, but they are underlain by a different material in other places. Because the acreage is small, these soils are not important to the agriculture of this county. The native vegetation ranges from cedar or short grasses in the more droughty areas to bottom-land hardwoods and an understory of mid and tall grasses in the areas where there is more moisture.

In most places the surface layer is brown or light-brown loam about 12 inches thick. It is friable when moist and soft to hard when dry, and it has weak granular structure. The subsoil is highly stratified; it contains thin layers of reddish sand and loam, but the texture is dominantly fine sand. The subsoil is very friable when moist and loose when dry, and it is structureless.

The texture of the surface layer ranges from clay to loamy fine sand. Generally the texture is clayey in areas of swales. Most of these areas are narrow, but some areas are fairly wide. In a few of the wider areas, these soils are seldom if ever flooded.

The Lincoln soils occur with the Yahola soils. They have a more sandy subsoil than those soils.

Most of the acreage is used for grazing. Part of it, however, is seeded to feed crops that grow in winter and spring when moisture is adequate for crops.

**Lincoln soils** (0 to 1 percent slopes) (ls).—These are the only Lincoln soils mapped in the county. They are mainly on bottom lands along the Red River.

Included in the areas mapped as these soils are small areas of Norwood and Miller soils, generally in swales. Norwood and Miller soils make up about 6 percent of the acreage mapped as these soils.

Lincoln soils are droughty. They are naturally fertile. Most of the acreage is used for grazing, but a few areas are used for small grains and vetch. Some areas have been improved for tame pasture by planting bermudagrass as the base sod, and they produce a large amount of forage. Pecan trees make up part of the native vegetation in most pastures, and they are culled, thinned, and cultivated as a crop in many places. Only cultivated crops that grow during the rainy season in spring are suitable for planting. If legumes are grown, phosphate is needed. Zinc is likely to be needed for pecans. (Capability unit IVs-2; Sandy Bottomland range site)

## Loamy Alluvial Land

**Loamy alluvial land** (0 to 1 percent slopes) (lv) occurs in all parts of the county on narrow bottom lands that are dissected by stream channels. In most places the areas are less than 150 feet wide, and the areas suitable for tillage are less than 3 acres in size. Some areas are frequently flooded, but the stream channel is deep enough in other areas to carry normal runoff. Underlying most areas of this land type is sandy to clayey alluvium, but a few areas are underlain by limestone at a depth of 30 to 50 inches. The native vegetation was bottom-land hardwoods, Osage-orange, and tall and mid grasses.

The soil material in this land type ranges from light colored to dark colored, from fine textured to moderately coarse textured, and from poorly drained to well drained. It generally absorbs and stores enough water for good growth of plants. In some places this land type is calcareous, but it is slightly acid in other places.

Included in the areas mapped as this land type are small areas of Gowen loam, Gowen clay loam, Port loam, and Pulaski fine sandy loam. Included also are soils in small isolated areas that are not dissected by stream channels and that are large enough to cultivate.

Most of the acreage is used for grazing, and some areas have been improved for tame pasture by planting bermudagrass as the base sod. Generally the yield of forage is large, but it is difficult to plant and maintain the pastures because of the dissecting stream channels and drainageways. Weeds and brush must be controlled if the maximum yields of forage are to be obtained. Pecan trees grow in most places, and they have been thinned and developed into pecan orchards in some places. (Capability unit Vw-2; Loamy Bottomland range site)

## Miller Series

In the Miller series are dark-colored, fine-textured, calcareous soils on bottom lands along the Red River. These soils formed in alluvium. The native vegetation

was bottom-land hardwoods and mid and tall grasses between the trees.

In most places the surface layer is reddish or brownish clay about 14 inches thick. It is very firm when moist and hard when dry, and it breaks to weakly developed blocks  $\frac{1}{4}$  to  $\frac{1}{2}$  inch in diameter. The texture of the surface layer ranges from clay to clay loam. The subsoil is slightly less brownish and more reddish than the surface layer, but it has about the same texture, consistence, and structure. In some places it is several feet thick.

The Miller soils are more reddish and less brownish than the Navasota and Lela soils. They have a more clayey subsoil than the Norwood soils, and their subsoil has more blocky structure.

The Miller soils are generally moderately well drained, but the drainage is somewhat poor in the areas where water accumulates. Their internal drainage is very slow.

Most of the acreage is cultivated, and the main crops are alfalfa, corn, cotton, and small grains and vetch. These soils are highly productive and respond well if fertilizer is added.

**Miller clay** (0 to 1 percent slopes) (Mr).—This is the only Miller soil mapped in the county. It is mainly along the Red River on bottom lands that are occasionally flooded.

Included in the areas mapped as this soil are small areas of Norwood soils. These included soils generally occupy narrow areas at a slightly higher elevation than this soil. Norwood soils make up about 5 percent of the acreage mapped as this soil.

Most of the acreage is cultivated and is used mainly for alfalfa, corn, cotton, and small grains. Pecan trees are part of the native vegetation, and some of these trees have been left standing in most cultivated fields. In some places the native stands of pecan trees have been culled, thinned, and developed into pecan orchards. This soil is highly productive, but it is difficult to farm because it is wet and sticky for long periods of time. It responds well if it is properly managed and fertilizer is added. Drainage is needed in many places. A large amount of crop residue should be left on the surface or worked into the surface layer. (Capability unit IIIw-1; Heavy Bottomland range site)

## Minco Series

In the Minco series are soils that have a dark-colored, medium-textured or moderately coarse textured surface layer and generally a subsoil of nearly the same texture as the surface layer. These soils are on benches along the Red River, high above the level reached by overflow. They formed in sediments derived from red beds. The native vegetation was mid and tall grasses with a few oak, elm, and hickory trees.

In most places the surface layer is brownish loam to fine sandy loam about 14 inches thick. It is friable when moist and soft to slightly hard when dry, and it breaks to weakly formed to moderately well formed granules. The subsoil is brownish and is about 20 inches thick. In most places it has about the same texture as the surface layer. It is very friable when moist and slightly hard when dry. It breaks to weakly formed elongated blocks, 1 to 2 inches in diameter, that in turn, break to moderately well formed granules.

In a few places where swales run through areas of these soils, the surface layer is finer textured than typical. In some places where these soils have slopes of 3 to 5 percent, the subsoil is sandy clay loam.

The Minco soils occur with the Vanoss and Teller soils. Their subsoil is less clayey than that of the Vanoss and Teller soils.

The Minco soils are well drained. They have medium internal drainage.

Most of the acreage is cultivated, and the crops are mainly cotton, small grains, alfalfa, corn, sorghum, and peanuts. These soils are more productive than most other soils in this county. Crops grown on them respond well if fertilizer is applied and good management is practiced. Some small areas of these soils are irrigated.

**Minco fine sandy loam, 0 to 1 percent slopes (MsA).**—In most places this soil is on stream benches high above the level reached by overflow. It occurs in scattered areas along the Red River in the southern part of the county.

Included in the areas mapped as this soil are a few areas of a soil that has a loam surface layer and is in low places where water accumulates. Included also are some areas of Eufaula soils where windblown sandy material has been deposited. The included soils make up about 2 percent of the acreage mapped as this soil.

In most places this soil is cultivated and is used mainly for cotton, peanuts, corn, small grains, and sorghum. Some areas have been improved for tame pasture by planting bermudagrass as the base sod. Control of wind erosion is necessary in the cultivated areas. Crops that produce a large amount of residue should be grown, and the residue ought to be left on the surface. The crops respond well if fertilizer is added. (Capability unit IIe-4; Loamy Prairie range site)

**Minco fine sandy loam, 1 to 3 percent slopes (MsB).**—This soil is along the edges of stream benches high above the level reached by overflow. It occurs in scattered areas along the Red River in the southern part of the county. In most places the texture is fairly uniform throughout the profile, but it varies in some places where windblown sandy material has accumulated. In many places this soil contains a plowpan so firm that much of the water runs off the surface of the soil and causes the formation of deep gullies.

Most of the acreage is cultivated and is used mainly for cotton, corn, small grains, and peanuts. In the cultivated areas there is some wind erosion, but most of the erosion is caused by water. In a few places terraces are necessary to keep water from accumulating, but generally these are not needed if this soil is well managed. Good management practices include varying the depth of tillage, growing crops that produce a large amount of residue, and leaving crop residue on the surface or working it into the surface layer. The response is good if fertilizer is added. Some areas have been improved for tame pasture by planting bermudagrass as the base sod. (Capability unit IIe-4; Loamy Prairie range site)

**Minco fine sandy loam, 3 to 5 percent slopes (MsC).**—This soil is mainly along the edges of stream benches high above the level reached by overflow. It occurs in scattered areas along the Red River in the southern part of the county.

Included in the areas mapped as this soil are small areas of Eufaula soils where windblown material has accumulated. Also included are small areas of Teller soils that have slopes of about 3 to 5 percent. The included soils make up about 10 percent of the mapped areas of this soil.

About half of the acreage is cultivated and is mainly in cotton, small grains, and peanuts. The other half is used for pasture, but only a small acreage has been improved for tame pasture. This was done by planting bermudagrass or lovegrass as the base sod. In the cultivated areas protection from both wind and water erosion is necessary. If row crops are grown, the soils should be terraced and farmed on the contour. Crops that produce a large amount of residue ought to be grown and the crop residue left on the surface. Fertilizer is needed so that plants will produce the maximum amount of foliage. (Capability unit IIIe-7; Loamy Prairie range site)

**Minco loam, 0 to 1 percent slopes (MtA).**—This soil is generally on benches along the Red River, high above the level reached by overflow. Most of the acreage is in the extreme southwestern part of the county, near the town of Courtney.

Included in the areas mapped as this soil are small areas of Vanoss soils, generally in depressions or low areas. Vanoss soils make up about 2 percent of the mapped areas of this soil.

Nearly all of the acreage is cultivated, and the crops are mainly cotton, small grains, alfalfa, corn, and sorghum. Maximum crop yields are obtained if this soil is well managed and is properly fertilized. Small areas have been improved for tame pasture by planting bermudagrass as the base sod. (Capability unit I-3; Loamy Prairie range site)

## Navasota Series

The Navasota series consists of deep, dark-colored, fine-textured soils on bottom lands that are frequently flooded. These soils are mainly along Walnut Bayou and Mud Creek. They formed in alluvium that was derived chiefly from the red beds. The native vegetation was bottom-land hardwoods; tall and mid grasses grew between the trees.

In most places the surface layer is dark reddish-gray clay about 12 inches thick. It is very plastic when wet and very hard when dry, and breaks to weakly formed irregular blocks ½ to 1 inch in diameter. The subsoil is dark-gray to brownish clay 18 to 36 inches thick. Where it is grayish, it is faintly mottled with brown in many places. The subsoil is very plastic when wet and very hard when dry, and it breaks to weakly formed blocks ½ to 1 inch in diameter.

The thickness of the surface layer varies from place to place. A thin layer of loamy material has been deposited on the surface in some places. In many places along Walnut Bayou, these soils are underlain by stratified material consisting of clay, sandy clay loam, and clay loam.

The profile of the Navasota soils is similar to that of the Miller soils, but the Navasota soils are less well drained than the Miller, are less reddish and more gray in most places, and are less calcareous. Also the Navasota soils

are frequently flooded and the Miller soils are occasionally flooded. The Navasota soils occur with the Roebuck soils and are mapped in an undifferentiated unit with those soils.

The Navasota soils are poorly drained. They have very slow internal drainage.

Large areas of these soils have been cultivated but have been abandoned and are now used for grazing. Although most of the acreage is used for pasture, not much forage is produced.

### Norwood Series

In the Norwood series are dark-colored, moderately fine textured, calcareous soils on bottom lands along the Red River. These soils formed in sediments derived mainly from calcareous red beds. The native vegetation was bottom-land hardwoods and tall and mid grasses between the trees.

The surface layer is brownish silty clay loam or clay loam about 18 inches thick. It is firm when moist and hard when dry and breaks to well-formed granules. Below the surface layer is slightly more clayey, stratified soil material that is several feet thick. The texture of this material ranges from loam to clay, but it is clay loam to heavy clay loam in most places. This material is friable when moist and hard when dry, and it breaks to weakly formed blocks  $\frac{1}{4}$  to 1 inch in diameter.

The Norwood soils occur with the Miller and Yahola soils. They are less clayey and are more friable than the Miller soils. Their subsoil is less sandy and more clayey than that of the Yahola soils. The profile of the Norwood soils is similar to that of the Port soils, but the Norwood soils are more calcareous than the Port.

The Norwood soils are well drained and have medium internal drainage. They are subject to occasional flooding, but the flooding is not frequent enough to affect the use of these soils for crops.

These soils are among the most productive in the county. Most of the acreage is cultivated, and the main crops are corn, alfalfa, small grains, cotton, and sorghum. The crops respond well if the soils are managed well and are properly fertilized. Several areas are irrigated.

**Norwood clay loam** (0 to 1 percent slopes) (Nc).—This is the only Norwood soil mapped in the county. It is mainly on low benches or on high bottom lands along the Red River, but generally it occupies the slightly higher ridges on the bottom lands. Some areas are in swales on benches high above the level reached by overflow. In most places the texture of the surface layer is clay loam, but this soil is stratified, and the texture throughout the profile ranges from clay to loam.

Included in the areas mapped as this soil are small areas of Miller soils. The Miller soils are along swales that run through areas of this soil.

Almost all of the acreage is cultivated and is used mainly for alfalfa, corn, small grains, cotton, and sorghum. Some areas are irrigated and are used for about the same kinds of crops. Other areas are used for pecan orchards. This soil is highly productive if it is properly managed and fertilized. Crop residue should be left on the surface or worked into the surface layer. (Capability unit I-2; Loamy Bottomland range site)

### Port Series

The Port series consists of dark-colored soils that have a medium-textured surface layer and a medium-textured and neutral or slightly acid subsoil. These soils are chiefly along small streams in the western part of the county, and some of the areas are subject to frequent flooding. These soils formed in loamy sediments derived from red beds. The native vegetation was bottom-land hardwoods and tall and mid grasses between the trees.

The profile of these soils is fairly uniform in texture and color. In most places the surface layer is reddish loam, about 18 inches thick. It is friable when moist and hard when dry and breaks to weakly developed irregular blocks  $\frac{1}{4}$  to 1 inch in diameter. Generally the subsoil has about the same color and structure as the surface layer, but it is slightly finer textured. In many places it is stratified and contains layers of light loam or heavy loam to clay loam. The subsoil is several feet thick in many places.

The profile of the Port soils is similar to that of the Norwood soils. The Port soils are less sandy than the Yahola soils. Unlike the Norwood and Yahola soils, the Port soils are noncalcareous.

The Port soils are well drained and have medium internal drainage. They absorb water well, and the stored moisture is available to plants.

These are among the most productive soils in the county. Most of the acreage is used for grazing, however, because much of it is in areas that are too small or too frequently flooded to be suitable for cultivation. Some of the areas have been improved for tame pasture. In areas that are cultivated, the main crops are alfalfa, small grains, cotton, and sorghum.

**Port loam** (0 to 1 percent slopes) (Pr).—This soil is mainly on bottom lands along small streams in the western part of the county. It is flooded occasionally, but the flooding does not last long and generally is not detrimental to crops.

Included in the areas mapped as this soil are small areas of Pulaski soils. These small areas are generally near stream channels and near recent deposits of fine sandy loam. The Pulaski soils make up about 4 percent of the acreage mapped as this soil.

Most areas that are large enough are cultivated and are used mainly for alfalfa, small grains, cotton, and corn. Some areas have been improved for tame pasture by planting bermudagrass as the base sod. Other areas have been developed into pecan orchards. Crop yields are favorable if this soil is properly managed. It is necessary to leave a large amount of crop residue on the surface, however, or to work the residue into the surface layer. (Capability unit I-1; Loamy Bottomland range site)

**Port soils, frequently flooded** (0 to 1 percent slopes) (Ps).—In most places these soils are on bottom lands along Walnut Bayou. They are stratified and consist of layers of loam, fine sandy loam, and clay, generally not more than 4 inches thick. In most places the uppermost 30 inches is clay loam.

Included in the areas mapped as these soils are small areas of Roebuck, Navasota, and Pulaski soils and clayey soils that contain numerous areas of Slickspot soils. The included soils occur in no definite pattern. They make up about 5 percent of the acreage mapped as these soils.

These soils are too frequently flooded to be suitable for cultivation, but some areas have been developed into pecan orchards. Most of the acreage is used for grazing, and part of it has been improved for tame pasture by planting bermudagrass as the base sod. The weeds and sprouts should be controlled and grazing managed carefully so that the maximum growth of forage plants is obtained. (Capability unit Vw-1; Loamy Bottomland range site)

### Pulaski Series

In the Pulaski series are soils that have a moderately coarse textured surface layer and a moderately coarse textured subsoil. These soils occur throughout the county on bottom lands along small streams that drain areas of Dougherty, Eufaula, Windthorst, and Stephenville soils. They formed in alluvium, and they occur as alluvial fans in some places. Where the Pulaski soils occur as alluvial fans, the loamy material in their profile is 30 inches or more thick. The native vegetation was mainly bottomland hardwoods and some tall and mid grasses between the trees.

In most places the surface layer is brownish fine sandy loam about 15 inches thick. It is very friable when moist and soft or slightly hard when dry and is generally structureless. Beneath the surface layer, the soil material is stratified. It consists of layers of reddish fine sandy loam and loam that are very friable when moist and soft when dry and are structureless.

The Pulaski soils are less reddish and less calcareous than the Yahola soils. They are better drained than Wet alluvial land and are generally lighter colored.

The Pulaski soils are well drained and have rapid or medium internal drainage. They absorb water well and hold abundant water available for plants.

Some areas of Pulaski soils are flooded too frequently to be suitable for cultivation. Areas that are large enough and that are not flooded too frequently are cultivated and are used mainly for peanuts, pecans, cotton, and small grains.

**Pulaski fine sandy loam** (0 to 1 percent slopes) (Pu).—This soil is mainly on bottom lands along small streams. In a few places it is along larger streams where it consists of an alluvial fan spread over a large area of the bottom land. Generally, the texture of the surface layer is fine sandy loam, but it is loamy fine sand in a few places.

Included in the areas mapped as this soil are small areas of Gowen soils and of wet soils, frequently flooded soils, and soils that are dissected by meandering stream channels. Most areas of the included Gowen soils are on bottom lands away from the stream channel. The wet soils generally occupy areas where silt has clogged the channel of a spring. The included frequently flooded soils occur along the lower reaches of small streams where these flow into a large stream that floods frequently.

Nearly all of the larger areas of this soil are cultivated and are used mainly for peanuts, cotton, and small grains. Pecans grow in nearly all of the areas, and they have been thinned and developed into pecan orchards in some places. Some areas have been improved for tame pasture by planting bermudagrass as the base sod. This soil has lower natural fertility than most soils of the bottom lands. Crop yields are greatly increased, however, if fertilizer is

applied and crops that produce a large amount of residue are seeded. The crop residue should be left on the surface, or worked into the surface layer. (Capability unit I-1; Loamy Bottomland range site)

**Pulaski soils, frequently flooded** (0 to 1 percent slopes) (Pv).—These soils are mainly on bottom lands along small streams. Generally these streams carry a large amount of sediment that clogs the channel in some places and causes the streamflow to spread out over the bottom lands.

Included in the areas mapped as these soils are small areas of wet soils and some areas of soils that are only occasionally flooded. The wet soils occur where the channel has been clogged and the streamflow has spread out over the bottom lands. Generally the soils that are flooded only occasionally are along the sides of the valleys.

These soils are used chiefly for grazing and for growing pecans. Cattle graze among the trees in most places. Many areas have been improved for tame pasture by planting bermudagrass as the base sod. In some places the trees have been thinned and developed into pecan orchards. These soils are flooded so frequently that most areas are not suitable for cultivation. In some places, however, crops may be grown in summer. Crop yields are not favorable, unless these soils are properly fertilized and managed. Weeds and sprouts should be controlled. (Capability unit Vw-1; Loamy Bottomland range site)

### Renfrow Series

The Renfrow series consists of deep, dark-colored, droughty soils that have a medium-textured surface layer and a fine-textured subsoil. These soils are generally on ridges in the northwestern part of the county. They formed in calcareous beds of clay or in clayey material weathered from shale of the red beds. The native vegetation was mid and short grasses.

In most places the surface layer is reddish loam about 6 inches thick. It is friable when moist and slightly hard when dry, and it breaks to moderately well formed granular structure. The subsoil is reddish clayey material about 36 inches thick. It is firm when moist and very hard when dry. It breaks to weakly formed to moderately well formed irregular blocks  $\frac{1}{4}$  to 1 inch in diameter that grade to well-formed blocks  $\frac{1}{2}$  to 1 inch in diameter. In the lower part of this subsoil there are limy concretions.

The profile of the Renfrow soils is fairly uniform in texture, but the color of the subsoil varies. In the more gently sloping areas, the color is generally darker than in the nearly level areas.

The Renfrow soils have a thicker surface layer than the Vernon soils, and they are not calcareous. They occur with the Zaneis soils, but their subsoil is more clayey and has more blocky structure than the subsoil of the Zaneis soils. The subsoil of the Renfrow soils is more reddish and more clayey than that of the Chickasha soils, and it has more blocky structure.

The Renfrow soils are moderately well drained and have slow internal drainage. They are droughty because they do not absorb water well.

Most of the acreage is cultivated and is used mainly for small grains, sorghum, and cotton. These soils are better

suited to crops that grow during the rainy season than to crops that grow during the dry season. Crop yields are not high.

**Renfrow silt loam, 1 to 3 percent slopes (ReB).**—This is the only Renfrow soil mapped in the county. Generally it is on the tops of ridges in the northwestern part of the county.

Included in the areas mapped as this soil are a few small areas of Chickasha and Zaneis soils. These included soils are on small knolls in most places. The included Chickasha and Zaneis soils make up about 6 percent of the acreage mapped as this soil.

Most of the acreage is cultivated, but some areas have been improved for tame pasture by planting bermudagrass or King Ranch bluestem as the base sod. The crops are mainly small grains, vetch, sorghum, and cotton. Crops should be grown that produce a large amount of residue, and the crop residue ought to be left on the surface or worked into the surface layer. Because this soil is droughty, it is better suited to crops that grow in spring than to crops that grow in dry seasons. The cultivated areas should be terraced and farmed on the contour. Fertilizer is necessary if good crop yields are to be obtained. (Capability unit IIIe-6; Claypan Prairie range site)

## Rocky Broken Land

**Rocky broken land (Rk)** consists of very steep escarpments of limestone, of the sloping shoulders of these escarpments, and of the soils directly below. It has slopes of 30 to 60 percent. The material on the lower slopes was derived mainly from the underlying soft sandstone, but it has also been affected by limy material from the escarpments. The native vegetation was mid grasses, elm and oak trees, and brush.

Included in the areas mapped as this land type are small areas of Tarrant soils. The Tarrant soils are generally near the tops of the slopes and formed in material weathered from the caprock. About 20 percent of the acreage mapped as this land type consists of rock escarpments and large boulders that support either a small amount of short grasses or no vegetation. These areas are generally at the tops of slopes where there are small included areas of Tarrant soils. Also included are some small areas of Windthorst and Stephenville soils near the bottom of the slopes. The Tarrant, Windthorst, and Stephenville soils make up about 8 percent of the acreage mapped as this land type.

This land type ranges from excessively drained to well drained. It is excessively drained in areas of rock escarpments and in areas of the included Tarrant soils. It is well drained on the lower parts of the slopes.

This land type is not suitable for revegetation. Because the land is droughty, yields of forage are low. Grazing should be controlled so that maximum yields of forage can be obtained. (Capability unit VIIIs-3; Breaks range site)

## Roebuck Series

In the Roebuck series are deep, dark-brown, fine-textured soils of the bottom lands. These soils are chiefly on bottom lands along Mud Creek and Walnut Bayou in the western and central parts of the county. Many of the

areas are subject to frequent flooding. These soils formed in clayey alluvium that is only slightly weathered. The alluvium washed from areas of soils on prairies that are underlain by red beds. In most places the native vegetation was bottom-land hardwoods and mid and tall grasses between the trees.

The surface layer is dark reddish-gray clayey material about 16 inches thick. It is very firm when moist and very hard when dry, and it breaks to moderately well formed granules. The subsoil is reddish clayey material that is very firm when moist and very hard when dry. It breaks to weakly formed to moderately well formed blocks of irregular shape  $\frac{1}{4}$  to 1 inch in diameter. The underlying alluvium is more massive than the subsoil and generally is more calcareous.

The Roebuck soils have a profile similar to that of the Miller soils, but they are less calcareous than the Miller soils. Either they are not so well drained as the Miller soils or they occur along streams that overflow frequently instead of occasionally. They occur with areas of Slickspots and Saline land, but they have a less blocky structure and are more permeable than those land types. They occur with the Navasota soils, but they are less grayish and mottled and more reddish than those soils. In this county the Roebuck and Navasota soils are mapped together because it is not feasible to map them separately.

The Roebuck soils are poorly to somewhat poorly drained. They are subject to frequent flooding.

These soils are used mainly for grazing and are not suitable for cultivation. They produce only a small amount of palatable forage.

**Roebuck and Navasota clays (0 to 1 percent slopes) (Rn).**—These soils are on bottom lands along streams that drain areas of soils on prairies underlain by red beds. They are chiefly along Mud Creek and Walnut Bayou in the central and western parts of Love County.

Included in the areas mapped as these soils are small areas of clayey soils that contain numerous patches of Slickspot soils in no well-defined pattern. Also included are areas of soils that are more loamy than these Roebuck and Navasota soils. These last included soils are along drainageways and are deep enough in a few places to be classified as Port soils. The included soils make up about 5 percent of the acreage mapped as these soils.

These Roebuck and Navasota soils are used mainly for grazing, but they produce only a small amount of palatable forage. Most of the acreage of these soils along Mud Creek has not been cleared, but much of the acreage along Walnut Bayou has been cultivated and then abandoned. No tame pastures have been observed on these soils. The areas subject to flooding need drainage and protection from overflow. In the areas that are grazed, it is necessary to control the growth of weeds and brush and to protect the soils from overgrazing. (Capability unit Vw-4; Heavy Bottomland range site)

## Sandy Broken Land

**Sandy broken land (Sy)** is in most places steep and coarse textured or moderately coarse textured. It is mainly on the faces of escarpments that form the sides of the valley of the Red River. In the extreme eastern part of the county, it is dissected by deep ravines that have steep sides. The slopes range from 25 to 50 percent.

The thickness and characteristics of the soil material that make up this land type are variable, mainly because the underlying material varies from place to place. Generally, the material is sandy. It is finer textured in some places, however, because the areas through which the river has cut are made up of fine-textured soils. This fine-textured calcareous material is exposed on the escarpments in a few places and is a part of this land type. In many places this land type is adjacent to Minco, Eufaula, and Teller soils on alluvial benches. The timbered areas generally support oak, elm, and hickory trees, but there are scattered areas of mid and tall grasses between the trees.

Included in the areas mapped as this land type are small areas of Lincoln soils. These Lincoln soils occur near the stream channel.

In most places this land type is excessively drained. Internal drainage is medium to rapid.

The acreage is used mainly for grazing. Improving it for tame pasture is not feasible, because the slopes are too steep. Not much desirable vegetation is produced, because the slopes are steep and the canopy of trees is dense. The vegetation should be grazed lightly so that erosion is controlled and productivity is maintained. (Capability unit VIIc-1; Sandy Savannah range site)

### San Saba Series

The San Saba series consists of soils that are deep, nearly black, and fine textured. These soils are in gently sloping areas of the uplands in the central part of the county. They formed in brownish to olive clayey material that contains partly weathered limy gravel and many calcareous concretions. In about 70 percent of the acreage, the surface layer is calcareous. The native vegetation was tall and mid grasses.

In most places the surface layer is very dark gray to black clay. It is very firm when moist and very hard when dry and breaks to well-formed blocks of irregular shape that are  $\frac{1}{4}$  to 1 inch in diameter. The thickness of the surface layer varies greatly from place to place because of the cracking of the soil. In some places where cracks occur, the surface layer is 3 to 4 feet deep, but in other places where the underlying material has been pushed up, it is only about 8 inches thick. The subsoil is dark-gray silty clay or clay that is 15 to 30 inches thick. It is massive and grades to the underlying material.

The San Saba soils are generally less brownish and have a thicker surface layer than the Denton soils, and they are less well drained. In most places they are on the tops of ridges, rather than on the lower parts of the slopes and in the valleys. The San Saba soils are mapped with the Denton soils because they occur in such an intricate pattern that it is not feasible to map them separately. The subsoil of the San Saba soils is more friable and less plastic than that of the Lela soils, and the San Saba soils have slightly stronger slopes.

The San Saba soils are moderately well drained. They have slow internal drainage.

Most of the acreage is cultivated. The chief crops are cotton, small grains, and sorghum.

**San Saba-Denton clays, 1 to 3 percent slopes (SdB).**—The San Saba and Denton soils are mapped together because they occur in such an intricate pattern that it is not feasible to map them separately. They are in the central

part of the county. In some places sheet erosion has removed much of the surface layer of these soils, but gullies have not formed.

Included in the areas mapped as these soils are small areas of soils along small streams that have meandering channels. These small areas are not suitable for cultivation. The included soils make up less than 1 percent of the acreage mapped as these soils.

These soils are highly productive. They are difficult to till, however, because they are very sticky when wet and dry out slowly after rains. Most of the acreage is cultivated, but some areas have been improved for tame pasture by seeding King Ranch bluestem as the base sod. The main crops are small grains, cotton, corn, and sorghum. The crops respond well if fertilizer is added. If row crops are grown, the soils should be terraced and farmed on the contour. The soils take in water slowly, but the rate of infiltration can be increased by leaving a large amount of crop residue on or near the surface. (Capability unit IIe-3; Blackclay Prairie range site)

### Slickspots and Saline Land

**Slickspots and Saline land (Se)** is dark colored and fine textured and contains salts that retard the growth of desirable grasses. It is on bottom lands, mainly along Walnut Bayou, Mud Creek, and Clear Creek, in areas where sediments have not been deposited recently. Generally this land type is droughty. The areas are nearly level. In some places, generally along the smaller drainageways, the material at the surface is loamy. Areas of Slickspot soils that support little or no desirable vegetation make up about 5 percent of the acreage.

Included in the areas mapped as this land type are small areas of Roebuck, Navasota, and Port soils. These included soils are on bottom lands, but they occur in no definite pattern, though the Port soils are generally near the stream channel.

This land type occurs with the Roebuck and Navasota soils, but consists of more blocky soil material than those soils and has been more affected by salts. Also the areas of Slickspot soils are much more numerous.

Drainage is somewhat poor. Water is absorbed slowly.

This land type is not suitable for cultivation. Apparently most of the acreage has been cultivated and then abandoned. The areas are now used for grazing. They do not produce much desirable forage; the vegetation is mainly short grasses, mesquite, and saltgrass (fig. 12), but there are numerous small low pockets, including many shallow areas in swales, that catch and hold water after rains. Controlling the growth of weeds and mesquite is necessary. (Capability unit Vs-1; Alkali Bottomland range site)

### Stephenville Series

In the Stephenville series are light-colored soils that have a moderately coarse textured surface layer and a moderately fine textured subsoil. These soils are mostly in the northern part of the county, but they are also in small scattered areas in other parts of the county. In the steeper areas the surface layer is slightly thinner than in other areas. These soils formed in reddish sandy clay. This sandy clay in the western and northern parts of the county



Figure 12.—A large area of Slickspots and Saline land. Not much desirable vegetation grows on this land type.

comes from older material than that in the central and eastern parts. The native vegetation was oak and hickory trees and mid and tall grasses between the trees.

The upper part of the surface layer is brownish fine sandy loam about 5 inches thick. It is lighter colored in cultivated areas than in other areas because much of the organic matter was lost when the soils were tilled. The lower part of the surface layer is about 12 inches thick and is lighter brown than the upper part. It is darker colored in cultivated areas, however, because part of the soil material in the upper part of the surface layer has been mixed with it by tillage implements. The surface layer is very friable when moist and soft when dry, and it is structureless.

The subsoil is reddish sandy clay loam about 26 inches thick. It is friable when moist and hard when dry. The material in the subsoil breaks to weakly formed, elongated blocks,  $1\frac{1}{2}$  to 3 inches in diameter, that, in turn, break to moderately well formed blocks of irregular shape that are  $\frac{1}{2}$  to 1 inch in diameter.

The Stephenville soils occur with the Windthorst soils, but their subsoil is less clayey and less blocky than that of the Windthorst soils. They have a lighter colored surface layer than the Dougherty soils.

The Stephenville soils are well drained. They have medium internal drainage. Their natural fertility is low.

About half the acreage where these soils are gently sloping to moderately sloping has been cultivated, but only about a fourth of this acreage is now cultivated. Most of the acreage is used for grazing. The main crops in the cultivated areas are peanuts, small grains and vetch, grain sorghum, and cotton. The crops respond well if the soils are well managed and a large amount of fertilizer is added. Only a small acreage, where these soils have been cultivated and then abandoned, has been improved for tame pasture.

**Stephenville fine sandy loam, 1 to 3 percent slopes (SbB).**—This soil is in the more gently rolling areas throughout the county. Generally it is on side slopes and in valleys where soil material has accumulated.

Included in the areas mapped as this soil are small areas of Windthorst soils, generally on the crowns of hills. Also included are areas of a soil that has slopes of more than 3 percent. Generally this more sloping soil is on the

side slopes of narrow valleys that run through areas of this soil.

About 75 percent of the acreage is used for grazing, and some areas have been improved for tame pasture by planting bermudagrass as the base sod. The rest of the acreage is cultivated. The crops are mainly peanuts, small grains and vetch, sorghum, and cotton, but yields are low unless a large amount of fertilizer is added. In places where this soil has not been properly managed, deep gullies are common. Wind erosion is a hazard in some places where crops are grown that produce only a small amount of residue. Crops ought to be grown that produce a large amount of residue, and the residue should be left on the surface or worked into the upper part of the surface layer. Areas that are used for row crops need to be terraced and farmed on the contour. (Capability unit IIe-5; Sandy Savannah range site)

**Stephenville fine sandy loam, 3 to 5 percent slopes (SbC).**—This soil is mainly on side slopes or in valleys. It occurs in all parts of the county, mainly in small areas within large fields of other soils that are severely eroded and gullied. It has low natural fertility.

Included in the areas mapped as this soil are small areas of Windthorst soils. Generally the Windthorst soils are on the crowns of ridges.

Most of the acreage was cultivated, was later abandoned, and is now used for pasture. Only a small acreage has been improved for tame pasture by planting bermudagrass as the base sod. In the areas that are now cultivated, the chief crops are small grains and vetch, peanuts, and cotton. These crops respond well if a large amount of fertilizer is added. The areas used for row crops should be terraced and farmed on the contour. (Capability unit IIIe-2; Sandy Savannah range site)

**Stephenville fine sandy loam, 5 to 8 percent slopes (SbD).**—This soil is generally below the escarpments or is on the side slopes of drainageways. Its surface layer is generally thinner than that in the profile described for the Stephenville series.

Included in the areas mapped as this soil are small areas of Windthorst soils. Also included are areas of a soil that has slopes of more than 8 percent. This included steeper soil is generally on the side slopes of drainageways.

Only a small acreage has been cleared and cultivated. Most of the acreage is used for grazing, and some areas have been improved for tame pasture by planting bermudagrass as the base sod. Only a small amount of palatable vegetation is produced in areas where trees shade the ground, but the production of forage is favorable in the areas where the trees have been removed. In many of the pastures, the trees have been killed by spraying. In cultivated areas close-growing crops should be seeded that produce a large amount of residue. The crop residue ought to be left on the surface or worked into the upper part of the surface layer. (Capability unit IVe-2; Sandy Savannah range site)

**Stephenville fine sandy loam, 1 to 5 percent slopes, eroded (SbC2).**—This soil is in gently rolling areas in all parts of the county. The surface layer is about 5 inches thick in at least half of the unit and is more reddish than that in the profile described for the Stephenville series. This is because part of the subsoil has been mixed into the surface layer by tillage.

Included in the areas mapped as this soil are small areas of Windthorst soils, generally on ridges. Windthorst soils make up about 2 percent of the acreage mapped as this soil.

Most of the acreage has been cultivated but has since been abandoned because of the low crop yields. In areas that are still cultivated, the chief crops are small grains and vetch, peanuts, and cotton. Crops that produce a large amount of residue ought to be grown. The crop residue should be left on the surface or worked into the upper part of the surface layer so that it will help to control erosion. If this soil is used for row crops, terracing and farming on the contour are needed. Good response is received if a large amount of fertilizer is added. Some areas have been improved for tame pasture by planting bermudagrass as the base sod. (Capability unit IIIe-2; Sandy Savannah range site)

**Stephenville-Windthorst complex, severely eroded** (1 to 5 percent slopes) (Sw3).—The soils of this complex generally occur in the more gently rolling areas throughout the county. Severe erosion has limited the use of the soils. The Stephenville soils have a subsoil that is less clayey than that of the Windthorst soils, and they have lost only a small part of the surface layer between the gullies. Much of the surface layer of the Windthorst soils, however, has been lost through erosion.

Included in the areas mapped as this complex are small areas of Dougherty and Teller soils. Included also are small areas of a soil that is only slightly eroded. The included soils make up about 5 percent of the acreage mapped as this complex.

The soils of this complex are not suitable for cultivation and are used mostly for pasture or range. Some areas have been improved for tame pasture by planting bermudagrass as the base sod. Controlling weeds and sprouts is needed in the pastures. Good response is received if fertilizer is added. (Capability unit VIe-3; Eroded Sandy Savannah range site)

## Tarrant Series

The Tarrant series consists of dark-colored, medium-textured to moderately fine textured, droughty soils. These soils are shallow over limestone. They are in small areas, mostly on the borders of the prairies, but they also occur in small areas throughout the prairies. These soils formed in material weathered from consolidated crystalline limestone. On their surface are strewn fragments of limestone that range from less than 3 to 10 inches in diameter. The native vegetation was mostly short grasses, but it included some mid grasses.

In most places the surface layer is brownish to reddish loam about 8 inches thick. It is very friable when moist and slightly hard when dry, and it has weak to moderate granular structure.

The surface layer ranges from 2 to 12 inches in thickness. In the few places where these soils are underlain by limestone other than Goodland limestone, the texture throughout their profile is clay loam.

The Tarrant soils occur with the Claremore soils. Their surface layer is less thick than that of the Claremore soils, and they lack a B horizon.

The Tarrant soils are excessively drained. Runoff is medium to very rapid, and internal drainage is medium.

These soils are used mainly for range. Yields are low.

**Tarrant soils** (1 to 10 percent slopes) (Tc).—These soils occur throughout the prairies in the central part of the county. They are shallow over limestone, and limestone crops out in places.

Included in the areas mapped as these soils are small areas of Claremore soils. The Claremore soils generally occupy areas where the material weathered from limestone is deeper than it is in the typical Tarrant soils.

These Tarrant soils are droughty. They are not suitable for revegetation. The only agricultural practice that is feasible on these soils is the control of grazing so that maximum yields of forage can be obtained. (Capability unit VIIs-2; Very Shallow range site)

## Teller Series

In the Teller series are deep, dark-colored, nearly level soils that have a medium-textured to moderately coarse textured surface layer and a moderately fine textured subsoil. These soils are mostly on alluvial benches along the Red River in the southern part of the county. They formed in moderately fine textured alluvium deposited by streams that drain areas underlain by red beds. The native vegetation was mid and tall grasses with a few oak, hickory, and elm trees.

In most places the surface layer is reddish to brownish loam or fine sandy loam about 12 inches thick (fig. 13). It is very friable when moist and slightly hard when dry. It breaks to weakly formed to moderately well formed elongated blocks, 1/2 to 2 inches in diameter, that, in turn, break to granular structure. The subsoil is generally yellowish-red to reddish-brown loam to clay loam about 3 feet thick. It is friable when moist and hard when dry. It breaks to weakly formed, elongated blocks, 2 to 4 inches in diameter, that, in turn, break to granular structure. This structure permits good development of roots and absorption of water.

The texture of the surface layer ranges from loam to fine sandy loam, but it is fairly uniform within each area. Generally the subsoil is light clay loam where the surface layer is fine sandy loam, and it is clay loam where the surface layer is loam.

The Teller soils occur with and are somewhat similar to the Vanoss soils, but they are more reddish and less brownish. The lower part of their surface layer, unlike that of the Dougherty and Stephenville soils, is about the same color throughout. The subsoil of the Teller soils is more clayey than that of the Minco soils.

The Teller soils are well drained and have medium internal drainage. They take in water readily and have high water-holding capacity.

These soils are used mainly for cultivated crops. The chief crops are cotton, alfalfa, peanuts, small grains, and corn.

**Teller fine sandy loam, 0 to 1 percent slopes** (TfA).—This soil is on alluvial benches high above the level reached by overflow. It occurs in scattered areas along the Red River and in a few places along Mud Creek and Walnut Bayou.

Included in the areas mapped as this soil are areas of Brewer and Vanoss soils. Generally, the Brewer and Vanoss soils are in depressions where water accumulates.

Most of the acreage is cultivated, and the main crops are cotton, corn, alfalfa, peanuts, and small grains. This soil

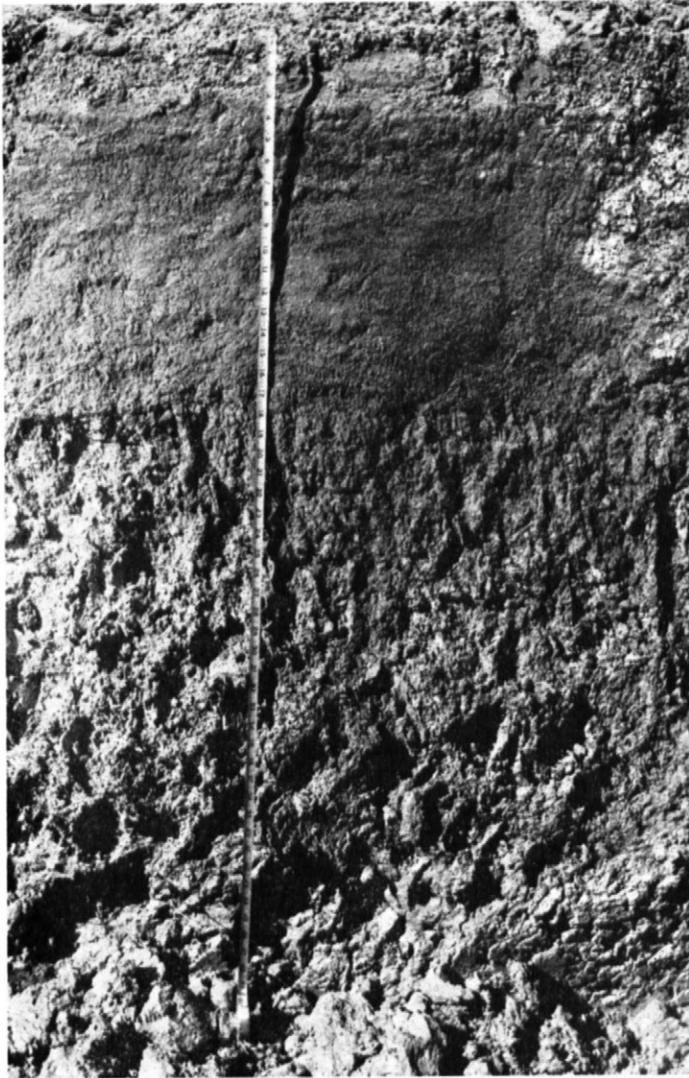


Figure 13.—Profile of Teller loam.

is susceptible to wind erosion, but it is easily tilled and is highly productive. Good response is received if a large amount of fertilizer is added. If peanuts are grown, practices that control wind erosion are needed. Crops that produce a large amount of residue should be grown, and the residue ought to be left on the surface or worked into the surface layer. (Capability unit IIe-2; Loamy Prairie range site)

**Teller fine sandy loam, 1 to 3 percent slopes (TfB).**—In most places this soil is on alluvial benches high above the level reached by overflow. Its surface layer is 1 to 3 inches thinner than the one in the profile described for the Teller series. In some fields there are a few gullies.

Included in the areas mapped as this soil are small areas of Minco soils, generally where some windblown material has accumulated. Minco soils make up about 1 percent of the mapped areas of this soil.

Most of the acreage is cultivated, and the crops are chiefly small grains, peanuts, and cotton. Terracing and contour farming are needed where row crops are grown. If peanuts are grown, wind erosion needs to be controlled

by planting a winter cover crop after the peanuts are harvested. Crops grown on this soil respond well if a large amount of fertilizer is added. (Capability unit IIe-2; Loamy Prairie range site)

**Teller loam, 0 to 1 percent slopes (TmA).**—This soil is on alluvial benches high above the level reached by overflow. It occupies large areas in the eastern part of the county and scattered areas along the Red River.

Included in the areas mapped as this soil are small areas of Brewer and Vanoss soils. The included soils occur in areas where drainage is restricted.

If this Teller soil is fertilized and well managed, it is one of the most productive in the county. Most of the acreage is used for crops, chiefly alfalfa, corn, cotton, small grains and vetch, and sorghum. A few areas have been improved for tame pasture, generally by planting bermudagrass as the base sod. (Capability unit I-3; Loamy Prairie range site)

**Teller loam, 1 to 3 percent slopes (TmB).**—This soil is on alluvial benches high above the level reached by overflow. It occupies scattered areas along the Red River. Most areas are adjacent to large areas of Teller loam, 0 to 1 percent slopes.

Included in the areas mapped as this soil are small areas of Vanoss soils and small areas of a Teller soil that has a more sandy surface layer than this soil. The Vanoss soils are generally in the more nearly level areas or in depressions, but the more sandy Teller soil is likely to occur in any of the areas mapped.

Most of the acreage is cultivated, and the crops are chiefly alfalfa, corn, cotton, small grains and vetch, and sorghum. Some areas have been improved for tame pasture, generally by planting bermudagrass as the base sod.

The main problem in managing this soil is control of water erosion. Terracing and farming on the contour are needed if row crops are grown. Unless the waterways are well grassed, gullying is likely when water concentrates in them. (Capability unit IIe-1; Loamy Prairie range site)

## Vanoss Series

In the Vanoss series are dark-colored soils that have a medium-textured surface layer and a moderately fine textured subsoil. These soils are generally on alluvial benches near the Red River. They formed in moderately fine textured alluvium washed from areas of red beds. The native vegetation was mid and tall grasses with a few oak, hickory, and elm trees.

The surface layer is brownish loam to fine sandy loam about 12 inches thick. It is very friable when moist and slightly hard when dry, and it has granular structure. The subsoil is brownish clay loam about 2 feet thick. It is friable when moist and hard when dry and has granular structure. In many places the lower part of the subsoil has faint mottles of red and brown.

In most places the surface layer is loam, but it is fine sandy loam in a few places. In some low areas the subsoil is heavy clay loam and there are a few patches of Slickspot soils.

The Vanoss soils occur with the Teller soils, but they have a more brownish and less reddish subsoil than those soils. They have a more clayey subsoil than the Minco soils.

Generally the Vanoss soils are well drained, but they are moderately well drained in a few places. They have medium internal drainage and good water-holding capacity.

**Vanoss loam, 0 to 1 percent slopes (VaA).**—This soil is in nearly level to slightly concave areas on alluvial benches along the Red River. It is high above the level reached by overflow.

This soil occurs with Brewer soils in areas where drainage is restricted. Included in the areas mapped as this soil are some areas of Brewer soils, generally along drainage ways where water does not run off rapidly. Also included are a few areas of Slickspot soils.

Nearly all of the acreage is cultivated, but a few areas have been improved for tame pasture by planting bermudagrass as the base sod. The main crops are cotton, peanuts, alfalfa, sorghum, and small grains. This soil is only slightly susceptible to erosion. It is highly productive if it is properly managed. (Capability unit I-3; Loamy Prairie range site)

## Vernon Series

The Vernon series consists of dark-colored, droughty soils that are moderately fine textured. These soils are in the northwestern part of the county near the town of Orr. They formed in compact, calcareous, red clay derived from red beds, and they are shallow over clayey material. The native vegetation was mostly short and mid grasses.

In most places the surface layer is brownish clay or light clay loam that is firm when moist and hard when dry and is 4 to 8 inches thick. The clay or light clay loam breaks to moderately well formed blocks of irregular shape that are  $\frac{1}{4}$  to  $\frac{3}{4}$  inch in diameter. Beneath the surface layer is reddish to brownish, compact clay. The clay breaks either to well-formed blocks of irregular shape that are  $\frac{1}{2}$  to 1 inch in diameter or, in many places, to well-formed blocks 1 to 2 inches in diameter. It contains a large amount of limy material that is in the form of white splotches in many places.

The Vernon soils occur with the Renfrow soils. Their profile is similar to that of the Renfrow soils, but their surface layer is thinner.

The Vernon soils are somewhat excessively drained. Runoff is rapid on these soils.

These soils are not suitable for cultivation. They are used entirely for range, but yields of forage are low.

**Vernon-Chickasha complex (3 to 8 percent slopes) (Vc).**—The Vernon and Chickasha soils of this complex are mapped together because they are so intricately mixed that it is not practical to map them separately. They are mainly near the town of Orr. The profile of the Vernon soil is similar to the one described for the Vernon series. Its surface layer is thin and fine textured, and it is underlain by fine-textured material. The profile of the Chickasha soil is 4 to 6 inches thinner than the one described for the Chickasha series, and the depth to underlying material ranges from less than 20 to more than 26 inches.

The Vernon soil makes up about 50 percent of the acreage mapped as this complex, and the Chickasha soil makes up about 30 percent. The remaining 20 percent is made up of other soils that have some characteristics of either the Vernon or Chickasha soils.

Most of the acreage is used for range. If the range is well managed, yields of forage are favorable. (Capability unit VIe-1; Vernon soils in Shallow Prairie range site, and Chickasha soils in Loamy Prairie range site)

**Vernon-Stephenville complex (8 to 35 percent slopes) (Vb).**—In this soil complex Vernon, Stephenville, and Windthorst soils each occupy about one-third of the acreage. These soils occur in such an intricate pattern that it is not practical to show them separately on the map.

The profile of the Vernon soil is similar to the one described for the Vernon series, except that it contains numerous pebbles of waterworn quartz  $\frac{1}{4}$  to 2 inches in diameter. The surface layer of the Vernon soil is thin and fine textured, and it is underlain by fine-textured, reddish to grayish material derived from the red beds.

The profile of the Stephenville soils is similar to the one described for the Stephenville series, except that the surface layer is 5 to 10 inches thinner in most places and the subsoil is 10 to 15 inches thinner.

In most places the profile of the Windthorst soils is somewhat different from the one described for the Windthorst series. The Windthorst soil of this complex grades from a soil that has a profile similar to the one described for the Windthorst series to a soil that is shallower and has a less permeable subsoil. In many areas of this complex, the Windthorst soils grade to Stephenville soils, but they grade to Vernon soils in other places. The Windthorst soils of this complex generally occur in areas around the Stephenville soil.

The Vernon-Stephenville complex occurs with the soils of the Windthorst-Darnell complex. The soils of the Vernon-Stephenville complex are similar to those of Windthorst-Stephenville fine sandy loams, 5 to 12 percent slopes, except that part of the acreage consists of fine-textured Vernon soils.

Most of the acreage is used for range. Controlling the growth of brush is necessary on the Windthorst and Stephenville soils. Otherwise, only good range management is needed to produce good yields of forage. (Capability unit VIIe-1; Vernon soils in Shallow Prairie range site, and Stephenville and Windthorst soils in Sandy Savannah range site)

## Waurika Series

In the Waurika series are dark-colored, nearly level, somewhat poorly drained soils that have a medium-textured surface layer and a fine-textured subsoil. These soils are in the central part of the county and are at the heads of small streams in many places. They formed in slightly calcareous clay beds. In many places they contain areas of Slickspot soils. The native vegetation was mostly short and mid grasses.

The upper part of the surface layer is grayish loam to silt loam that is about 8 inches thick and is friable when moist and hard when dry. It has granular structure in some places and is structureless in other places. The lower part is brownish to grayish loam to silt loam that is about 2 inches thick and is somewhat lighter colored than the upper part. The subsoil is dark-gray clay about 5 feet thick. It is extremely firm when moist and very hard when dry, and it breaks to moderately well formed

blocks  $\frac{1}{2}$  to 1 inch in diameter. The subsoil is so dense that it is not easily penetrated by water and roots.

In places the lower part of the surface layer is about the same color as the upper part. This occurs mainly in cultivated areas where the lower part of the surface layer has been mixed with the upper part by tillage.

The profile of the Waurika soils is similar to that of Brewer soils. The lower part of their surface layer is generally lighter colored than the upper part, however, and their subsoil is less mottled. The Waurika soils occur with the Durant, San Saba, Denton, and Labette soils. Their subsoil is more clayey than that of the Durant soils, and it has more blocky structure.

**Waurika loam** (0 to 1 percent slopes) (Wc).—This is the only Waurika soil mapped in this county. It is mainly in the central part of the county, but small areas are in other parts. It is a soil of the prairie.

Included in the areas mapped as this soil are small areas of Durant soils. Generally the Durant soils are in places where the surface drainage is better than normal for the Waurika soil.

Much of the acreage is on ranches and is used for grazing, but generally not much forage is produced. In most places cattle have overgrazed the more desirable grasses instead of grazing in other areas where the soils are better drained. Some areas have been improved for tame pasture by planting bermudagrass or King Ranch bluestem as the base sod. In cultivated areas the chief crops are small grains. Because this soil is droughty, it should be used only for crops that grow during the cool season. (Capability unit IIs-1; Claypan Prairie range site)

## Wet Alluvial Land

**Wet alluvial land** (Wb) is made up of highly stratified material that ranges from moderately coarse textured to moderately fine textured. The texture varies greatly within short distances. This land type is generally on narrow flood plains along small streams. It is wet most of the time because the water table is high. Also, the stream channel has been clogged with sand, and as a result, the water spreads out over the bottom land. Each time the stream is flooded, fresh sandy sediments are added to further clog the channel. Many of the streams are fed by springs that flow most of the time.

Included in the areas mapped as this land type are small areas of Pulaski soils. Generally these Pulaski soils are along the edges of the bottom lands.

The acreage is mainly in woods or is used for pasture or range. Under the canopy of willow and cottonwood trees, some sedges grow and supply forage for grazing during cool seasons. The areas where the woody vegetation has been removed are more productive than other areas. Therefore the growth of woody vegetation and the amount of grazing should be controlled to permit the growth of a maximum amount of grass. (Capability unit Vw-3; Wetland range site)

## Windthorst Series

In the Windthorst series are light-colored soils that have a moderately coarse-textured surface layer and a fine-textured subsoil. These soils are generally near the tops of ridges and in the timbered areas in the northern part

of the county. In the north-central and northeastern parts of the county, they formed in material weathered from sandy shale. In the northwestern and northern parts, they formed in similar material that weathered from older material. The vegetation in areas that are not cultivated is mainly post oak and some mid and tall grasses between the trees.

In areas that have not been cultivated the upper part of the surface layer of these soils is dark-brown or grayish-brown fine sandy loam about 4 inches thick. It has weak granular structure and is very friable when moist. The lower part is light-brown or pale-brown fine sandy loam about 8 inches thick. It is structureless and very friable when moist. In cultivated areas the surface layer is generally light brown. This is because of the reduction in organic matter and the mixing of the underlying lighter colored soil material into the surface layer. In most places the subsoil is reddish to yellowish sandy clay about 4 feet thick. It breaks to well-formed blocks  $\frac{1}{4}$  to  $\frac{3}{4}$  inch in diameter. The subsoil is very firm when moist and very hard when dry. It is not easily penetrated by roots.

Where the Windthorst soils are mapped in a complex with Darnell soils, their profile is shallower than where they are mapped separately or with Stephenville soils. Also, the profile contains some cherty sandstone gravel.

The Windthorst soils occur with and are similar to the Stephenville soils, but they have a more clayey, blocky subsoil than those soils. Their subsoil is less clayey than that of the Axtell soils, and they are on uplands rather than on stream benches. The Windthorst soils have a thicker profile and a more clayey subsoil than the Darnell soils.

The Windthorst soils are well drained. They have medium internal drainage.

**Windthorst-Darnell complex** (5 to 25 percent slopes) (Wn).—This complex is in rolling to hilly areas in the northeastern part of the county near Lake Murray State Park. It is also in the northwestern part of the county. Windthorst soils make up about 65 percent of the complex, and Darnell soils about 20 percent. Gravel and boulders of cherty limestone are strewn over the surface in most places. The surface layer of the Windthorst soils is generally 3 to 5 inches thick. In most places the profile of the Windthorst soils is less thick than that described for the series, and the subsoil is more reddish. The profile of the Darnell soils is similar to that described for the Darnell series.

Included in the areas mapped as this complex is a soil that is neither a Windthorst nor a Darnell soil, but that has some of the characteristics of both. Also included are a few areas of a soil on ridges in Lake Murray State Park where sandstone crops out in 50 percent or more of the acreage.

The soils of this complex are used mostly for range, and some areas have been cleared of timber. If the growth of brush is controlled and range is managed well, good yields of desirable vegetation are obtained. (Capability unit VIIs-1; Windthorst soils in Sandy Savannah range site, and Darnell soils in Shallow Savannah range site)

**Windthorst fine sandy loam, 1 to 5 percent slopes** (WdC).—In most places this soil is on the crowns of gently sloping ridges. It occurs in timbered areas throughout the county.

Included in the areas mapped as this soil are small areas of Stephenville soils. Most of the included areas are along small drainageways where some colluvium has accumulated or where internal drainage is better than in the typical areas of Windthorst soils.

Most of the areas are grazed, and some areas have been improved for tame pasture. Other areas are cultivated. The crops are chiefly small grains and vetch, sorghum, and cotton. In the fields where row crops are grown, this soil should be terraced and farmed on the contour. In areas that are grazed or used as range, yields of forage are maximum if the growth of woody plants is controlled and grazing is well managed. Yields of forage are low, however, where the trees have not been removed. Most of the areas that have been improved for tame pasture were once old fields; they were improved by planting bermudagrass as the base sod. (Capability unit IIIe-2; Sandy Savannah range site)

**Windthorst fine sandy loam, 1 to 5 percent slopes, eroded (WdC2).**—This soil is mainly on the gently sloping crowns of ridges throughout the county. Generally it is in timbered areas where old fields have been abandoned.

The profile of this soil is similar to the profile described for the series, except that it has a thinner surface layer. In many places the present surface layer is redder than the original one because some material from the subsoil has been mixed into it by tillage.

Included in the areas mapped as this soil are small areas of Windthorst soils that are not eroded. Such areas are generally between gullies or along the borders of fields.

Most of the acreage is used for grazing, but some areas are in crops, chiefly small grains and sorghum. Some areas have been improved for tame pasture, chiefly by planting bermudagrass as the base sod. If the tame pasture is properly fertilized and managed, yields of forage are high, provide only a small amount of forage. The areas that provide only a small amount of forage. The areas that remain in crops are used mainly for small grains and vetch and sorghum. Terracing and farming on the contour are desirable where row crops are grown. (Capability unit IVe-2; Sandy Savannah range site)

**Windthorst-Stephenville fine sandy loams, 5 to 12 percent slopes (WsD).**—The soils of this complex are along drainageways and in timbered areas throughout the county. The profiles of these soils are similar to those described for the Windthorst and Stephenville soils, except that they are thinner.

Included in the areas mapped as this complex are areas, mainly of Stephenville soils, that have slopes greater than 8 percent. Those areas contain only a small proportion of Windthorst soils and are mostly along drainageways south of Lake Murray State Park. Also included in the complex, near the tops of ridges, are areas of Windthorst soils that have slopes of less than 5 percent. In addition, near the bottoms of the slopes and in the valleys, areas of Stephenville fine sandy loam, 3 to 5 percent slopes, are included.

Most of the acreage is used for range. In some areas that have been cleared, crop yields are high. Most areas that have been cultivated, however, are severely eroded and have been abandoned. Some areas have been improved for tame pasture by using bermudagrass as the base sod. In the areas that are pastured, the growth of brush and trees needs to be controlled. Only good management of range

or pasture is needed for high yields. (Capability unit VIe-2; Sandy Savannah range site)

## Yahola Series

The Yahola series consists of dark-colored, calcareous soils that have a moderately coarse textured surface layer and a moderately coarse textured subsoil. These soils are along the Red River on bottom lands that are occasionally flooded. The frequency of flooding varies from place to place. The soils formed in calcareous, reddish, sandy alluvium derived from sediments of the red beds. The native vegetation was bottom-land hardwoods with mid and tall grasses between the trees.

In most places the surface layer is reddish loam to fine sandy loam that contains a large amount of calcareous material. It is generally about 15 inches thick, but ranges from 8 to 25 inches. It is very friable when moist and slightly hard when dry and is structureless. Beneath the surface layer is stratified fine sandy loam to loam that is about the same color and has about the same structure as the surface layer. In most places the texture of the material in the lower part of the profile is fine sandy loam.

The Yahola soils have a profile similar to that of the Lincoln soils, but the lower part is less sandy. The Yahola soils occur with the Norwood soils. They have a profile somewhat similar to that of the Norwood soils, but the lower part is more sandy.

The Yahola soils are well drained and have rapid to medium internal drainage. They are easily worked, and they absorb and hold enough water for the good growth of adapted plants.

Most of the acreage is cultivated. The main crops are pecans, cotton, small grains and vetch, and alfalfa.

**Yahola fine sandy loam (0 to 1 percent slopes) (Yc).**—This is the only Yahola soil mapped in the county. It is on bottom lands along the Red River and is occasionally flooded.

Included in the areas mapped as this soil are narrow areas of soils in swales. In those areas the surface layer is clay loam.

This Yahola soil is highly productive if it is well managed. Most of the acreage is cultivated, and the crops are mainly alfalfa, small grains and vetch, cotton, and pecans. Because the areas of included soils in swales are generally only a few feet wide, the use and management of this soil is only slightly affected by them. Generally, however, the soils in those areas remain wet longer after rains than the soils around them, and as a result, tillage is frequently delayed. (Capability unit I-1; Loamy Bottomland range site)

## Zaneis Series

In the Zaneis series are dark-colored soils that have a medium-textured surface layer and a moderately fine textured subsoil. These soils are on prairies in the northwestern part of the county near the town of Orr. They formed in clayey material weathered from sandstone or from sandy shale of the red beds. The native vegetation was mid and tall grasses.

In most places the surface layer is dark-brown loam about 6 inches thick. It is friable when moist and hard when dry and has weak granular structure in most places.

Generally, the subsoil is reddish loam to clay loam about 3 feet thick. It is friable or firm when moist and hard when dry, and it breaks to moderately well formed blocks of irregular shape that are  $\frac{1}{4}$  to 1 inch in diameter.

Where the wind has winnowed this soil, the texture of the surface layer is fine sandy loam.

The Zaneis soils occur with the Chickasha soils, and they are mapped in an undifferentiated unit with the Chickasha soils in some places. They are more reddish than the Chickasha soils. The Zaneis soils also occur with the Renfrow soils. Their color is similar to that of the Renfrow soils, but they have a less clayey subsoil. Their subsoil is more clayey than that of the Teller soils, and generally they are on prairies rather than on alluvial benches along the Red River.

The Zaneis soils are well drained and have medium internal drainage. Most of the acreage is used for grazing.

**Zaneis loam, 3 to 5 percent slopes (Z<sub>0</sub>C).**—This soil is on the prairie near the town of Orr. It is underlain by sandy shale or sandstone.

Included in the areas mapped as this soil are small areas of Renfrow soils. The Renfrow soils are on the side slopes of drainageways that run through areas of the Zaneis soil.

Most of the acreage is used for range. Areas that were once cultivated have been abandoned long enough for native grasses to reseed naturally. A few acres is still cultivated and is used mainly to grow small grains and sorghum. Where close-growing crops are grown, good management of crop residue is needed. Good management is also needed in range areas so that the grasses grow vigorously. (Capability unit IIIe-1; Loamy Prairie range site)

## Use and Management of the Soils

A large part of the acreage in Love County is used for crops and for tame pasture or range. This section explains how the soils of the county may be managed for these main purposes, and also for developing pecan orchards and for windbreaks and woodland. In addition it discusses the soils in relation to wildlife and indicates the suitability of the soils for engineering structures.

## General Management Practices for Crops and Tame Pasture<sup>1</sup>

If the farmer is to plan an effective system of soil management, he must know what practices are best suited to the soils and to the climate, how much the soils will produce under the best management, and what the limitations of the soils are.

In this section the practices commonly required in this county are discussed. Practices applicable to specific soils are described in the subsection "Capability Groups of Soils."

### FIELD CROPS

Conserving moisture, providing enough crop residue for protection, maintaining good tilth for efficient production, and supplying nutrients in amounts adequate for the good

growth of plants are all problems in managing the soils of this county. The chief management problem, however, is susceptibility of the soils to erosion by wind and water.

The soils are likely to be droughty in summer and early in fall. As a result, the growth of vegetation that protects them from erosion is limited in those seasons. The soils that are the most droughty, and that are thus likely to be eroded because they are not adequately protected, are those that have a blocky, fine-textured subsoil. Also in spring, before plants have grown enough to provide a good cover, periods of rainfall of high intensity and of high winds are common. During storms, the medium-textured and fine-textured soils of the uplands are likely to lose much of their valuable surface layer through erosion; the coarse-textured, rapidly permeable soils are likely to be damaged by gullyng.

The crops normally grown in this county are alfalfa, cotton, corn, pecan trees, small grains and vetch, and grain sorghum on the loamy soils of bottom lands and stream benches; cotton, small grains, small grains and vetch, grain sorghum, and sweetclover on the clayey and loamy soils of the prairies; and peanuts, small grains and vetch, cotton, and grain sorghum on the sandy soils and on the coarser textured loamy soils.

Erosion is controlled most effectively if a combination of good management practices is used. In general, for the purpose of planning suitable management, the soils of the county can be divided into the following three groups, each of which requires a different kind of management: (1) Nearly level, fine-textured to moderately coarse textured soils of bottom lands and stream benches; (2) gently sloping or moderately sloping, fine-textured to moderately coarse textured soils on hillsides or other sloping areas; and (3) soils that may be either nearly level or sloping but that are coarse textured. The following are general practices applicable to all the soils in each group:

The soils of the first group are more productive than the other soils in the county. The only management practices they require are those that maintain soil fertility, the content of organic matter, and good tilth. These purposes are accomplished by applying the proper kinds and amounts of fertilizer, as determined by the results of soil tests. More intensive fertilization is profitable in the areas where these soils are irrigated. Also in the irrigated areas, a more intensive cropping system is used and the cultural practices are more intensive.

For the gently sloping or moderately sloping soils of the second group, the same practices are required as are required for the soils of group 1, but more intensive management is required in clean-tilled areas. This intensive management consists mainly of terracing, farming on the contour, growing legumes in winter, and working all crop residue into the surface layer or leaving it on the surface. Also, for these soils the cropping system should include small grains, legumes, and other crops that help to control erosion.

The soils of the third group are sandy and are subject to erosion by wind and water. Good management practices are needed to maintain fertility and to protect against erosion. The practices required are applying fertilizer, growing crops that produce a large amount of residue, and tilling in a way that keeps crop residue on the surface. Frequent applications of fertilizer are necessary because the plant nutrients rapidly leach out of these soils. There-

<sup>1</sup>This section is mainly by M. D. GAMBLE, conservation agronomist, Soil Conservation Service. CHESTER FRY, range conservationist, Soil Conservation Service, also supplied information for tame pastures.

fore, fertilizer should be applied at planting time and again during the growing season.

All the practices indicated for these three groups are designed to protect the soils, to supply enough nutrients so that plants will make good growth, and to utilize crop residue in a way that will conserve soil moisture. In the following pages general practices mentioned for these three groups are further described. Practices suitable for individual soils are given in the subsection "Capability Groups of Soils."

*Cropping systems.*—If a good cropping system is used, the soils remain productive year after year and crops grown on them make good yields at the least practical cost. A good cropping system gives protection from erosion, improves or maintains tilth, and helps to control weeds, insects, and diseases. In this county the main crops that do all of these things are legumes and perennial grasses, but small grains meet most of these objectives.

Vetch, the principal legume used as a soil-improving crop in this county, is usually grown in combination with small grains or perennial grasses. Alfalfa, grown on many of the bottom lands in the county, is another legume that is considered to be a soil-building crop if it is properly fertilized. The most benefit is derived from alfalfa if the last cutting is returned to the soils.

Perennial grasses are the best for improving the structure of the soils and for controlling erosion. Wherever it is practical to grow them, perennial grasses should be rotated with other crops in the cropping system.

As a rule, if small grains are grown and the straw is plowed under as a source of organic matter, nitrogen fertilizer is required to help decompose the straw. During years of limited rainfall, however, when there is only a small amount of straw, nitrogen is not likely to be needed. Nitrogen fertilizer, added to the crop residue, acts as insurance to prevent yields from becoming lower the year after a large amount of straw has been produced and turned under.

Such crops as peanuts and cotton do not supply much protection for the soils during the growing season, and they return only a small amount of residue to the soils. If peanuts or cotton is grown, perennial grasses or a crop that produces a large amount of residue should be grown the following year.

*Use of cover crops.*—Cover crops and green-manure crops protect the soils from erosion by wind and water. They also return organic matter and stored plant nutrients to the soils. These crops produce a large amount of residue. They should be planted immediately after the harvest of a crop that produces only a small amount of residue, especially on sandy soils that are susceptible to severe wind erosion.

Small grains, rye, and millet are all good cover crops, but rye makes the best cover for the sands and fine sands. In summer millet provides a good cover for fine-textured soils because it grows rapidly. Sow rye early in fall so that it will grow tall enough to provide a good cover before winter. A special drill can be used for seeding the rye among the cotton plants in September. If cotton, peanuts, or sorghum is to be grown, keep a cover crop on the surface in winter and work it into the surface layer about April 1.

*Crop residue.*—Leaving crop residue on the surface when the soil is not protected by a growing crop and later working it into the surface layer are desirable practices in

this county. The crop residue helps to protect the soil during periods when the hazard of erosion is severe, and it returns to the soil a part of the plant nutrients that were removed when the plants were growing. The residue also improves the structure of the surface layer and makes the surface layer more porous. As a result, more water enters the soil and surface crusting is reduced.

The amount of residue needed on the surface to control wind erosion depends upon the climate and the kind of soil. Among the factors that must be considered in providing for crop residue are the texture and tilth of the soil and the intensity of wind or rainfall that can be expected in the area.

*Stripcropping.*—A practice suitable for helping to control wind erosion on sandy soils is stripcropping. It consists of growing in strips various kinds of crops that do not provide much protection from erosion. Those strips are alternated with strips of small grains or other crops that protect the soils. Where sorghum is alternated with a crop that provides less protection from erosion, a high stubble is left standing to provide protection from wind in winter and early in spring. The erodibility of the soils determines the width of the strips. It depends on many factors, but it is closely related to the soil texture.

The strips of erosion-resistant crops and of crops that do not provide much protection from erosion should be of the same width. All strips ought to be run as nearly as feasible at right angles to the direction of the prevailing winds.

*Contour farming.*—Plowing, planting, and tilling soils as nearly as feasible at right angles to the slope, instead of up and down the slope, has many advantages. Erosion by water is reduced because more water soaks in. Because of this additional water, crops usually grow better. Operating farm equipment on the contour is also easier than up and down the slope, and sometimes it is more economical. Contour farming (fig. 14) is necessary in terraced fields. It may also be effective in areas that have not been terraced.

*Terraces.*—A terrace is a combination of a ridge and channel built across the slope, generally on a slight grade. A terrace reduces erosion and conserves moisture; it also serves as a guideline for contour farming.

Two main kinds of terraces, diversion terraces and field terraces, are used. The differences between the two are mainly those of size and purpose. Diversion terraces are



Figure 14.—A field that is tilled on the contour between the terraces.

used to protect the soils in a cultivated field from runoff from adjoining fields or other areas. In contrast, field terraces are designed mainly to slow or stop the movement of water within a field. By so doing, they increase the amount of water that soaks in. Field terraces thus appreciably improve yields, for the limited supply of water is among the chief obstacles to good crop yields in this county.

*Grassed waterways.*—For most terrace systems, grassed waterways are needed to provide a way of disposing of excess water without causing erosion. They are used with terraces, and they may also be used with an irrigation system or in any place where there is a need to dispose of excess water without causing erosion.

Each waterway must be individually designed. The width and depth of the waterway and the kind of vegetation needed are determined primarily by the site, the slope and permeability of the soils, the practices already established to control erosion, and the plant cover in the drainage area. Bermudagrass or native grasses are commonly used to provide a plant cover in the waterway.

Practices needed to maintain the waterway consist of (1) fencing if feasible, (2) mowing or spraying to control weeds, (3) lifting farm implements when the waterway is crossed, (4) establishing farm roads in other areas so that the waterway is not used as a road, (5) protecting the

waterway from overgrazing, (6) fertilizing as needed, and (7) plowing or doing other farmwork carefully so as to leave enough space at the edges for the waterway not to be crowded.

*Minimum tillage.*—Keeping tillage to a minimum is important in this county. Of course, when soils are used for crops, they must be worked to some extent to prepare a seedbed so that the plants will have a favorable place to grow and weeds or other competitive vegetation will be controlled. But tillage breaks down the structure of the soils. If it is excessive, it reduces the size of the natural aggregates and eventually pulverizes the soil material. The soils then tend to puddle, and a crust forms on the surface. As a result, less water is taken in and stored for the use of plants.

Compaction, which is likely to result from excessive or untimely tillage, is a problem in managing some of the soils. When the soils are plowed over and over at the same depth, a compact layer, or plowpan, forms, particularly in soils that have a surface layer of loam or silt loam. This compact layer, just below plow depth, reduces aeration and the ability of the soils to store moisture in the lower part of the profile. It ordinarily restricts the normal growth of roots. In some soils plants can use only the moisture and nutrients available above the pan, or to the depth of normal tillage.

TABLE 2.—Grasses and legumes, rated by capability units,<sup>1</sup> according to their suitability for tame pasture

Capability unit	Bermudagrass	King Ranch and Caucasian bluestems	Weeping lovegrass	Tall fescue	Vetch	Burelover and black medic <sup>2</sup>	Sweetclover <sup>2</sup>
I-1	Good	Good	Good	Fair	Good	Good	Good.
I-2	Good	Good	Not suitable	Good	Good	Good	Good.
I-3	Good	Good	Good	Fair	Good	Good	Good.
IIe-1	Good	Good	Good	Poor	Good	Good	Good.
IIe-2	Good	Fair	Good	Not suitable	Good	Fair	Fair.
IIe-3	Poor	Good	Not suitable	Poor	Good	Good	Good.
IIe-4	Good	Fair	Good	Not suitable	Good	Good	Good.
IIe-5	Good	Fair	Good	Not suitable	Good	Fair	Fair.
IIs-1	Poor	Good	Not suitable	Not suitable	Good	Fair	Not suitable.
IIIe-1	Good	Good	Fair	Poor	Good	Good	Good.
IIIe-2	Good	Fair	Good	Not suitable	Good	Fair	Poor.
IIIe-3	Good	Poor	Good	Not suitable	Good	Not suitable	Not suitable.
IIIe-4	Good	Good	Fair	Poor	Good	Good	Good.
IIIe-5	Poor	Good	Poor	Poor	Good	Good	Good.
IIIe-6	Poor	Good	Not suitable	Poor	Good	Good	Not suitable.
IIIe-7	Good	Fair	Good	Not suitable	Good	Fair	Poor.
IIIw-1	Poor	Fair	Not suitable	Good	Good	Good	Good.
IVe-1	Poor	Good	Poor	Not suitable	Good	Good	Good.
IVe-2	Good	Fair	Good	Not suitable	Good	Fair	Poor.
IVe-3	Good	Fair	Good	Not suitable	Good	Not suitable	Not suitable.
IVe-4	Fair	Good	Poor	Not suitable	Good	Good	Good.
IVs-1	Poor	Poor	Good	Not suitable	Good	Not suitable	Not suitable.
IVs-2	Good	Not suitable	Not suitable	Poor	Good	Fair	Poor.
Vw-1	Good	Not suitable	Not suitable	Good	Good	Good	Good.
Vw-2	Good	Good	Good	Fair	Good	Good	Good.
Vw-3	Good	Not suitable	Not suitable	Good	Not suitable	Not suitable	Not suitable.
Vw-4	Poor	Not suitable	Not suitable	Fair	Fair	Fair	Fair.
VIe-1	Poor	Good	Not suitable	Not suitable	Fair	Poor	Good.
VIe-2	Good	Fair	Good	Not suitable	Good	Fair	Fair.
VIe-3	Good	Fair	Fair	Not suitable	Good	Fair	Fair.
VIe-4	Poor	Good	Not suitable	Not suitable	Good	Good	Good.
VIs-1	Not suitable	Poor	Good	Not suitable	Good	Not suitable	Not suitable.

<sup>1</sup> Capability units Vs-1, Vs-2, and VIIe-1 through VIIs-4 are not listed, because the soils are not suitable for the grasses or legumes named in this table and are not suitable for tame pasture.

<sup>2</sup> Lime, as well as fertilizer, is needed in some areas where burelover, black medic, and sweetclover are grown.

**Weed control.**—Johnsongrass, crabgrass, cocklebur, nightshade, and other noxious weeds grow in many of the cultivated fields in this county. Johnsongrass is the most common. It grows in fields, and it also covers roadsides, the banks of creeks, and railroad rights-of-way. Its seed is spread by wind, birds, floodwaters, and tillage equipment. Practices used to control this weed are tillage, chemical sprays, and use of the field as pasture throughout the growing season.

Crabgrass is a problem in fields where cotton, peanuts, and corn are grown. Spraying and tilling before these seedlings emerge are the most widely used control measures. Cocklebur and nightshade can be controlled by proper cultivation, use of seed that is free of weeds, and well-planned spraying.

**Soil amendments.**—The decision about what kind of fertilizer to use and the amount to apply is based on many things. Mainly it is based on the results of soil tests, on the kind of yields desired, on the kind of cropping system, on the kind and amount of fertilizer added in the past, and on the kind of soils and their potential.

Fertilizing requires much planning. For such crops as small grains, sorghum, corn, and grass, the limited supply of nitrogen in the soils generally limits yields unless a fertilizer high in nitrogen is added. For legumes, lack of phosphorus is likely to limit yields unless phosphate is added, and lime may also be required.

The soils on which fertilizer will benefit crops the most are those that are moderately sandy or sandy, especially if those soils are inherently low in fertility. Most soils in the county do not need lime, but agricultural gypsum is beneficial in some places. Current recommendations of the Oklahoma Agricultural Experiment Station can be used as a guide in determining the kinds and amounts of fertilizer and the amount of lime to use.

#### TAME PASTURES

Grass is an inexpensive source of feed. Therefore, most farmers and ranchers in the county profitably use tame pasture as a source of feed for their livestock. For a number of years, much work has been done toward establishing pastures that will provide good year-round grazing. Many good pastures have been established in the county, but a large acreage not suitable for cultivated crops remains. It could be planted to locally suited grasses.



**Figure 15.**—This machine plants sprigs or roots of grasses rapidly and efficiently. This field will be used for tame pasture.



**Figure 16.**—Overseeding legumes in an excellent stand of bermudagrass.

Table 2 lists the capability units made up of soils suited to tame pasture and shows the relative suitability of the soils of each group for adapted pasture plants.

A base grass is the foundation for all permanent tame pasture. When a tame pasture is planned, however, it is necessary not only to choose the best suited base grass but also to consider the requirements of the soils and of the farmer or rancher, the season when additional forage is needed, and the best legume or legumes to seed with the base grass.

The main base grasses used in this county are bermudagrass, King Ranch bluestem, weeping lovegrass, and Caucasian bluestem (fig. 15). Bermudagrass is best suited to the sandy and loamy soils of the bottom lands, but it is also used successfully on some of the deeper sandy and loamy soils of the uplands. Weeping lovegrass is best adapted to the soils of the uplands where the soils are more sandy than in other places. King Ranch bluestem and Caucasian bluestem produce the most forage on well-drained, medium-textured and fine-textured soils. They also grow fairly well on soils that contain a claypan, where stands of other grasses are difficult to establish and maintain. Tall fescue is not widely used for pastures in this county, but it is generally well adapted to the wet soils.

Most of the tame pastures yield less than their potential, and more forage could be produced by improving management. Improved management practices include the use of fertilizer and overseeding the base grass with legumes (fig. 16). Because most grasses are high in carbohydrates and legumes are high in protein, calcium, and phosphorus, a mixture that is about 60 to 80 percent grass and the rest legumes is considered good for tame pasture.

The pastures should be grazed at a rate that will maintain a stand of grasses and legumes of high quality. The grasses and legumes provide a cover that conserves water and protects the soils from erosion. Control of weeds and brush is usually not a problem if tame pasture is well managed. In areas where control is needed, however, the weeds or brush can be mowed or they can be sprayed with a chemical.

#### Capability groups of soils

The capability classification is a grouping of soils that shows, in a general way, how suitable the soils are for most kinds of farming. It is a practical grouping based on

limitations of the soils, the risk of damage when they are used, and the way they respond to treatment.

In this system all the kinds of soil are grouped at three levels, the capability class, subclass, and unit. The eight capability classes in the broadest grouping are designated by Roman numerals I through VIII. In class I are the soils that have few limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products.

The subclasses indicate major kinds of limitations within the classes. Within most of the classes there can be up to four subclasses. The subclass is indicated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* means that water in or on the soil will interfere with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony, and *c*, used in only some parts of the country, indicates that the chief limitation is a climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few or no limitations. Class V can contain, at the most, only subclasses *w*, *s*, and *c*, because the soils in it are subject to little or no erosion but have other limitations that restrict their use largely to pasture, range, woodland, or wildlife.

Within the subclasses are the capability units, groups of soils enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally identified by numbers assigned locally, for example, IIe-1 or IIIe-2.

Soils are classified in capability classes, subclasses, and units in accordance with the degree and kind of their permanent limitations; but without consideration of major and generally expensive landforming that would change the slope, depth, or other characteristics of the soil; and without consideration of possible but unlikely major reclamation projects.

The eight classes in the capability system, and the subclasses and units in this county, are described in the list that follows.

**Class I.** Soils that have few limitations that restrict their use. (No subclasses)

Unit I-1. Deep, nearly level, well-drained soils that have a moderately coarse textured to medium-textured surface layer and are on first and second bottoms.

Unit I-2. Deep, nearly level, moderately well drained soils that have a moderately fine textured surface layer and are on first and second bottoms.

Unit I-3. Deep, nearly level, well-drained, medium-textured soils on high alluvial benches.

**Class II.** Soils that have some limitations that reduce the choice of plants or that require moderate conservation practices.

Subclass IIe. Soils subject to moderate erosion if they are not protected.

Unit IIe-1. Deep, dark-colored, well-drained, gently sloping soils that have a medium-textured surface layer.

Unit IIe-2. Deep, dark-colored, well-drained, nearly level and gently sloping soils that have a moderately coarse textured surface layer.

Unit IIe-3. Deep, dark-colored, moderately well drained, gently sloping soils that have a fine-textured surface layer.

Unit IIe-4. Deep, dark-colored, well-drained, nearly level and gently sloping soils that have a moderately coarse textured surface layer but lack a well-developed profile.

Unit IIe-5. Deep, light-colored, well-drained, gently sloping soils that have a moderately coarse textured surface layer.

Subclass IIs. Soils that have moderate limitations because of moisture capacity.

Unit IIs-1. Deep, somewhat poorly drained, nearly level soils that have a medium-textured surface layer.

**Class III.** Soils that have severe limitations that reduce the choice of plants, or require special conservation practices, or both.

Subclass IIIe. Soils subject to severe erosion if they are cultivated and not protected.

Unit IIIe-1. Deep to shallow, well-drained, gently sloping to moderately sloping soils that have a medium-textured to moderately fine textured surface layer.

Unit IIIe-2. Deep, light-colored, well-drained soils that are nearly level to moderately sloping and have a moderately coarse textured surface layer.

Unit IIIe-3. Deep, well-drained, nearly level to gently sloping soils that have a coarse-textured surface layer.

Unit IIIe-4. Deep, dark-colored, moderately well-drained, gently sloping soils that have a medium-textured surface layer and a fine-textured subsoil.

Unit IIIe-5. Deep, moderately well-drained, moderately sloping soils that have a fine-textured surface layer.

Unit IIIe-6. Deep, dark-colored, moderately well drained, gently sloping soils that have a medium-textured surface layer and a fine-textured subsoil.

Unit IIIe-7. Deep, dark-colored, well-drained, moderately sloping soils that have a moderately coarse textured surface layer.

Subclass IIIw. Soils that have severe limitations because of excess water.

Unit IIIw-1. Deep, somewhat poorly drained or moderately well drained, nearly level soils that have a fine-textured surface layer and are on bottom lands and low stream benches.

Class IV. Soils that have very severe limitations that restrict the choice of plants, require very careful management, or both.

Subclass IVe. Soils subject to very severe erosion if they are cultivated and not protected.

Unit IVe-1. Deep, to shallow, gently sloping to strongly sloping, fine-textured to medium-textured soils that have a moderately fine textured surface layer.

Unit IVe-2. Deep, light-colored well-drained, gently sloping to strongly sloping soils that have a moderately coarse textured surface layer and a moderately fine textured or fine textured subsoil.

Unit IVe-3. Deep, light-colored, well-drained, moderately sloping or strongly sloping soils that have a coarse-textured surface layer and a moderately fine textured subsoil.

Unit IVe-4. Deep, dark-colored, gently sloping, moderately well-drained soils that have a moderately fine textured surface layer and a fine textured subsoil.

Subclass IVs. Soils that have very severe limitations of stoniness, low moisture capacity, or other soil features.

Unit IVs-1. Deep, excessively drained, undulating soils that have a coarse-textured surface layer.

Unit IVs-2. Deep, somewhat excessively drained or excessively drained bottom-land soils that have a fine-textured to coarse-textured surface layer over sandy and loamy material.

Class V. Soils, not likely to erode, that have other limitations, impractical to remove without major reclamation, that limit their use largely to pasture or range, woodland, or wildlife food and cover.

Subclass Vw. Soils too wet for cultivation; drainage or protection not feasible.

Unit Vw-1. Deep, frequently flooded soils of the bottom lands that have a moderately coarse textured to moderately fine textured surface layer.

Unit Vw-2. Land types on narrow bottom lands dissected by meandering stream channels.

Unit Vw-3. Frequently flooded land types that have a high water table and are on bottom lands.

Unit Vw-4. Deep, frequently flooded soils that have a fine-textured surface layer and are on bottom lands.

Subclass Vs. Soils generally unsuitable for cultivation, because of moisture capacity or tilth.

Unit Vs-1. Saline soils that have a fine-textured subsoil and are on bottom lands or benches.

Unit Vs-2. Soils that have a fine-textured subsoil and are on benches.

Class VI. Soils that have severe limitations that make them generally unsuitable for cultivation and that limit their use largely to pasture or range, woodland, or wildlife food and cover.

Subclass VIe. Soils severely limited, chiefly by risk of erosion if protective cover is not maintained.

Unit VIe-1. Dark-colored, shallow to deep soils that have a medium-textured to fine-textured surface layer, or soils that are severely eroded.

Unit VIe-2. Light-colored, strongly sloping to moderately steep soils that have a moderately coarse textured surface layer and a moderately coarse textured to moderately fine textured subsoil.

Unit VIe-3. Light-colored, severely eroded soils that have a moderately coarse textured to medium-textured surface layer.

Unit VIe-4. Dark-colored, medium-textured to fine-textured, moderately steep or steep land types on the sides of small drainageways and on the enclosed valley floors.

Subclass VIi. Soils generally unsuitable for cultivation and limited for other uses by their moisture capacity, stones, or other features.

Unit VIi-1. Deep, hummocky soils that have a coarse-textured surface layer.

Class VII. Soils that have very severe limitations that make them unsuitable for cultivation without major reclamation, and that restrict their use largely to grazing, woodland, or wildlife.

Subclass VIIe. Soils very severely limited, chiefly by risk of erosion if protective cover is not maintained.

Unit VIIe-1. Dark-colored to light-colored, shallow to deep soils.

Subclass VIIi. Soils very severely limited by moisture capacity, stones, or other soil features.

Unit VIIi-1. Light-colored, shallow soils that are stony in many places.

Unit VIIi-2. Dark-colored soils that are shallow over limestone.

Unit VIIi-3. Steep, shallow to deep land types on stony breaks.

Unit VIIi-4. Dark-colored, moderately fine textured land types that are shallow over limestone or beds of calcareous marl.

Class VIII. Soils and landforms that, without major reclamation, have limitations that preclude their use for commercial production of plants and restrict their use to recreation, wildlife, water supply, or esthetic purposes. (None in Love County.)

#### CAPABILITY UNIT I-1

In this capability unit are deep, nearly level, well-drained soils on first and second bottoms along streams. The surface layer of these soils is loam or fine sandy loam. The native vegetation was bottom-land hardwoods and a ground cover of tall and mid grasses. The soils in this unit are—

Gowen loam.  
Port loam.  
Pulaski fine sandy loam.  
Yahola fine sandy loam.

These soils are fertile and highly productive. They are moderately permeable, and rainfall penetrates them well. In some years, however, crops grown on them are destroyed by flooding. Diversion terraces are needed where water accumulates and in the areas that receive runoff from ad-

adjacent slopes. In most places good management is needed only for maintaining fertility and good soil structure.

Most of the acreage is cultivated, and the crops are mainly cotton, alfalfa, peanuts, pecans, small grains and vetch, corn, and sorghum. Needed for at least one-fourth of the time are small grains, corn, or other crops that supply a large amount of residue. Cotton, peanuts, and other crops that supply only a small amount of residue ought not to be grown longer than 6 consecutive years. If the depth of tillage is varied, formation of a plowpan can be prevented.

Some areas have been improved for tame pasture. Pasture plants that are well suited are King Ranch bluestem, Caucasian bluestem, and weeping lovegrass. These soils are less well suited to tall fescue, though tall fescue can be grown.

#### CAPABILITY UNIT I-2

In this capability unit are deep, nearly level, moderately well drained soils on first and second bottoms along streams. The surface layer of these soils is moderately fine textured. The native vegetation was bottom-land hardwoods and a ground cover of tall and mid grasses. The soils in this unit are—

Gowen clay loam.  
Norwood clay loam.

These soils are fertile and highly productive, but they are slowly permeable and rainfall penetrates them slowly. In some years crops are destroyed by flooding, particularly the crops in low spots. Diversion terraces are needed where water accumulates and in the areas that receive runoff from adjacent slopes. In most places good management is needed only for maintaining fertility and good soil structure.

Most of the acreage is cultivated, and the main crops are cotton, alfalfa, corn, pecans, small grains and vetch, and sorghum. At least one-fourth of the time, grow corn, small grains, or other crops that supply a large amount of residue. Limit cotton and other crops that do not produce a large amount of residue to no longer than 6 consecutive years. A plowpan does not form easily in these soils, but if tillage is done when the content of moisture is right, compaction is prevented.

Some small areas, generally along drainageways, are used for woods pasture, and some areas have been improved for tame pasture. Plants that are suitable for pasture are bermudagrass, tall fescue, King Ranch bluestem, and Caucasian bluestem. These soils are not suited to weeping lovegrass.

#### CAPABILITY UNIT I-3

The soils in this capability unit are deep, nearly level, well-drained loams. They are on high benches along large streams in the county. The native vegetation included oak and hickory trees and a ground cover of tall and mid grasses. The soils in this unit are—

Minco loam, 0 to 1 percent slopes.  
Teller loam, 0 to 1 percent slopes.  
Vanoss loam, 0 to 1 percent slopes.

These soils are fertile and highly productive. They are moderately permeable, and rainfall penetrates them well. Because these soils are nearly level, erosion is not a hazard in most areas. In a few places, however, gullies have cut into the high benches and practices that control erosion

are needed. The chief problems in managing these soils are maintaining fertility and good soil structure.

Most areas of these soils are cultivated, and the main crops are cotton, alfalfa, small grains and vetch, corn, and sorghum. At least one-fourth of the time, grow small grains, vetch, corn, alfalfa, and other crops that produce a large amount of residue. Limit cotton and other crops that produce only a small amount of residue to no longer than 6 consecutive years. The depth of tillage can be varied to prevent formation of a plowpan.

Some areas have been improved for tame pasture, and pasture plants that are well suited are bermudagrass, King Ranch bluestem, Caucasian bluestem, and weeping lovegrass. These soils are less well suited to tall fescue, though tall fescue can be grown.

#### CAPABILITY UNIT IIe-1

Deep, dark-colored, gently sloping soils on prairies and on high benches along the major streams make up this capability unit. These soils are well drained and have medium internal drainage. Their surface layer is medium textured. The native vegetation was tall and mid grasses, and these grasses still occupy some areas of meadow and range. The soils in this unit are—

Chickasha and Zaneis loams, 1 to 3 percent slopes.  
Labette loam, 1 to 3 percent slopes.  
Teller loam, 1 to 3 percent slopes.

In sloping areas that are bare or lack enough plant cover for protection, the hazard of erosion is severe. The problems in managing these soils are maintaining fertility and good soil structure and controlling water erosion.

Most of the acreage is cultivated, and the main crops are cotton, small grains and vetch, and sorghum. Alfalfa is grown in some places on the Teller soil. Where row crops are grown, construct terraces and farm the terraced areas on the contour. At least one-fourth of the time, grow small grains and other crops that supply a large amount of residue. Limit cotton and other crops that do not supply a large amount of residue to no longer than 6 consecutive years, and follow these crops with a cover crop. A plowpan forms easily in these soils, but its formation can be prevented by varying the depth of tillage and by tilling only when the soils do not contain a large amount of moisture.

Some areas of these soils have been improved for tame pasture. Pasture plants that are well suited are bermudagrass, King Ranch bluestem, and Caucasian bluestem. These soils are poorly suited to tall fescue, but tall fescue can be grown.

#### CAPABILITY UNIT IIe-2

In this capability unit are deep, dark-colored, well-drained, nearly level and gently sloping soils on high benches along the larger streams in the county. These soils have a subsoil of loam to clay loam. The native vegetation was tall and mid grasses that grew under a thin stand of oak trees. The soils in this unit are—

Teller fine sandy loam, 0 to 1 percent slopes.  
Teller fine sandy loam, 1 to 3 percent slopes.

In areas where these soils are bare or lack enough plant cover for protection, the hazard of erosion is severe. These soils are moderately permeable, and rainfall penetrates them well. Maintaining fertility and good soil structure.

and controlling wind and water erosion are the chief management problems.

Most of the acreage is cultivated, and the main crops are cotton, corn, peanuts, small grains and vetch, and alfalfa. If row crops are grown in the gently sloping areas, construct terraces and farm the terraced areas on the contour. At least one-fourth of the time, grow small grains and other crops that supply a large amount of residue. Limit cotton, peanuts, and other crops that supply only a small amount of residue to not longer than 6 consecutive years, but follow these crops with a cover crop. A plowpan forms easily in these soils. Varying the depth of tillage and tilling when the soils do not contain a large amount of moisture are ways to prevent a plowpan from forming.

Many areas have been improved for tame pasture. Pasture plants that are well suited are bermudagrass and weeping lovegrass, but these soils are not suited to tall fescue. King Ranch bluestem and Caucasian bluestem can be grown, but these soils are not well suited to them.

#### CAPABILITY UNIT IIe-3

Only the mapping unit, San Saba-Denton clays, 1 to 3 percent slopes, is in this capability unit. These are deep, dark-colored, moderately well drained soils that have slow internal drainage. Their surface layer is clayey. The native vegetation was tall and mid grasses.

These soils are fertile and productive. Sheet erosion is common in areas where these soils are bare or lack enough plant cover for protection. The chief management problems are controlling runoff, improving the capacity for absorbing water, and maintaining fertility and good soil structure.

Most of the acreage is cultivated, and the main crops are cotton, small grains, sorghum, and corn. At least one-fourth of the time, grow corn, sorghum, and other crops that produce a large amount of residue. Limit cotton and other crops that do not produce a large amount of residue to 4 consecutive years. Construct terraces in areas that are used for row crops, and farm the terraced areas on the contour. A plowpan does not form in these soils. It is best not to till these soils, however, if the content of moisture is high.

Many areas have been improved for tame pasture. Pasture plants that are well suited are King Ranch bluestem and Caucasian bluestem. These soils are not suited to weeping lovegrass. Bermudagrass and tall fescue can be grown, but the soils are poorly suited to them.

#### CAPABILITY UNIT IIe-4

In this capability unit are deep, dark-colored, nearly level and gently sloping soils on high benches along the Red River. These soils lack a well-developed profile. Their surface layer is moderately coarse textured, and the texture is about the same throughout the profile. The soils are well drained and have medium internal drainage. The native vegetation was tall and mid grasses and a few oak trees. The soils of this unit are—

- Minco fine sandy loam, 0 to 1 percent slopes.
- Minco fine sandy loam, 1 to 3 percent slopes.

These soils are moderately permeable, and water penetrates them easily. Controlling wind erosion and maintaining fertility and good soil structure are the chief management problems.

Nearly the entire acreage is cultivated, and the main crops are cotton, peanuts, corn, small grains and vetch, and sorghum. At least one-fourth of the time, grow small grains and other crops that supply a large amount of residue. Limit cotton, peanuts, and other crops that do not supply a large amount of residue to not longer than 6 consecutive years, and follow these crops with a cover crop. Terraces are needed in some sloping areas where row crops are grown. Farm all terraced land on the contour to help control runoff and conserve moisture. A plowpan forms easily in these soils if the depth of tillage is not varied.

Some areas have been improved for tame pasture. Pasture plants that are well suited are bermudagrass and weeping lovegrass. These soils are less well suited to King Ranch bluestem and Caucasian bluestem, but those grasses can be grown. The soils are not suited to tall fescue.

#### CAPABILITY UNIT IIe-5

The only soil in this capability unit is Stephenville fine sandy loam, 1 to 3 percent slopes. This soil is on uplands in all parts of the county. It is deep, light colored, and well drained, and it is gently sloping. The surface layer is fine sandy loam, and the subsoil is sandy clay loam and is moderately permeable. The native vegetation was hickory, blackjack oak, and post oak and a ground cover of tall and mid grasses.

In areas that are bare or lack enough plant cover for protection, the hazard of erosion is severe. The chief problems in managing this soil are controlling wind erosion and water erosion and maintaining fertility and good soil structure. In areas where terracing is done, farming on the contour is also necessary.

A large acreage has been cultivated, but much of the acreage has been abandoned and is now used for pasture. The main crops are grain sorghum, small grains and vetch, peanuts, and cotton. At least one-fourth of the time, grow small grains, vetch, and other crops that produce a large amount of residue. Limit peanuts, cotton, and other crops that produce only a small amount of residue to not more than 6 consecutive years, and follow those crops with a cover crop. In areas used for row crops, construct terraces and farm the terraced areas on the contour. A plowpan forms in this soil if the depth of tillage is not varied.

Pasture plants to which this soil is well suited are bermudagrass and weeping lovegrass. This soil is less well suited to King Ranch bluestem and Caucasian bluestem, but those grasses can be grown.

#### CAPABILITY UNIT IIe-1

In this capability unit are deep, nearly level, somewhat poorly drained soils that are mainly on prairies or on high stream benches. Internal drainage is very slow. The surface layer of these soils is loam. Generally the subsoil contains a fine-textured claypan. The native vegetation was mid and short grasses. The soils in this unit are—

- Brewer-Vanoss complex.
- Waurika loam.

These soils are very slowly permeable, and water penetrates them slowly. The chief management problems are maintaining fertility and good soil structure and improving the ability to absorb water. In areas that are bare or lack enough plant cover for protection, some sheet erosion has taken place. In some places a crust is likely to form, and as a result, it is difficult for seedlings to emerge.

These soils are difficult to work. They are wet in seasons of high rainfall and droughty in seasons of low rainfall. Plants that grow in spring are the best suited.

Nearly the entire acreage of Brewer-Vanoss complex is used for cultivated crops. Most of the acreage of the Waurika soil was once in small fields, but much of the acreage is now used for range. The main crops are small grains, cotton, small grains and vetch, and sorghum. At least one-fourth of the time, grow small grains, sorghum, and other crops that supply a large amount of residue. Limit cotton and other crops that supply only a small amount of residue to less than 6 consecutive years. Construct terraces in the few sloping areas that are used for row crops, and farm the terraced areas on the contour. Drainage is necessary in many places.

Some areas have been improved for tame pasture. Pasture plants that are well suited are King Ranch bluestem and Caucasian bluestem, but these soils are not suited to weeping lovegrass and tall fescue. Bermudagrass can be grown, but the soils are poorly suited to it.

#### CAPABILITY UNIT IIIe-1

In this capability unit are gently sloping to moderately sloping soils of the prairies. These soils are well drained and have medium internal drainage. The surface layer is clay loam to loam, and the subsoil is clay to clay loam. The Labette and Zaneis soils are deep, but the Claremore soil is shallow and is underlain by limestone at a depth of about 19 inches. The native vegetation was tall and mid grasses. The soils in this unit are—

Claremore silt loam, 1 to 3 percent slopes.  
Labette clay loam, 1 to 3 percent slopes, eroded.  
Zaneis loam, 3 to 5 percent slopes.

These soils are slowly permeable, and water does not penetrate them readily. Maintaining fertility and good soil structure, controlling runoff and water erosion, and maintaining enough moisture for the growth of crops are the chief management problems.

A large acreage has been cultivated, but much of this acreage has been abandoned and is now used for pasture. The main crops are small grains and vetch and sorghum. At least one-fourth of the time in the cultivated areas, grow small grains, vetch, or other crops that supply a large amount of residue. Limit cotton or other crops that supply only a small amount of residue to no longer than 3 or 4 consecutive years. Varying the depth of tillage is a way to prevent the formation of a plowpan. If row crops are grown, these soils should be terraced and farmed on the contour.

Many areas have been improved for tame pasture. Pasture plants that are well suited are bermudagrass, King Ranch bluestem, and Caucasian bluestem. These soils are not well suited to tall fescue, though tall fescue can be grown.

#### CAPABILITY UNIT IIIe-2

The soils in this capability unit are deep, light colored, and well drained. They are in rolling areas throughout the county and are nearly level to moderately sloping. The surface layer ranges from loamy fine sand in the Dougherty soils to fine sandy loam in the other soils, and the subsoil is sandy clay loam to sandy clay. The native

vegetation was oak and hickory trees and mid and tall grasses between the trees. The soils in this unit are—

Dougherty soils, 0 to 3 percent slopes, eroded.  
Stephenville fine sandy loam, 3 to 5 percent slopes.  
Stephenville fine sandy loam, 1 to 5 percent slopes, eroded.  
Windthorst fine sandy loam, 1 to 5 percent slopes.

These soils are slowly permeable to moderately permeable. Rainfall penetrates the Stephenville and Dougherty soils readily, but it penetrates the Windthorst soil more slowly. The chief problems in managing these soils are maintaining fertility and controlling water erosion.

A large acreage of these soils has been cultivated, but much of the acreage has been abandoned and is now used for pasture. The main crops are small grains and vetch, sorghum, peanuts, and cotton. Construct terraces and farm on the contour the areas used for row crops. At least half the time, grow small grains, vetch, and other crops that produce a large amount of residue. Limit peanuts, cotton, and other crops that produce only a small amount of residue to no longer than 2 or 3 consecutive years. Grow a cover crop after a clean-tilled crop has been harvested so that these soils will be protected from erosion and improved by the addition of the crop residue. Apply fertilizer for the maximum amount of top growth on these soils.

Many areas have been improved for tame pasture. Pasture plants that are well suited are bermudagrass and weeping lovegrass, but these soils are not suited to tall fescue. King Ranch bluestem and Caucasian bluestem can be grown, but the soils are not well suited to them.

#### CAPABILITY UNIT IIIe-3

The only soil in this capability unit is Dougherty loamy fine sand, 0 to 3 percent slopes, which is mostly on high benches along the major streams in the county. It is deep and well drained and has medium internal drainage. The surface layer is loamy fine sand, and the subsoil is sandy clay loam that is moderately permeable. The native vegetation consisted of open stands of oak trees and a ground cover of dwarf oak and tall and mid grasses.

The main problems in managing this soil are controlling wind erosion and maintaining soil fertility. Only a small amount of water runs off because the surface layer of this soil is deep and sandy and the subsoil is moderately permeable. As a result, the hazard of water erosion is slight, but the hazard of wind erosion is severe in areas that are bare or lack enough plant cover for protection.

Only about 30 percent of the acreage has been cultivated, and the main crops are peanuts, small grains, and vetch. At least half the time, grow small grains and other crops that supply a large amount of residue. Limit peanuts and other crops that do not supply a large amount of residue to no longer than 3 consecutive years, and follow these crops by a cover crop. The depth of tillage can be varied to prevent formation of a plowpan. Fertilizer is required for the maximum amount of top growth on this soil.

A few areas have been improved for tame pasture. Pasture plants that are well suited are bermudagrass and weeping lovegrass.

#### CAPABILITY UNIT IIIe-4

The only soil in this capability unit is Durant loam, 1 to 3 percent slopes, on prairies in the central part of the

county. It is deep, dark colored, and moderately well drained. Internal drainage is slow. The subsoil is clayey and is very slowly permeable. The native vegetation was tall and mid grasses.

Because much of the rainfall runs off, the hazard of erosion is severe in areas that are bare or lack enough plant cover for protection. Maintaining good soil structure, controlling runoff and water erosion, and holding enough moisture in the soil for the growth of crops are the chief management problems. In some places a crust is likely to form, and then it is difficult for seedlings to emerge. Terracing and farming on the contour are needed if row crops are grown.

About half of the acreage has been cultivated, but much of this acreage has been abandoned and is now used for pasture. The main crops are small grains, small grains and vetch, cotton, and sorghum. At least half the time, grow small grains, vetch, and other crops that supply a large amount of residue. Limit cotton and other crops that do not produce a large amount of residue to not longer than 4 consecutive years. A plowpan forms in this soil, but varying the depth of tillage and working the soil when the content of moisture is not high helps to prevent one from forming.

Some areas have been improved for tame pasture. Pasture plants that are well suited are bermudagrass, King Ranch bluestem, and Caucasian bluestem. This soil is less well suited to weeping lovegrass and is poorly suited to tall fescue, but both of these grasses can be grown.

#### CAPABILITY UNIT IIIe-5

Denton-San Saba clays, 3 to 5 percent slopes, is the only mapping unit in this capability unit. These soils are on the prairie near the town of Marietta. They are deep and moderately well drained. Internal drainage is medium. The surface layer and the subsoil are both clayey. The native vegetation was tall and mid grasses.

These soils are slowly permeable, and water penetrates them slowly. The chief management problems are controlling runoff and water erosion, improving the absorption of water, and maintaining fertility and good soil structure. Sheet erosion is common in areas that are bare or lack enough plant cover for protection.

About half the acreage has been cultivated, but most of the cultivated acreage has been abandoned and is now used for pasture. The main crops are small grains, small grains and vetch, cotton, and sorghum. At least half the time on the acreage still cultivated, grow small grains, vetch, and other crops that produce a large amount of residue. Limit cotton and other crops that produce only a small amount of residue to not longer than 4 consecutive years. Where row crops are grown, construct terraces and farm the terraced areas on the contour.

Some areas have been improved for tame pasture. Pasture plants that are well suited are King Ranch bluestem and Caucasian bluestem. These soils are less well suited to bermudagrass, weeping lovegrass, and tall fescue, but those grasses can be grown.

#### CAPABILITY UNIT IIIe-6

This capability unit consists only of Renfrow silt loam, 1 to 3 percent slopes, on prairies in the northwestern part of the county. This soil is deep, dark colored, and moder-

ately well drained. Internal drainage is slow. The surface layer is generally silt loam, and the subsoil is clay that is very slowly permeable. The native vegetation was mid and short grasses.

The chief management problems are maintaining good soil structure, controlling runoff and water erosion, and holding enough moisture in the soil for the growth of crops. Sheet erosion is common in areas that are bare or lack enough plant cover for protection. In some places a crust is likely to form, and then it is difficult for seedlings to emerge.

About 80 percent of the acreage has been cultivated, but some of it has been abandoned. The main crops are small grains and vetch, cotton, and sorghum. At least half the time, grow small grains, vetch, and other crops that supply a large amount of residue. Limit cotton and other crops that do not supply a large amount of residue to not longer than 4 consecutive years. Where row crops are grown, construct terraces and farm the terraced areas on the contour. A plowpan is likely to form in this soil, but it can be broken up by varying the depth of tillage.

Some areas have been improved for tame pasture. Pasture grasses that are well suited are King Ranch bluestem and Caucasian bluestem. This soil is not well suited to bermudagrass and tall fescue, but those grasses can be grown.

#### CAPABILITY UNIT IIIe-7

The only soil in this capability unit is Minco fine sandy loam, 3 to 5 percent slopes, on high benches along the Red River. It has about the same texture throughout the profile and is deep, dark colored, and well drained. The native vegetation was tall and mid grasses.

This soil is moderately permeable, and water penetrates it easily. Maintaining fertility and controlling wind erosion and water erosion are the chief management problems. The hazards of wind erosion and water erosion are severe.

Most of the acreage has been cultivated, and about half is still cultivated. The main crops are small grains and vetch, sorghum, peanuts, and cotton. At least half the time, grow small grains, vetch, sorghum, and other crops that supply a large amount of residue. Limit peanuts, cotton, and other crops that do not produce a large amount of residue to not longer than 3 consecutive years. If these crops are grown, follow them with a cover crop. In areas where row crops are grown, construct terraces and farm the terraced areas on the contour.

Many areas have been improved for tame pasture. Pasture grasses that are well suited are bermudagrass and weeping lovegrass. This soil is less well suited to King Ranch bluestem and Caucasian bluestem, but those grasses can be grown.

#### CAPABILITY UNIT IIIw-1

In this capability unit are deep, nearly level, and somewhat poorly drained or moderately well drained soils on low stream benches and on bottom lands. Internal drainage is very slow. These soils have a surface layer of clay and a subsoil of heavy clay. The native vegetation on the Lela soil was dense stands of tall and mid grasses. On the Miller soil it was bottom-land hardwoods and a ground cover of mid and tall grasses. The soils in this unit are—

Lela clay.  
Miller clay.

Crops grown on the Miller soil are likely to be damaged occasionally by flooding, but the Lela soil is seldom, if ever, flooded. The chief problems in managing these soils are the need for drainage and for improving the soil structure. These soils are difficult to farm. They are wet for long periods in spring and are likely to be droughty in summer. They store some moisture, but this moisture is not available to plants.

Most of the acreage is cultivated, and the main crops are alfalfa, corn, cotton, and small grains and vetch. At least three-fourth of the time, grow small grains, vetch, corn, and other crops that produce a large amount of residue. Limit cotton and other crops that produce only a small amount of residue to not longer than 2 consecutive years. Drainage ditches or rows arranged to facilitate drainage are necessary to dispose of the excess surface water in many places.

Some areas have been improved for tame pasture. Tall fescue is a well-suited pasture plant. These soils are less well suited to bermudagrass, King Ranch bluestem, and Caucasian bluestem, but those grasses can be grown. The soils are not suited to weeping lovegrass.

#### CAPABILITY UNIT IVe-1

In this capability unit are dark-colored, gently sloping to strongly sloping, moderately well drained or well drained soils of the prairies in the central part of the county. The surface layer is clay to loam, and the subsoil is clay. Some areas of these soils are deep, but the soils of the Denton-Tarrant complex are generally shallow over fragmented limestone. The native vegetation was tall and mid grasses. The soils in this unit are—

Denton clay, 5 to 8 percent slopes.  
Denton-Tarrant complex.

These soils are slowly permeable, and water penetrates slowly. The chief management problems are controlling erosion, maintaining good soil structure, and improving the ability to absorb water. Sheet erosion is common in areas that are bare or lack enough plant cover for protection.

Only a small part of the acreage of Denton clay, 5 to 8 percent slopes, has been cultivated. Although in many places the acreage in the Denton-Tarrant complex consists of small areas in arable fields, only about half of this acreage has been cultivated, and most of that has been abandoned. The main crops grown are small grains, small grains and vetch, and sorghum. Because the hazard of erosion is severe, however, only sweetclover, small grains, and other close-growing crops that produce a large amount of residue should be grown. Construct terraces and farm terraced areas on the contour if crops that produce only a small amount of residue are grown.

Some areas have been improved for tame pasture. Pasture grasses that are well suited are King Ranch bluestem and Caucasian bluestem. These soils are not well suited to bermudagrass and weeping lovegrass, but those grasses can be grown. The soils are not suited to tall fescue.

#### CAPABILITY UNIT IVe-2

This capability unit consists of deep, well-drained, light-colored, gently sloping to strongly sloping soils in rolling areas in all parts of the county. These soils have a surface layer of fine sandy loam and a subsoil of sandy clay to

sandy clay loam. The native vegetation was oak and hickory trees and a ground cover of tall and mid grasses. The soils in this unit are—

Stephenville fine sandy loam, 5 to 8 percent slopes.  
Windthorst fine sandy loam, 1 to 5 percent slopes, eroded.

These soils are slowly to moderately permeable. Water penetrates the Windthorst soil slowly, but it penetrates the Stephenville soil readily. Controlling erosion and maintaining soil fertility are the chief management problems. Because these soils are strongly sloping in some places, the hazard of erosion is severe, particularly in areas that are bare or lack enough plant cover for protection. It is difficult to prevent the formation of gullies.

Only a small part of the acreage of these soils has been cultivated. The main crops are small grains and vetch and sorghum, but only close-growing crops should be grown. If other crops are grown that produce only a small amount of residue, construct terraces and farm terraced areas on the contour.

Some areas have been improved for tame pasture. Pasture grasses that are well suited are bermudagrass and weeping lovegrass. These soils are less well suited to King Ranch bluestem and Caucasian bluestem, but those grasses can be grown. These soils are not suited to tall fescue.

#### CAPABILITY UNIT IVe-3

In this capability unit are deep, light-colored, moderately sloping or strongly sloping soils on high benches along the Red River. These soils are well drained and have medium internal drainage. Their surface layer is loamy fine sand, and their subsoil is sandy clay loam. The native vegetation consisted of open stands of oak trees, dwarf oaks, and tall and mid grasses. The soils in this unit are—

Dougherty loamy fine sand, 3 to 5 percent slopes.  
Dougherty loamy fine sand, 5 to 8 percent slopes.  
Dougherty soils, 3 to 5 percent slopes, eroded.

The soils are moderately permeable, and water penetrates them easily. The chief management problems are maintaining fertility and controlling wind erosion and water erosion. The hazard of erosion is severe in areas that are bare or lack enough plant cover for protection.

The main crops are peanuts, sorghum, and small grains and vetch. Grow close-growing crops to protect these soils from erosion. These crops produce a large amount of residue if enough fertilizer is added.

Some areas have been improved for tame pasture. Pasture grasses that are well suited are bermudagrass and weeping lovegrass. These soils are not well suited to King Ranch bluestem or Caucasian bluestem, but those grasses can be grown. The soils are not suited to tall fescue.

#### CAPABILITY UNIT IVe-4

This capability unit consists only of Durant clay loam, 1 to 3 percent slopes, eroded, which occurs mainly on the prairie near the town of Marietta. This soil is deep, dark colored, and moderately well drained. Internal drainage is slow. The native vegetation was mid and tall grasses.

This soil erodes rapidly if it is bare or lacks enough plant cover for protection. Much of the surface layer has already been removed by erosion. A crust forms after rains, and therefore it is difficult for seedlings to emerge.

The chief problems in managing this soil are controlling erosion and maintaining fertility and good soil structure.

A large part of the acreage that was once cultivated has been abandoned and is now used for pasture. The main crops are small grains and vetch, cotton, and sorghum, but only small grains, vetch, and other close-growing crops that produce a large amount of residue should be grown.

Some areas have been improved for tame pasture. Pasture grasses that are well suited are King Ranch bluestem and Caucasian bluestem. This soil is less well suited to bermudagrass.

#### CAPABILITY UNIT IVs-1

The only soil in this capability unit is Eufaula fine sand, undulating, on high benches along the major streams in the county. This soil is deep. It is excessively drained and has rapid internal drainage. The native vegetation was many dwarf oaks, a few other oaks, and a ground cover of mid and tall grasses.

In most places this soil has a weakly developed profile, but a poorly defined subsoil is at a depth of 30 inches or more. The chief management problems are maintaining fertility and controlling wind erosion. Only about 20 percent of the acreage has been cultivated, and most of that acreage has been abandoned. The main crop in the areas that are cultivated is small grains and vetch. Year after year in the areas that are cultivated it is necessary to grow such close-growing crops that produce a large amount of residue. Because this soil is porous and contains only a small amount of clay, it is easily leached of plant nutrients. Therefore it is necessary to apply a small amount of fertilizer frequently.

Some areas of this soil have been improved for tame pasture. Weeping lovegrass is a pasture grass that is well suited, but this soil is not well suited to bermudagrass, King Ranch bluestem, or Caucasian bluestem.

#### CAPABILITY UNIT IVs-2

This capability unit consists only of Lincoln soils on bottom lands along the Red River. These soils are deep and are flooded occasionally. In most places they are somewhat excessively drained, but they are excessively drained in some places. The surface layer is loamy fine sand to clay. The subsoil is stratified and consists of thin layers of sandy material and loam. The native vegetation ranges from bottom-land hardwoods, with tall and mid grasses growing between the trees, to cedar and short grasses.

These soils are droughty in most places because their subsoil is sandy. Maintaining fertility and controlling wind erosion are the chief management problems. The hazard of wind erosion is slight.

To prevent wind erosion, grow, year after year, crops that produce a large amount of residue. Winter and spring feed crops are occasionally grown on the soils. These crops require fertilizer. Pecan trees grow in many areas of swales and in other places where there is enough moisture. In some places these trees have been thinned and developed into pecan orchards.

Some areas have been improved for tame pasture, and bermudagrass is generally well suited as a pasture plant. These soils are not well suited to tall fescue, but tall fescue can be grown. Weeping lovegrass, King Ranch bluestem, and Caucasian bluestem are not suited.

#### CAPABILITY UNIT Vw-1

In this capability unit are deep soils of flat bottom lands, generally along the smaller streams in the county. These soils are frequently flooded. In most places they consist of highly stratified loamy and clayey material as a result of the frequent flooding. The surface layer ranges from moderately coarse textured to moderately fine textured. The native vegetation consisted of bottom-land hardwoods and a ground cover of tall and mid grasses. The soils in this unit are—

Gowen soils, frequently flooded.  
Port soils, frequently flooded.  
Pulaski soils, frequently flooded.

These soils are not suitable for cultivation, because they are flooded too frequently. Most of the acreage is used for range and pasture, but pecan orchards have been developed in a few places.

Many areas have been improved for tame pasture. Pasture plants that are well suited are bermudagrass and tall fescue. These soils are not suited to weeping lovegrass, King Ranch bluestem, or Caucasian bluestem, because of the frequent flooding.

#### CAPABILITY UNIT Vw-2

Only Loamy alluvial land is in this capability unit. This land type occupies narrow areas of flat bottom lands along small streams. It is dissected by meandering stream channels and is flooded occasionally. The floodwaters generally remain for only a short period. The material that makes up this land type ranges from clay loam to fine sandy loam in texture and is extremely variable in color and reaction. This variability reflects the many kinds of material that make up the soils drained by the small streams. The native vegetation was bottom-land hardwoods and a ground cover of tall and mid grasses.

Pecan trees grow naturally on this land type, and they have been thinned and developed into pecan orchards in a few places. Some areas have been improved for tame pasture. Pasture plants that are well suited are bermudagrass, weeping lovegrass, King Ranch bluestem, and Caucasian bluestem. This land type is less well suited to tall fescue, but tall fescue can be grown.

#### CAPABILITY UNIT Vw-3

Only Wet alluvial land is in this capability unit. It is on flat bottom lands along small streams in areas where the stream channels have been clogged with silt and sand. The material that makes up this land type ranges from clay loam to fine sandy loam. The native vegetation was mainly willow and cottonwood trees and sedges that grew in the shade of the trees. It included only a few desirable grasses.

The water table is high. Because the streams are fed by springs in many places, water is ponded most of the year.

Some areas have been improved for tame pasture. Pasture plants that are well suited are bermudagrass and tall fescue. This land type is not suited to weeping lovegrass, King Ranch bluestem, or Caucasian bluestem.

#### CAPABILITY UNIT Vw-4

Roebuck and Navasota clays is the only mapping unit in this capability unit. These soils are on bottom lands along

Walnut Bayou and Mud Creek. They are subject to frequent flooding. These soils are deep and are moderately well drained to poorly drained. Internal drainage is very slow. The surface layer and subsoil are clayey. The native vegetation was bottom-land hardwoods and a ground cover of mid and tall grasses.

Frequent flooding makes these soils unsuitable for cultivated crops. Most of the acreage along Walnut Bayou has been cultivated but has been abandoned for crops because of the frequent flooding.

These soils are used mostly for range, but only a small amount of palatable vegetation is produced. Little if any of the acreage has been improved for tame pasture. Tall fescue is a fairly well suited pasture plant, but these soils are not suited to weeping lovegrass, King Ranch bluestem, or Caucasian bluestem. Bermudagrass can be grown, but the soils are not well suited to it.

#### CAPABILITY UNIT Vs-1

This capability unit consists of only Slickspots and Saline land. Most of the areas are on bottom lands along Walnut Bayou, Clear Creek, and Mud Creek, but some small areas are on benches along the Red River. These land types are somewhat poorly drained and have slow internal drainage. The native vegetation was mostly short grasses. The soil material near the surface is clay to clay loam and is underlain by clay.

These land types are saline or have been affected by salts, and the clayey material has a blocky structure. Most of the acreage has been cultivated but has been abandoned. Because these land types are droughty, are difficult to till, and crust badly if they are cultivated, they are not suitable for cultivation. No tame grasses have been found that are suitable for growing on them, and therefore the areas have not been improved for tame pasture.

#### CAPABILITY UNIT Vs-2

The only soil in this capability unit is Axtell loam, mainly on low alluvial benches along Mud and Clear Creeks in the western part of the county. This soil is deep and is light colored. It is somewhat poorly drained and has slow internal drainage. In most places the surface layer is loam, but it is fine sandy loam in some places. The subsoil is clay. The native vegetation was post oaks and a ground cover of mid and tall grasses.

This soil is not suitable for cultivation. It is droughty and crusts badly when it is tilled. The soil is not well suited to tame pasture, as the plants needed for tame pasture do not grow well. It is used mainly as range.

#### CAPABILITY UNIT VIe-1

In this capability unit are dark-colored, gently sloping to strongly sloping soils of the prairies near the towns of Marietta and Orr. The soils range from shallow to deep, and some areas are severely eroded. Internal drainage is moderately good to good. The surface layer is clay to fine sandy loam. The native vegetation was tall, mid, and short grasses. The soils in this unit are—

Eroded loamy land.  
Vernon-Chickasha complex.

These soils are not suitable for cultivation. Most of the acreage is used for range, but some areas have been improved for tame pasture. The acreage used for range or pasture is productive. Pasture plants that are well suited

are King Ranch bluestem and Caucasian bluestem. Bermudagrass is not well suited, but it can be grown. Weeping lovegrass and tall fescue are not well suited.

#### CAPABILITY UNIT VIe-2

Windthorst-Stephenville fine sandy loams, 5 to 12 percent slopes, is the only mapping unit in this capability unit. The soils are light colored and are well drained. They are mainly on the sides of valleys in timbered areas of the county. The surface layer is fine sandy loam, and the subsoil is sandy loam to sandy clay loam. The native vegetation was tall and mid grasses and oak and hickory trees.

In areas of these soils that are bare or lack enough plant cover for protection, the hazard of erosion is severe. Nearly all the acreage is in woods pasture, but some areas have been improved for tame pasture. Pasture plants that are well suited are bermudagrass and weeping lovegrass. These soils are less well suited to King Ranch bluestem and Caucasian bluestem, but those grasses can be grown. The soils are not suited to tall fescue.

#### CAPABILITY UNIT VIe-3

In this capability unit is Stephenville-Windthorst complex, severely eroded. The soils of this complex are on uplands and are light colored, gently sloping to moderately steep, and severely gullied. Their surface layer is loam to fine sandy loam. The native vegetation was oak and hickory trees and a ground cover of tall and mid grasses.

The soils of this complex are not suitable for cultivation, because they are severely gullied. They are used mainly for pasture and range, and some areas have been improved for tame pasture. Bermudagrass is a pasture plant that is well suited. These soils are less well suited to King Ranch bluestem, Caucasian bluestem, and weeping lovegrass, but those grasses can be grown. The soils are not suited to tall fescue.

#### CAPABILITY UNIT VIe-4

Only Breaks-Alluvial land complex is in this capability unit. The land types that make up this complex are moderately steep or steep and are on the sides of small drainageways and on the narrow enclosed valley floors. The material that makes up this land type is medium textured to fine textured and is extremely variable in depth. Drainage is good. The native vegetation was tall and mid grasses.

These land types are not suitable for cultivation, because they are steep, shallow, or stony, and they are used mainly for range. Some of the smoother areas, particularly in the narrow valleys, may be improved for tame pasture. The areas used for range or pasture are productive. Pasture plants that are well suited are King Ranch bluestem and Caucasian bluestem. These soils are less well suited to bermudagrass, but bermudagrass can be grown. Weeping lovegrass and tall fescue are not suited.

#### CAPABILITY UNIT VIe-5

The only soil in this capability unit is Eufaula fine sand, hummocky, mainly on high benches along major streams in the county. It is deep and light colored and is moderately sloping to moderately steep. The native vegetation was many dwarf oaks, a few other oaks, and a ground cover of mid and tall grasses.

This soil is not suitable for cultivation, because it is too sandy and droughty. Wind erosion is a problem in areas that are bare or lack enough plant cover for protection. Nearly all the acreage is used for woods pasture. Some areas have been improved for tame pasture. Weeping lovegrass is a well-suited pasture plant, but this soil is not well suited to King Ranch bluestem and Caucasian bluestem.

**CAPABILITY UNIT VIIe-1**

Only Vernon-Stephenville complex, along Mud Creek in the western part of the county, is in this capability unit. The soils are somewhat excessively drained and are shallow to deep, light colored to dark colored, and moderately steep or steep. Their surface layer ranges from clay loam that is strewn with gravel in many places to fine sandy loam. The subsoil is clay to sandy clay. On the Vernon soils the native vegetation was short grasses. On the Stephenville and Windthorst soils it was oak and hickory trees and a ground cover of tall and mid grasses.

The acreage is used entirely for range. These soils are not suitable for cultivation, because they are too shallow and rolling.

**CAPABILITY UNIT VIIs-1**

The soils in this capability unit are light colored, somewhat excessively drained, and shallow, and they are strongly sloping to steep. The surface layer is fine sandy loam to loamy fine sand and is strewn with numerous stones and boulders in many places. The native vegetation was oak and hickory trees and a ground cover of tall and mid grasses. The soils in this unit are—

- Sandy broken land.
- Windthorst-Darnell complex.

These soils are stony in many places, and their depth varies from place to place. All of the acreage is used for range.

**CAPABILITY UNIT VIIs-2**

The only mapping unit in this capability unit is Tarrant soils. These soils are dark colored, gently sloping, and

excessively drained in most places. They lie mainly just above limestone escarpments and are less than 12 inches thick over limestone. The surface layer is clay loam to loam. The native vegetation was short grasses.

These soils are not suitable for tame pasture, because they are too shallow. All of the acreage is used for range.

**CAPABILITY UNIT VIIs-3**

Only Rocky broken land is in this capability unit. This land type is generally in areas of steep limestone escarpments. The depth and texture of the soil material range from deep and loamy at the foot of the slopes to shallow and fine textured near the top. Boulders are strewn over the surface near the upper part of the slopes.

As much as 20 percent of this land type consists of rock escarpments that support little or no vegetation. In many places short grasses grow on the upper part of the slopes below the escarpments, but mid and tall grasses grow in some places on the lower part. Nearly all of the acreage is used for range.

**CAPABILITY UNIT VIIs-4**

This capability unit consists only of Clayey broken land that is dark colored, moderately sloping to steep, and somewhat excessively drained. This land type is shallow over beds of calcareous marl, and its surface is strewn with limestone boulders in many places. Its texture is mainly clay loam. The native vegetation was mid and short grasses.

This land type is not suitable for cultivation or for use as tame pasture, because it is too shallow and sloping. All of the acreage is used for range. The range supports a moderate amount of vegetation that is palatable to livestock.

**Predicted yields**

In table 3 are predicted long-term average yields per acre of the principal crops grown in Love County. Yields are given under two levels of management for most of the

**TABLE 3.—Predicted average acre yields of principal crops and annual gains of beef per acre of pasture under two levels of management**

[Yields in columns A are to be expected under customary management; yields in columns B are to be expected under improved management. Absence of yield figure indicates crop is seldom grown on the soil specified, is not suited to the soil, or the soil is not arable]

Soil	Wheat		Oats <sup>1</sup>		Grain sorghum		Cotton (lint)		Peanuts		Alfalfa		Tame pasture <sup>2</sup>	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Lb.	Lb.	Lb.	Lb.	Tons	Tons	Lb. of beef per acre, 1-yr.-old steers	Lb. of beef per acre, 1-yr.-old steers
Axtell loam.....														
Breaks-Alluvial land complex.....														
Brewer-Vanoss complex.....	12	18	22	35	16	22	210	260					150	250
Chickasha and Zaneis loams, 1 to 3 percent slopes.....	14	20	28	40	21	30	260	335			1.1	2.1	150	225
Claremore silt loam, 1 to 3 percent slopes.....	12	18	22	34	17	23							100	175
Clayey broken land.....														
Denton clay, 5 to 8 percent slopes.....	10	14	18	26	14	18							75	150
Denton-San Saba clays, 3 to 5 percent slopes.....	16	20	28	36	18	24	200	280					100	200
Denton-Tarrant complex.....	8	12	14	22	10	14								
Dougherty loamy fine sand, 0 to 3 percent slopes.....	10	17	18	32	18	30	150	275	800	1,300			125	225
Dougherty loamy fine sand, 3 to 5 percent slopes.....	8	13	14	26	14	24	100	200	700	1,200			75	175
Dougherty loamy fine sand, 5 to 8 percent slopes.....			12	22	12	18							75	175

See footnotes at end of table.

TABLE 3.—Predicted average acre yields of principal crops and annual gains of beef per acre of pasture under two levels of management—Continued

[Yields in columns A are to be expected under customary management; yields in columns B are to be expected under improved management. Absence of yield figure indicates crop is seldom grown on the soil specified, is not suited to the soil, or the soil is not arable]

Soil	Wheat		Oats <sup>1</sup>		Grain sorghum		Cotton (lint)		Peanuts		Alfalfa		Tame pasture <sup>2</sup>		
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	
	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Lb.	Lb.	Lb.	Lb.	Tons	Tons	Lb. of beef per acre, 1-yr.-old steers	Lb. of beef per acre, 1-yr.-old steers	
Dougherty soils, 0 to 3 percent slopes, eroded...	9	16	16	28	16	28	125	250	700	1,200			100	200	
Dougherty soils, 3 to 5 percent slopes, eroded...			12	21	10	16							75	175	
Durant clay loam, 1 to 3 percent slopes, eroded...	12	18	26	36	16	21							75	150	
Durant loam, 1 to 3 percent slopes	14	20	30	42	18	25	200	280					100	175	
Eroded loamy land													50	100	
Eufaula fine sand, hummocky													50	125	
Eufaula fine sand, undulating			14	24	15	23	120	180	600	1,000			75	175	
Gowen clay loam	18	24	30	42	32	44	300	390			2.2	3.2	200	325	
Gowen loam	22	28	38	50	38	48	340	420			2.5	3.8	200	350	
Gowen soils, frequently flooded													100	225	
Labette clay loam, 1 to 3 percent slopes, eroded...	14	20	26	38	18	25	205	275					75	175	
Labette loam, 1 to 3 percent slopes	16	22	32	44	23	30	260	335					100	200	
Lela clay	16	24	32	45	30	38	270	350					100	200	
Lincoln soils													100	175	
Loamy alluvial land													( <sup>3</sup> )	( <sup>3</sup> )	
Miller clay	16	22	28	40	34	42	300	380			2.2	3.0	100	250	
Minco fine sandy loam, 0 to 1 percent slopes	15	20	22	35	23	34	250	340	700	1,200	1.5	2.5	175	275	
Minco fine sandy loam, 1 to 3 percent slopes	13	17	18	30	22	32	225	310	700	1,200			150	250	
Minco fine sandy loam, 3 to 5 percent slopes	11	15	14	26	17	27	175	260	600	1,100			100	200	
Minco loam, 0 to 1 percent slopes	17	22	26	40	30	42	290	380	800	1,300	1.6	2.7	200	300	
Norwood clay loam	24	30	40	55	40	50	360	460			2.8	3.8	200	350	
Port loam	22	30	38	55	36	50	355	450			2.9	3.8	200	350	
Port soils, frequently flooded													100	200	
Pulaski fine sandy loam	16	22	28	38	30	42	300	390			2.0	3.0	150	300	
Pulaski soils, frequently flooded													100	175	
Renfrow silt loam, 1 to 3 percent slopes	12	18	27	40	17	22	215	260					75	150	
Rocky broken land															
Roebuck and Navasota clays															
Sandy broken land															
San Saba-Denton clays, 1 to 3 percent slopes	18	22	34	46	26	33	270	350					150	225	
Slickspots and Saline land															
Stephenville fine sandy loam, 1 to 3 percent slopes	12	19	22	36	20	34	175	325	800	1,300			150	250	
Stephenville fine sandy loam, 3 to 5 percent slopes	10	17	18	30	16	28	125	275	700	1,200			100	200	
Stephenville fine sandy loam, 5 to 8 percent slopes	9	14	15	24	12	20							100	200	
Stephenville fine sandy loam, 1 to 5 percent slopes, eroded	9	15	16	28	14	24			600	1,100			100	200	
Stephenville-Windthorst complex, severely eroded													50	125	
Tarrant soils															
Teller fine sandy loam, 0 to 1 percent slopes	16	22	24	38	25	38	275	365	700	1,200	1.6	2.5	200	300	
Teller fine sandy loam, 1 to 3 percent slopes	15	20	22	36	25	35	275	365	700	1,200	1.3	2.0	175	275	
Teller loam, 0 to 1 percent slopes	19	25	28	42	34	46	325	415	800	1,300	1.8	3.1	200	325	
Teller loam, 1 to 3 percent slopes	16	22	24	38	28	40	290	375	700	1,200	1.4	2.5	175	300	
Vanoss loam, 0 to 1 percent slopes	18	24	28	42	32	44	305	395	800	1,300	1.7	3.0	200	325	
Vernon-Chickasha complex															
Vernon-Stephenville complex															
Waurika loam	15	22	30	42	20	28	235	290					75	150	
Wet alluvial land													100	175	
Windthorst-Darnell complex															
Windthorst fine sandy loam, 1 to 5 percent slopes	9	15	16	28	15	23							100	200	
Windthorst fine sandy loam, 1 to 5 percent slopes, eroded	7	12	12	23	12	20							75	150	
Windthorst-Stephenville fine sandy loams, 5 to 12 percent slopes															
Yahola fine sandy loam	18	24	32	42	38	46	315	395			2.3	3.2	175	315	
Zaneis loam, 3 to 5 percent slopes	12	17	22	34	17	26	190	260					100	175	

<sup>1</sup> If winter varieties are grown exclusively, the yields may be increased by approximately 35 percent.

<sup>2</sup> For best suited grass, see descriptions of capability units.

<sup>3</sup> Yields variable.

soils, but they are not given for soils that are normally considered not suitable for crops. Figures that reflect crop failures have been included in the averages.

The predictions are based partly on fertility studies, on tests made of yields of different crop varieties, and on the results of grazing tests recorded by the Oklahoma Agricultural Experiment Station. The Samuel Roberts Noble Foundation also furnished valuable information about yields. The figures have been further confirmed by other agricultural technicians working in the county.

Customary management (level A), or that management followed by a large number of farmers in the county, normally includes (1) proper rates of seeding, appropriate dates of planting, and efficient methods of harvesting; (2) enough control of weeds, insects, and diseases to insure good growth of plants; and (3) terracing and farming on the contour where necessary. However, year after year under this kind of management, no fertilizer or only a small amount of fertilizer is applied.

Improved management (level B) includes the first three practices listed under customary management plus (1) use of fertilizer in amounts indicated by the results of soil tests; (2) selecting adapted, improved varieties for crops and pasture; (3) growing a cover crop on sandy soils that blow readily; (4) plowing early and leaving a rough, trashy surface that resists erosion; (5) providing surface drainage where required; (6) practicing residue management and using those tillage methods that prevent erosion, maintain good soil structure, increase infiltration, and encourage the emergence of seedlings; (7) choosing a cropping sequence fitted to the goals of the operator and the specific needs of the specific soils; and (8) using management practices for tame pasture that include distribution of salt and water to insure uniform grazing, cross fencing to allow deferred grazing or rotation deferred grazing, and control of weeds and brush. Other management practices suited to specific soils are described briefly in the subsection "Capability Groups of Soils."

**Management of Range <sup>2</sup>**

Management of range in this county is designed mainly for efficiently producing a large amount of forage. Secondary to this main purpose is the control of erosion, for erosion is generally slight in the areas of range; only in a few places are there gullies along trails and in areas that have been disturbed. Another secondary benefit derived from good range management is a decrease in the hazard of flooding. The soils in well-managed areas of range take in and store much of the water from rainfall. This moisture helps to produce maximum yields of forage and makes the range less susceptible to damage from droughts that last for only a short period.

About 65 percent of the acreage in the county is used for native range, and most of this acreage is not suitable for cultivation. Some areas that formerly were cultivated were later seeded to native grass because they were eroded or were too low in fertility for good yields of field crops. Other areas are now in some stage of natural revegetation. The range is usually grazed throughout the year, except where tame pasture or other supplemental grazing is available.

<sup>2</sup> By CHESTER FRY, range conservationist, Soil Conservation Service.

Beef cattle are the livestock most commonly raised, and the main product is feeder and stocker beef calves. The calves are usually sold at weaning time.

This section is provided to aid ranchers in planning management of their range so that they can obtain maximum yields of forage and livestock and protect their soils from excessive runoff and erosion. It describes how range condition classes are appraised, describes the range sites in the county, and provides estimated yields for each range site. It also discusses practices that will improve yields from the range.

The practices discussed in this subsection will help the manager of range to obtain maximum yields of forage and livestock on his site. It will also help him to provide the soils with the best protection from erosion and excess runoff.

**Range sites**

Range sites are distinctive kinds of rangeland that have potential for producing different kinds or amounts of native range plants. Soils that can produce similar kinds and amounts of native plants are grouped into one range site. One range site differs from another enough to require different management, for example, a different stocking rate. In this county the changes in elevation and the differences in the average amount of rainfall from place to place are only moderate, and they do not influence the determination of the range sites.

The plants that originally grew on a range site are called climax vegetation. They are best adapted to the site and generally are the most productive forage plants. Most of these plants are palatable and nutritious for grazing animals. The kind and amount of vegetation presently on a site may vary from the potential for the site as a result of grazing management and cultural practices, such as weed or brush control or cultivation.

A number of different range sites are recognized in this county. In general, however, the range sites are of three kinds—those consisting of dark-colored soils of the upland prairies in the central and eastern parts of the county; those consisting of light-colored soils in sandy areas of the uplands; and those consisting of soils of the bottom lands. The dark-colored soils are favorable for desirable range plants. Oak brush and an understory of desirable range plants grow on the light-colored sandy soils. Bottom-land hardwoods with an understory of desirable range plants grow on the soils of bottom lands.

**Range condition**

Range condition is the present state of the vegetation in relation to the potential or climax vegetation for a particular site. This potential vegetation is determined by studying rangeland that has never been overgrazed.

Determining range condition is a way of providing an approximate measure of the degree of deterioration that has taken place on a range site. Its purpose is to establish a basis for predicting the degree of improvement possible with good management. The following condition classes are generally recognized and are described according to the percentage of climax vegetation presently on the site:

Condition class :	<i>Climax vegetation,</i> <i>percent</i>
Excellent -----	76 to 100
Good -----	51 to 75
Fair -----	26 to 50
Poor -----	0 to 25

A range site in excellent condition is producing nearly the maximum climax vegetation for the site and the climate. Continued good grazing management will maintain this high productivity. The amount of forage produced fluctuates considerably, however, with changes in the climate.

A range in good condition offers an opportunity to increase production of forage rapidly by managing grazing to encourage the better plants. The actual time required to improve the range to excellent condition through management is naturally influenced by the weather.

A range in fair condition needs to be improved. The plant cover has been damaged. Deferment of grazing during the growing season is generally required for rapid improvement. Supplemental summer pasture can be used to make this possible. Weeds or woody plants on some sites may need to be controlled to speed recovery.

A range site in poor condition has lost so much of the stand of desirable forage plants that it produces only a small part of the forage it is capable of producing. Few, if any, of the original productive forage plants remain. Only a small proportion of the vegetation in the stand is palatable or productive. The soil is likely to deteriorate and may be subject to erosion. Restoring poor range to full productivity is difficult and requires a long period of time. Using supplemental summer pasture, deferring grazing during the growing season, and controlling weeds or woody plants are practices that are necessary. In addition, seeding may be required.

To facilitate determining the condition class of the range, plants are classified according to the way they react to grazing use on the various range sites. The classifications used are *decreaser plants*, *increaser plants*, and *invader plants*.

*Decreaser plants* are the kinds of plants in the climax vegetation that decrease under continued heavy grazing. They are generally the most productive and most palatable perennial plants. These plants tend to increase when grazing pressure is reduced enough.

*Increasing plants* are the kinds of plants in the climax vegetation that generally increase in abundance as the number of decreaser plants declines. Plants that increase at first may decrease later as heavy use is continued. Increasing plants are normally shorter, less productive, and less palatable than other plants in the climax vegetation. Most increasers tend to decrease under light use, but other measures of control may be required for oak, western ragweed, pricklypear, and some other plants of this kind.

*Invader plants* do not grow naturally on the site. They may be a normal part of the natural vegetation on a nearby site, or they may have come from distant areas. They are generally less productive, less palatable, or less dependable than climax plants for the site.

*Trends in range condition.*—Range condition is an indication of the present vegetation compared to the potential for the site, but it does not indicate whether the range is improving or deteriorating. Frequently, the trend must be determined before the rancher can plan grazing management that will maintain or improve the range. Some of the important characteristics of the vegetation and soils that indicate trend in range condition are the vigor of the range plants, abundance of seedlings and other young plants, changes in the composition of the stand, an accu-

mulation of plant residue, and the condition of the soil surface.

### **Descriptions of range sites**

The soils of Love County have been grouped in the range sites described in the following pages. The description of each range site gives the important characteristics of the soils and the names of the principal plants.

#### **ALKALI BOTTOMLAND SITE**

Slickspots and Saline land is the only mapping unit in this range site. These land types are clayey, droughty, and saline. Only a small amount of vegetation grows on them because the blocky clayey soil material restricts the penetration of moisture, and salts retard the growth of plants.

The climax vegetation consists of plants that tolerate drought. About 50 percent of this vegetation is alkali sacaton, sideoats grama, blue grama, western wheatgrass, white tridens, vine-mesquite, and other decreasers. Common increasers are tumblegrass, windmillgrass, buffalograss, and annuals that grow in cool seasons. Some areas where salts have accumulated are bare or produce only saltgrass or rhombopod. Mesquite trees have invaded many areas. Pricklypear is also common.

#### **BLACKCLAY PRAIRIE RANGE SITE**

This range site consists of dark-colored, nearly level to rolling, clayey and loamy soils that formed in material weathered from limestone, chalk, and marl. The high content of calcium causes these soils to have a good granular structure. The favorable structure enables the soils to hold the moisture needed for the growth of tall grasses that produce a large amount of forage. Generally these soils are highly fertile. The soils in this range site are—

Breaks-Alluvial land complex.

Denton clay, 5 to 8 percent slopes.

Denton-San Saba clays, 3 to 5 percent slopes.

Denton-Tarrant complex (Denton soil only).

San Saba-Denton clays, 1 to 3 percent slopes.

About 85 percent of the climax vegetation is little bluestem, big bluestem, indiagrass, switchgrass, some eastern gamagrass, and other decreaser grasses. There are a few leadplants and prairie rose and other small decreaser woody plants. Meadow dropseed, sideoats grama, buffalograss, and other increasers make up about 15 percent of the climax vegetation. Common invaders are silver bluestem, Japanese brome, common broomweed, western ragweed, annual three-awn, windmillgrass, and Texas wintergrass. In most places, however, prolonged overgrazing will result in a plant cover of meadow dropseed, silver bluestem, common broomweed, western ragweed, annual three-awn, Texas wintergrass, and Japanese brome. In some places common mesquite, winged elm, and Osage-orange will become common.

#### **BREAKS RANGE SITE**

Rocky broken land is the only mapping unit in this range site. It is steep and stony and has rock outcrops and breaks where material weathered from bedrock is exposed. Mid and short grasses are common in the areas of more shallow soil material where only a small amount of moisture is held, but tall and mid grasses are common on the deeper, loamy soil material where more moisture is



Figure 17.—Breaks range site in good condition. Little bluestem is dominant in this area, and indiagrass and big bluestem make up a smaller part of the plant cover. On the side slopes are rock outcrops and small bare areas.

stored and is available to plants. In some areas there is an open stand of trees.

In most areas of shallow soil material, the main vegetation is hairy grama, tall grama, Texas grama, sideoats grama, and some buffalograss. In other areas where the soil material is deeper or where more moisture is held, big bluestem, little bluestem, indiagrass, switchgrass, sideoats grama, and some trees are common (fig. 17). Under heavy grazing, shorter grasses and weeds replace the tall and mid grasses, and mesquite, persimmon, and other trees invade in some places.

Because it is steep, this range site is grazed less by cattle than adjacent range sites. If the acreage is large enough, fencing is desirable to separate this site from other sites and thus improve grazing management.

#### CLAYPAN PRAIRIE RANGE SITE

In this range site are soils that are deep and nearly level to moderately sloping. These soils have a loamy surface layer and a subsoil of compact, blocky clay. The clayey subsoil restricts the penetration of water and roots and causes very slow internal drainage. As a result, the soils are poorly aerated; the surface layer is saturated with water in seasons of high rainfall and is extremely dry in seasons of low rainfall. The soils in this range site are—

- Brewer-Vanoss complex (Brewer soil only).
- Renfrow silt loam, 1 to 3 percent slopes.
- Waurika loam.

The climax vegetation on this site is difficult to classify because the thickness of the surface layer and the density of the subsoil are variable. The main decreaser is sideoats grama; other decreaseers are little bluestem, switchgrass, vine-mesquite, and wildrye. The chief increaseers are windmillgrass, tumblegrass, gummy lovegrass, tumble lovegrass, silver bluestem, hairy grama, Texas grama and Texas wintergrass. Annual three-awn, Japanese brome, little barley, western ragweed, and other weedy grasses and forbs are among the invaders that increase rapidly as the climax vegetation deteriorates. Prolonged overgrazing results in a plant cover of pricklypear and mesquite.

The recovery of desirable vegetation is slow on this site. The plant cover is best maintained and improved by restricting the grazing to winter and early in spring.

#### CLAYPAN SAVANNAH RANGE SITE

The only soil in this range site is Axtell loam. It has a loamy surface layer that is strongly acid. Its subsoil has a dense claypan and is alkaline.

The climax vegetation consists of grasses and forbs under a thin stand of post oaks. It includes Virginia wildrye, vine-mesquite, purpletop, hairy grama, and buffalograss.

#### DEEP SAND SAVANNAH RANGE SITE

This range site consists of deep, sandy soils of the uplands. These soils take in moisture readily. The soils in this range site are—

- Dougherty loamy fine sand, 0 to 3 percent slopes.
- Dougherty loamy fine sand, 3 to 5 percent slopes.
- Dougherty loamy fine sand, 5 to 8 percent slopes.
- Eufaula fine sand, hummocky.
- Eufaula fine sand, undulating.

The climax vegetation consists of a fairly open stand of oak trees, mostly post oak, and an understory of dwarf oak, dwarf chinkapin oak, grasses, and forbs. The main grasses are sand bluestem, little bluestem, indiagrass, and switchgrass, and the main forbs are perennial lespedeza and tickclover. Other common plants are fringeleaf paspalum, sandgrass, sandbur, and snakecotton. Woody plants increase if the vegetation on this site is burned or overgrazed. In most places the original productivity of this site can be restored if the growth of brush is controlled and grazing is well managed.

#### ERODED SANDY SAVANNAH RANGE SITE

Stephenville-Windthorst complex, severely eroded, is the only mapping unit in this range site. Because of the severe erosion, particularly in gullied areas, the productive potential of this site has been drastically reduced. The native vegetation was grasses, forbs, and an open stand of trees. Most areas are now in the process of natural revegetation and are mainly free of woody plants.

Indiagrass, the most productive grass for this site, is common in most places where there is a source of seed and the range is protected from overgrazing. Little bluestem is the other most common desirable grass, broomsedge, splitbeard bluestem, and silver bluestem are common but less desirable. In most places seeding is needed to establish the more desirable range grasses. The growth of brush needs to be controlled in some areas.

#### HEAVY BOTTOMLAND RANGE SITE

In this range site are droughty clayey soils on bottom lands that are subject to flooding. The soils are droughty because they contain a large amount of clay. Trees of little commercial value grow in areas that have not been cultivated. The soils in this range site are—

- Lela clay.
- Miller clay.
- Roebuck and Navasota clays.

The climax vegetation consists of oak, elm, pecan trees, and many other woody plants. Common plants under the canopies of the trees are Virginia wildrye and beaked panicum. Those common in open areas are switchgrass, eastern gamagrass, big bluestem, and indiagrass. Sedges are common in wet areas, and sumpweed occupies most of the poorly drained areas.

**LOAMY BOTTOMLAND RANGE SITE**

In this range site are deep, loamy soils of the bottom lands. The moisture in most areas of the soils is favorable for the growth of trees, as well as for grasses and forbs. Much of the acreage has been cleared for cultivation. Some of the areas that were once cleared are now used for tame pasture, consisting mostly of bermudagrass. Most other areas are now covered with dense stands of trees and brush. The soils in this range site are—

Gowen clay loam.  
Gowen loam.  
Gowen soils, frequently flooded.  
Loamy alluvial land.  
Norwood clay loam.  
Port loam.  
Port soils, frequently flooded.  
Pulaski fine sandy loam.  
Pulaski soils, frequently flooded.  
Yahola fine sandy loam.

The climax vegetation consists of eastern gamagrass, big bluestem, indiangrass, switchgrass, beaked panicum, Canada wildrye, Virginia wildrye, and other tall and mid grasses. It also includes perennial sunflower, compass-plant, perennial lespedeza, and tickclover. Important trees in the climax vegetation are pecan, elm, oak, hackberry, ash, and cottonwood.

Woody plants have developed dense stands in most areas where heavy grazing has reduced the vigor and density of the productive grasses. The growth of brush needs to be controlled, and good management of grazing is necessary in areas where the productive potential of this site is to be restored. Reseeding will be necessary in many places.

**LOAMY PRAIRIE RANGE SITE**

The soils in this range site have a favorable texture for the growth of tall grasses that produce a large amount of forage. They are also deep enough to hold the moisture needed. In most places the texture of the surface layer is loam, silt loam, or fine sandy loam. On this site the normal growth of plants is not restricted by excess acidity or alkalinity. These soils are mainly nearly level to gently sloping and are on prairies. The soils in this range site are—

Brewer-Vanoss complex (Vanoss soil only).  
Chickasha and Zaneis loams, 1 to 3 percent slopes.  
Claremore silt loam, 1 to 3 percent slopes.  
Durant clay loam, 1 to 3 percent slopes, eroded.  
Durant loam, 1 to 3 percent slopes.  
Eroded loamy land.  
Lafayette clay loam, 1 to 3 percent slopes, eroded.  
Lafayette loam, 1 to 3 percent slopes.  
Minco fine sandy loam, 0 to 1 percent slopes.  
Minco fine sandy loam, 1 to 3 percent slopes.  
Minco fine sandy loam, 3 to 5 percent slopes.  
Minco loam, 0 to 1 percent slopes.  
Teller fine sandy loam, 0 to 1 percent slopes.  
Teller fine sandy loam, 1 to 3 percent slopes.  
Teller loam, 0 to 1 percent slopes.  
Teller loam, 1 to 3 percent slopes.  
Vanoss loam, 0 to 1 percent slopes.  
Vernon-Chickasha complex (Chickasha soil only).  
Zaneis loam, 3 to 5 percent slopes.

About 80 percent of the climax vegetation consists of little bluestem, switchgrass, indiangrass, big bluestem, and other decreaser grasses, as well as leadplant, prairie rose, and other small woody plants. About 20 percent of the climax vegetation is sideoats grama, meadow dropseed,

and other increasers. Among the most common invaders are silver bluestem, Japanese brome, common broomweed, western ragweed, annual three-awn, and windmillgrass, but common mesquite and coralberry have invaded in some places. In most areas prolonged heavy grazing will result in a plant cover of silver bluestem, western ragweed, annual three-awn, and Japanese brome.

**SANDY BOTTOMLAND RANGE SITE**

Only the mapping unit Lincoln soils is in this range site. The soils are on bottom lands along the Red River and are subject to flooding. They are droughty in some areas. The surface layer is sandy in some places, but it is clayey in other places. The material below the surface layer is generally sandy. This site is managed more as tame pasture than as range.

The plant cover on this range site varies widely from place to place. The climax vegetation is difficult to determine because of the changes made by floodwater. Bermudagrass, brought in by floodwater, is dominant in most areas. River switchgrass, indiangrass, beaked panicum, Florida paspalum, sand lovegrass, and buffalograss are among the native grasses. Woody plants include cottonwood, willow, ash, elm, pecan, and redcedar.

**SANDY SAVANNAH RANGE SITE**

The soils of this range site are deep, and they have a loamy surface layer. Most of the areas have been altered by cultural practices or grazing. Some fields that have been cleared for cultivation and then abandoned are in various stages of natural revegetation. In other fields that were abandoned after they had been cultivated, climax grasses have been seeded. Where fire and overgrazing have reduced the stand of climax grasses, dense thickets of oak brush grow. Native grasses are now dominant in areas where the oak brush has been controlled with herbicides. The soils in this range site are—

Dougherty soils, 0 to 3 percent slopes, eroded.  
Dougherty soils, 3 to 5 percent slopes, eroded.  
Sandy broken land.  
Stephenville fine sandy loam, 1 to 3 percent slopes.  
Stephenville fine sandy loam, 3 to 5 percent slopes.  
Stephenville fine sandy loam, 5 to 8 percent slopes.  
Stephenville fine sandy loam, 1 to 5 percent slopes, eroded.  
Vernon-Stephenville complex (Stephenville soil only).  
Windthorst-Darnell complex (Windthorst soil only).  
Windthorst fine sandy loam, 1 to 5 percent slopes.  
Windthorst fine sandy loam, 1 to 5 percent slopes, eroded.  
Windthorst-Stephenville fine sandy loams, 5 to 12 percent slopes.

The climax vegetation on this site consists of mid and tall grasses under open stands of oak trees and other woody plants. The dominant climax vegetation is little bluestem, switchgrass, big bluestem, indiangrass, and other decreaser grasses, as well as perennial lespedeza, tickclover, and other decreaser legumes. Among the increasers are purpletop, hairy grama, and sideoats grama; and open stands of woody plants, mostly blackjack and post oak, grow with these plants. Among the common invaders are broomsedge bluestem, splitbeard bluestem, silver bluestem, partridgepea, and deervetch.

If this site is not well managed, oak brush will increase rapidly. The productive potential can be restored, however, if the brush is controlled by mechanical or chemical means and grazing is well managed.



Figure 18.—Two areas of the Very Shallow range site. The area in the foreground has not been grazed, and this area is in excellent condition. The area across the fence has been closely grazed and is in only fair condition.

**SHALLOW PRAIRIE RANGE SITE**

The soils in this range site are rolling to steep, loamy, and shallow over shale. They formed in limy or clayey material weathered from the shale. Some rocks crop out in most areas. Because these soils are shallow and contain a fairly large amount of clay, they are droughty and their productivity is limited. The soils in this range site are—

- Clayey broken land.
- Vernon-Chickasha complex (Vernon soil only).
- Vernon-Stephenville complex (Vernon soil only).

About 50 percent of the climax vegetation is little bluestem, switchgrass, indiangrass, and other decreaser grasses. It also includes bigtop dalea, a common legume. Tall grama, sideoats grama, and hairy grama are among the increaser grasses; tall grama is the most common. Annual broomweed, Japanese brome, and in some places mesquite trees and pricklypear are common invaders.

**SHALLOW SAVANNAH RANGE SITE**

Only the Darnell soil of the Windthorst-Darnell complex is in this range site. This soil is rolling to steep. It is medium textured and is shallow over shale in some places. Rocks crop out in other places. The moisture in this soil is favorable for the growth of short, mid, and tall grasses and for open stands of oak brush.

About half of the climax vegetation is little bluestem, indiangrass, switchgrass, big bluestem, and other decreaser grasses, as well as perennial lespedeza, tickclover, and other legumes. About 40 percent of the climax vegetation is sideoats grama, hairy grama, purpletop, buffalograss, and other increaser grasses, and about 10 percent is post oak, blackjack oak, and other woody increasers. Western ragweed, Japanese brome, silver bluestem, Texas grama, broomsedge bluestem, splitbeard bluestem, windmillgrass, and many other invaders are common.

**VERY SHALLOW RANGE SITE**

In this range site are nearly level and gently sloping loamy soils that are shallow over limestone and are droughty. Rock outcrops are common in some places. Only a small amount of forage is produced on this site.

The soils in this range site are—

- Denton-Tarrant complex (Tarrant soil only).
- Tarrant soils.

The climax vegetation (fig. 18) is mostly hairy, tall, Texas, and sideoats gramas. Sideoats grama is dominant in areas of this range site that are in excellent condition. In areas where the condition of the range is fair, some of the sideoats grama has been replaced by buffalograss and hairy grama. In this part of the range, common broomweed and pricklypear are abundant. Little bluestem and tall grasses are in crevices between the rocks or in pockets where the soil material is deeper than normal for the Tarrant soils. Puffsheath dropseed, gaillardia, evax, and other annuals are common.

**WETLAND RANGE SITE**

Wet alluvial land is the only mapping unit in this range site. It is made up of sandy soil material along drainage-ways where the water table is high. The kinds of vegetation that can grow are limited by the excess moisture.

Willow and cottonwood trees grow in stands of varying density. Bushy bluestem, the most common grass, and sedges grow in the wettest areas. Along the edges of these areas, beaked panicum, Florida paspalum, switchgrass, and indiangrass are common.

**Range site productivity**

Only limited data on actual production of herbage in this county are available, but table 4 shows the estimated annual average yields for the different range sites. These estimates are for range in excellent condition in periods of both favorable and unfavorable weather. They represent the total amount of herbage that has been clipped to the ground and air dried. Yields may be higher than average, however, if the weather is extremely good for 1 or 2 years in a period of favorable weather, but they may be lower if extreme or prolonged drought occurs in a period of unfavorable weather.

TABLE 4.—Estimated annual average yields of forage in pounds per acre in favorable and unfavorable years

Range site	Average yields of forage in years of—	
	Favorable weather	Unfavorable weather
	<i>Lb. per acre</i>	<i>Lb. per acre</i>
Alkali Bottomland.....	3,000	1,200
Blacklay Prairie.....	7,000	3,500
Breaks.....	3,500	2,000
Claypan Prairie.....	3,000	1,600
Claypan Savannah.....	1,400	600
Deep Sand Savannah.....	3,800	1,900
Eroded Sandy Savannah.....	2,500	1,700
Heavy Bottomland.....	5,500	2,500
Loamy Bottomland.....	8,500	4,500
Loamy Prairie.....	6,000	3,000
Sandy Bottomland.....	3,800	2,000
Sandy Savannah.....	4,500	2,500
Shallow Prairie.....	3,000	1,500
Shallow Savannah.....	3,500	1,800
Very Shallow.....	2,000	500
Wetland.....	5,000	4,000

Normally the amount of usable forage or mowed hay is considerably less than the amount of herbage. From the information given in table 4, however, the range manager can gain a better understanding of what his range sites will produce. Generally he leaves half the herbage grown during the year on the ground. Probably less than half will be consumed by livestock because some of the herbage is likely to be consumed by rodents or insects or destroyed by unfavorable weather. Under this kind of management the livestock can be expected to consume 25 to 40 percent of the total herbage grown in one season.

### *Principles of range management*

Practices that aid in producing a large amount of desirable forage are proper range use, deferred grazing, development of watering places, seeding range plants, and controlling weeds and brush. These practices are discussed briefly in the following paragraphs.

*Proper range use.*—Under this practice the range is grazed at an intensity that permits the growth of a plant cover adequate for protecting the soils and that maintains or improves the quality and amount of desirable vegetation. This kind of grazing means leaving at least half the annual growth of the main decreaser plants on the range site.

Specific information about the stocking of rangeland is not included in this report. Technicians of local agricultural agencies help ranchers classify range sites, estimate the condition of the range, and suggest the number of animals to stock. In addition, the rancher needs to observe the condition of the vegetation from time to time and make the necessary adjustments in the number of livestock and the length of time a site is grazed.

*Deferred grazing.*—Periodically postponing or deferring grazing for a prescribed period during any period of plant growth helps to improve the range. Maximum range improvement can be expected if grazing is deferred during the entire growing season. Deferment in spring generally increases the vigor and productivity of warm-season range grasses; deferment in fall generally increases the production of seed. Control of weeds and brush is more effective in most places if grazing is deferred until the new grass has become established.

*Development of watering places.*—In most places water for livestock is provided by building ponds, but wells may be needed in the Deep Sandy Savannah range site. Properly spaced stock ponds and wells help to distribute grazing more evenly within large pastures.

*Range seeding.*—Seeding and establishing adapted grasses and legumes, primarily native plants, is an important range practice. The range plants of the climax vegetation listed in the descriptions of the range sites give the most satisfactory results. Seed is usually planted in a clean-tilled, firm seedbed, except in sandy areas that are subject to damage by wind erosion. In those areas grass should be seeded in sorghum stubble by using a grass-seed drill. For the first 2 or 3 years, or until the plants are well established, the grass should be protected from grazing during the growing season.

*Control of weeds and brush.*—Brush and other woody plants can be killed or controlled mechanically by spraying with chemicals or by using other methods. Control of brush is needed if maximum production is to be obtained

on much of either of the Savannah range sites and on other range sites that have been invaded by mesquite trees. Chemical control is generally more effective, as well as more economical, than other means in most large areas, but mechanical control is used in many small areas. Either method requires retreatment periodically, but the areas treated with chemical sprays need retreatment less frequently. The growth of highly productive native tall grasses in treated areas tends to reduce the frequency of retreatment and is the most economical.

Good range plants can be expected to take the place of weeds in areas where grazing is carefully controlled, but chemical sprays can speed the improvement in areas where stands of perennial weeds are dense and persistent. One of the most common weeds on the range in this county is western ragweed, which is easily controlled by spraying. Grazing management that favors the growth of highly productive native tall grasses tends to reduce the frequency of needed retreatment.

### **Management of Pecan Orchards<sup>3</sup>**

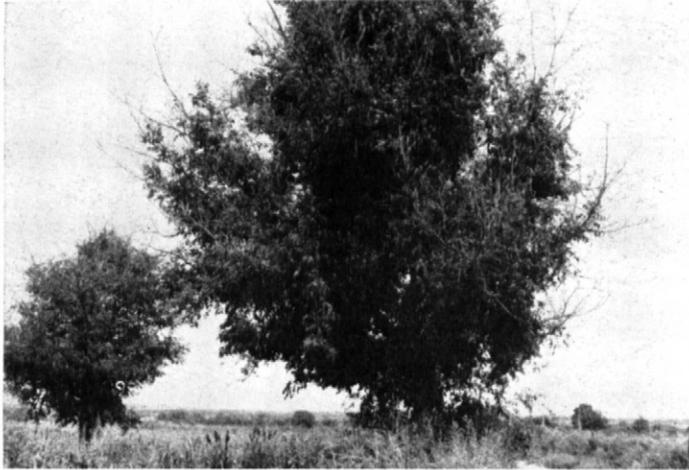
Pecan trees are among the native trees of the bottom lands in all parts of Love County. Pecans are a minor crop in this county, but more attention is given to this crop each year. According to the U.S. Bureau of the Census, the county had a total of 6,476 improved (papershell) pecan trees and 27,953 native pecan trees in 1954. In 1959 the total was 8,969 improved pecan trees and 38,547 native pecan trees. The soils where pecan trees grow most commonly are—

- Gowen clay loam.
- Gowen loam.
- Gowen soils, frequently flooded.
- Lincoln soils.
- Loamy alluvial land.
- Miller clay.
- Minco fine sandy loam, 0 to 1 percent slopes.
- Minco fine sandy loam, 1 to 3 percent slopes.
- Minco fine sandy loam, 3 to 5 percent slopes.
- Minco loam, 0 to 1 percent slopes.
- Norwood clay loam.
- Port loam.
- Port soils, frequently flooded.
- Pulaski fine sandy loam.
- Pulaski soils, frequently flooded.
- Roebuck and Navasota clays.
- Teller fine sandy loam, 0 to 1 percent slopes.
- Teller fine sandy loam, 1 to 3 percent slopes.
- Teller loam, 0 to 1 percent slopes.
- Teller loam, 1 to 3 percent slopes.
- Yahola fine sandy loam.

The yields of pecans vary greatly from year to year. The yield in 1959, for example, was considerably reduced over that in 1954, even though the number of trees had increased by about 25 percent. In 1954 the yield of improved (papershell) pecans was 78,940 as compared to 10,631 pounds in 1959. The yield of pecans from the native trees in 1954 was 242,753 pounds as compared to 73,614 pounds in 1959. Like the yields, the price of pecans fluctuates widely. Therefore, a bumper crop may be of less value than a crop that is below average in size. In 1960, however, the crop was large and the price was high.

Thinning and improving the native stands make the remaining trees more valuable. Yields are greatly reduced if the trees in the native stand are overcrowded.

<sup>3</sup> By JAMES GAYLOR, Samuel Roberts Noble Foundation.



*Figure 19.*—Pecan trees that show the effects of pecan rosette, caused by a deficiency of zinc in the soil. The ends of the limbs are dying back, and the density of the foliage has been altered by the disease.

This spacing or thinning is one of the major problems in producing pecans. The number of trees allowed to remain per acre depends upon the diameter of the trunks of the individual trees. Optimum yields are obtained if the total areas of all pecan tree trunks on a plot 1 acre in size is about 30 to 35 square feet. Normally, mature pecan trees have a diameter of 12 to 20 inches and should be thinned to 10 to 14 trees per acre. Large mature trees need to be spaced at least 70 feet apart. Many stands of native pecan trees have already been thinned and improved in this county.

For obtaining the best yields and the most income per acre from pecan orchards, growing well-fertilized small grains with legumes for winter pasture is a good practice. The soils should be left fallow the following summer. Many orchards and groves, especially in areas that are frequently flooded, have a permanent cover of plants, such as bermudagrass. In those areas overseeding with a winter legume helps to increase the yields of pecans and increases the carrying capacity for livestock. Inadequate soil fertility is a limiting factor in obtaining good yields of pecans. Where a large amount of fertilizer that lacks trace elements has been applied, however, pecan rosette (fig. 19) is a common disease in the pecan orchards. This disease is caused by a deficiency of zinc in the soil.

### Management of Woodland for Windbreaks and Post Lots<sup>4</sup>

Most of the trees that formerly occupied much of Love County have been removed during large-scale clearing operations. Some of the areas were cleared so that cultivated crops could be planted, and others were cleared so that tame pasture could be established. Trees still grow on some parts of the uplands and bottom lands, but the trend is toward clearing those areas for other uses.

The trees on the uplands are generally scrubby and slow growing, and few have any commercial value. Low-grade

<sup>4</sup>By H. R. WELLS, soil conservationist, and CHARLES BURKE, woodland conservationist, Soil Conservation Service.

post oak, blackjack oak, hickory, and other scrubby trees are typical on the Windthorst, Stephenville, Dougherty, Eufaula, and other sandy soils of the uplands.

Stands of hardwoods that included several usable or salable kinds of trees once grew on the bottom lands. These hardwoods once provided enough sawtimber for local use, and sawmills that operate intermittently still furnish mostly rough lumber. The stands of hardwoods have since become seriously depleted as the result of repeated cutting, cutting of the best quality trees so that those trees could not reproduce, and failing to protect the soils from fire and overgrazing. The trees that now grow on the bottom lands are mainly cottonwood and sycamore on the sandy soils and willows on the wettest soils. Oak, elm, hackberry, pecan, and hickory trees are common in other wooded areas of the bottom lands. Red mulberry, black walnut, black locust, green ash, and white ash are less common but are of considerable value.

No trees or only a few widely scattered trees grow on the San Saba, Durant, Vernon, Renfrow, and Chickasha soils of the prairies in the central and northwestern parts of the county. The few trees that do grow on the prairies are mostly in drainageways, except that there are a few scattered stands of Osage-orange in other areas on the San Saba and other black clayey soils.

### Windbreaks

Windbreaks consist of closely spaced strips of trees or shrubs, planted to reduce soil blowing in fields or to protect farmsteads or livestock from wind. Except in areas of Dougherty and Eufaula fine sands or loamy fine sands, there is little need in this county for windbreaks to reduce soil blowing in fields. No field windbreaks had been established in the county at the time this soil survey was made. Well-planned farmstead windbreaks, however, would contribute to more pleasant living conditions in the open parts of the county.

Many of the soils in the open parts of the county are suitable for trees, but the soils in the open areas range from excellent to unsuitable. Good depth, a favorable rate of water intake, permeability that allows water to move freely through the profile, and soil material that allows tree roots to penetrate readily are among the characteristics that make a soil suitable for trees. Other desirable characteristics are favorable internal and external soil drainage and absence of enough salts to damage the trees.

Multiple-row windbreaks are more desirable for protecting farmsteads or livestock than windbreaks consisting of only one row. Three to six rows of trees are desirable. The space between the rows should be at least 10 feet wide so that the areas can be cultivated at least three times during the first growing season and twice the second year. The space between the rows ought to be more than 10 feet where fast-growing and slow-growing trees are in adjacent rows. A spacing of 7 to 8 feet is needed between rows of fast-growing trees, but shrubs may be spaced as closely as 4 feet.

Trees adapted to windbreaks in this county are Siberian elm, American elm, honeylocust, cottonwood, and sycamore. Black locust can also be used for windbreaks on the sands or sandy loams. Cut the black locust for posts if signs of severe damage by borers appears, usually when the tree is 12 to 16 years old. The space formerly occupied by the damaged locust trees will be filled in with new trees

produced from sprouts if the area is protected from grazing.

One or more rows of evergreens add greatly to the appearance and effectiveness of the windbreak. Eastern redcedar and Austrian, shortleaf, and ponderosa pine are suitable for the soils listed in suitability group 1, and redcedar will also grow on most of the soils in the other groups.

#### **Post lots**

Although the use of metal and treated pine for posts is increasing, in many places satisfactory posts can be grown in the farm post lot. Black locust, catalpa, Osage-orange, red mulberry, and other post-lot trees are suited to the soils and climate of this county, but black locust can be grown on a greater number of soils than the other trees. Osage-orange grows naturally on heavy clays and is best suited to those soils. Catalpa should be planted only on the soils of woodland group 1.

Livestock ought to be excluded from the area where trees have been planted until the trees are well established. Protection from livestock is also desirable throughout the life of the trees. In places where trees planted for posts are also to be used as a windbreak, the livestock should have access to not more than two rows of trees in a planting five rows wide. Where livestock have access to the entire area, types of injury to the trees or soils include browsing damage to the foliage, injury to the roots, and soil erosion, soil compaction, and other soil deterioration. Protection of the trees from fire is essential at all times.

#### **Descriptions of woodland groups**

The soils of Love County that are suitable for windbreaks, post lots, and woodland have been placed in three suitability groups. These three groups consist of soils that are suitable for about the same kinds of trees and that require about the same kind of management. A fourth group is made up of soils that are not suitable for trees or that are only poorly suited.

##### **WOODLAND SUITABILITY GROUP 1**

In this woodland suitability group are deep, nearly level soils of bottom lands and deep, moderately permeable soils on alluvial benches. In general the soils on bottom lands are suitable for trees. The soils on the alluvial benches are fertile and allow good penetration of water. Therefore, trees grow well on them. The soils in this group are—

Gowen clay loam.  
Gowen loam.  
Lincoln soils.  
Loamy alluvial land.  
Minco fine sandy loam, 0 to 1 percent slopes.  
Minco fine sandy loam, 1 to 3 percent slopes.  
Minco fine sandy loam, 3 to 5 percent slopes.  
Minco loam, 0 to 1 percent slopes.  
Norwood clay loam.  
Port loam.  
Pulaski fine sandy loam.  
Teller fine sandy loam, 0 to 1 percent slopes.  
Teller fine sandy loam, 1 to 3 percent slopes.  
Teller loam, 0 to 1 percent slopes.  
Teller loam, 1 to 3 percent slopes.  
Vanoss loam, 0 to 1 percent slopes.  
Yahola fine sandy loam.

The soils of this group are good to excellent for growing farmstead windbreaks and post lots. Adapted trees for farmstead windbreaks are Siberian elm, American elm,

honeylocust, cottonwood, and sycamore. These can be used in the windbreak for the row of tall trees. They generally remain thrifty and vigorous for more than 20 years, and they should grow to a height of 70 to 80 feet in that length of time. Black locust can also be grown on the sandy loams if they are removed before they are 20 years old or before locust borers damage them.

Suitable evergreen trees for farmstead windbreaks are Austrian pine, shortleaf pine, ponderosa pine, and eastern redcedar. These trees should grow to a height of 25 to 30 feet in 20 years. Ordinarily they remain thrifty to that age.

Multiple-row windbreaks should have an outer row of dense, low-growing trees or shrubs on the windward side. A suitable tree for this purpose is Russian mulberry, which should be severely pruned at the top to make its foliage more dense. Among the adapted shrubs or shrub-like trees that are suitable for windbreaks are American plum, saltcedar, common lilac, and Russian-olive. The trees suitable for post lots are black locust, catalpa, red mulberry, and Osage-orange.

The native woodland in some areas of these soils may have a potential commercial value as timber if the trees are retained, protected, and well managed. In many areas of the Gowen soils, there are mixed stands of hardwoods, including oak, pecan, and sycamore. About the same kinds of trees are naturally adapted to the Port soil. The Lincoln and Yahola soils support stands of cottonwood and sycamore of commercial grade.

##### **WOODLAND SUITABILITY GROUP 2**

In this woodland suitability group are deep, moderately to rapidly permeable soils of the uplands and frequently flooded soils of the bottom lands. The soils in this group are—

Brewer-Vanoss complex.  
Dougherty loamy fine sand, 0 to 3 percent slopes.  
Dougherty loamy fine sand, 3 to 5 percent slopes.  
Dougherty loamy fine sand, 5 to 8 percent slopes.  
Dougherty soils, 0 to 3 percent slopes, eroded.  
Eufaula fine sand, hummocky.  
Eufaula fine sand, undulating.  
Gowen soils, frequently flooded.  
Port soils, frequently flooded.  
Pulaski soils, frequently flooded.  
Stephenville fine sandy loam, 1 to 3 percent slopes.  
Stephenville fine sandy loam, 3 to 5 percent slopes.  
Stephenville fine sandy loam, 5 to 8 percent slopes.  
Windthorst fine sandy loam, 1 to 5 percent slopes.

The soils in this group are only fair to good for growing trees. The adapted trees for farmstead windbreaks are the same as for woodland suitability group 1, that is, Siberian elm, American elm, honeylocust, sycamore, Austrian pine, shortleaf pine, ponderosa pine, eastern redcedar, Russian mulberry, American plum, saltcedar, common lilac, and Russian-olive. Black locust may be grown on the sandy loams. The tall trees and evergreens are suitable for both single-row and multiple-row windbreak; the low-growing trees and shrubs are suitable for the outer row of multiple-row windbreaks.

Trees on the soils of the bottom lands in this group grow at about the same rate as those on the bottom-land soils of group 1; they are as vigorous as those trees, and they live about as long. Flooding is a problem, however, in planting trees on the soils of the bottom lands. Generally,

for the soils of uplands in this group, the average height of the trees at 20 years of age is 15 to 20 percent less than that of trees grown on the soils of group 1. Also the broad-leaved trees are less vigorous and do not live so long as the same kind of trees on the soils of group 1.

In the main, the soils of this group are not suitable for posts. Only black locust should be planted in post lots.

#### WOODLAND SUITABILITY GROUP 3

In this woodland suitability group are deep soils of the uplands. These soils have a layer of clay that restricts the penetration of water and roots. Some of the soils are susceptible to erosion, and some are extremely wet. The soils in this group are—

Breaks-Alluvial land complex.  
 Chickasha and Zaneis loam, 1 to 3 percent slopes.  
 Claremore silt loam, 1 to 3 percent slopes.  
 Denton clay, 5 to 8 percent slopes.  
 Denton-San Saba clays, 3 to 5 percent slopes.  
 Dougherty soils, 3 to 5 percent slopes, eroded.  
 Durant clay loam, 1 to 3 percent slopes, eroded.  
 Durant loam, 1 to 3 percent slopes.  
 Labette clay loam, 1 to 3 percent slopes, eroded.  
 Labette loam, 1 to 3 percent slopes.  
 Lela clay.  
 Miller clay.  
 Roebuck and Navasota clays.  
 Sandy broken land.  
 San Saba-Denton clays, 1 to 3 percent slopes.  
 Stephenville fine sandy loam, 1 to 5 percent slopes, eroded.  
 Vernon-Stephenville complex (Stephenville soil only).  
 Vernon-Chickasha complex (Chickasha soil only).  
 Wet alluvial land.  
 Windthorst fine sandy loam, 1 to 5 percent slopes, eroded.  
 Windthorst-Stephenville fine sandy loams, 5 to 12 percent slopes.  
 Zaneis loam, 3 to 5 percent slopes.

Generally, farmstead windbreaks can be established fairly successfully on these soils, except on the Denton, Durant, and San Saba soils. Plantings are difficult to establish in years of drought, and the average height, length of life, and vigor of the trees will be less than for trees in group 2. Among the native trees suitable for Wet alluvial land are cottonwood, sycamore, and some oaks, but as a rule, none of these trees have commercial value.

Post-lot plantings should be made only on the Denton and San Saba soils. Osage-orange is the only kind of tree suitable for post-lot planting on these soils.

#### WOODLAND SUITABILITY GROUP 4

The soils in this woodland suitability group are shallow, rocky, saline, or severely eroded. Few, if any, trees of value grow naturally on them, and they are not suitable for tree plantings or for woodland. The soils in this group are—

Axtell loam.  
 Clayey broken land.  
 Denton-Tarrant complex.  
 Eroded loamy land.  
 Renfrow silt loam, 1 to 3 percent slopes.  
 Rocky broken land.  
 Slickspots and Saline land.  
 Stephenville-Windthorst complex, severely eroded.  
 Tarrant soils.  
 Vernon-Chickasha complex (Vernon soils only).  
 Vernon-Stephenville complex (Vernon soils only).  
 Waurika loam.  
 Windthorst-Darnell complex.

## Management of Wildlife Areas<sup>5</sup>

This section describes some general practices that can be used in Love County for improving habitats for wildlife. It also briefly discusses wildlife with reference to the different soil associations.

*Improving habitats for wildlife.*—The most important consideration in planning for wildlife is to provide habitats where food, water, and cover are available and are well distributed. This can be done most effectively if several landowners plan together for protecting and developing their resources over a large area. Because deer require large areas, it is necessary for several landowners to plan together if a large enough tract is to be available in areas where much of the acreage is cultivated. Wild turkeys, which have been introduced in this county, also require a large tract of land.

The carrying capacity of any given area for wildlife depends on the amount of food, cover, water, and living space available for each species. Barring abnormal weather, any habitat of good carrying capacity will provide an annual harvest of game. This harvest, when controlled to match the supply of feed and the losses from natural causes, is a practical use of the land.

Even in most areas where there is a large amount of good food and cover, the number of wildlife can be substantially increased if the vegetation is protected from fire and overgrazing. Permitting the growth of vegetation in fence rows and along the borders of fields supplies some food and cover. Such vegetation is particularly valuable because it creates travel lanes between good habitats. Establishing lespedeza along the borders of fields and woodlands and in grassed areas and abandoned fields also provides valuable food and cover. Thinning dense stands of trees admits more light in wooded areas and thus allows greater production of mast and fruit. Aerial spraying can be used to control the growth of unwanted trees and shrubs and should be used to preserve selected areas that will provide a good habitat. In areas that are sprayed, den trees ought to be preserved if at all feasible, and nest boxes for squirrels should be provided to add a supplemental source of cover.

Waterfowl need aquatic food if they are to be attracted and held in an area. This food can be supplied by managing the water level so that browntop millet, Japanese millet, smartweed, and bulrushes can be established in summer. Then the areas can be reflooded with shallow water in fall. Areas of shallow water below dams can be managed in much the same way by building dikes to hold back the water, seeding and establishing desirable plants for waterfowl, and later allowing the shallow water to reflood the areas. In deep water the growth of sage, or fennelleaf, pondweed, bushy pondweed, and other pondweeds can be encouraged.

*Soil associations and wildlife habitats.*—Many areas in soil associations 1 and 2 make particularly good natural habitats for wildlife because only part of those associations has been cleared. The soils in association 1 are undulating, and that association has many fairly steep areas along streams. The soils in association 2 are hilly and

<sup>5</sup> By HERBERT R. WELLS, soil conservationist, Soil Conservation Service.

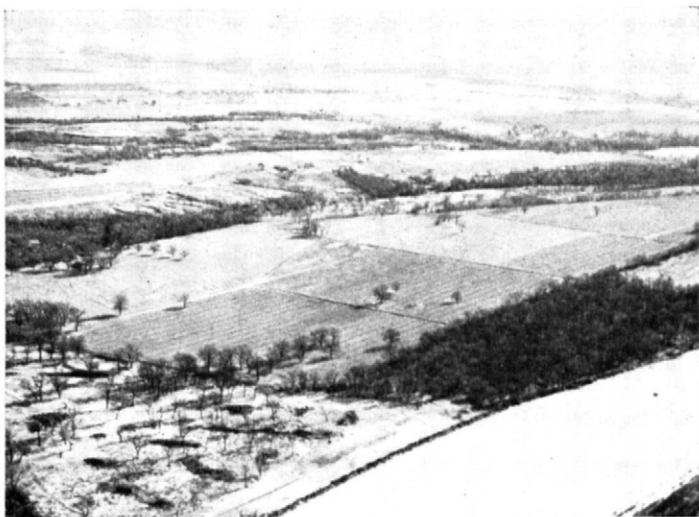


Figure 20.—An area of soil association 6. This association provides abundant food and cover for wildlife.

are less sandy than those in association 1. In association 2 are many small drainageways and deeply cut valleys.

Besides the trees that produce acorns and hickory nuts on the uplands of these two associations, many other trees and shrubs on the bottom lands and adjacent slopes provide food and shelter for wildlife. Hackberry, pecan, walnut, chittamwood, hawthorn, blackhaw, redcedar, elm, and other trees and shrubs produce food in winter and early in spring. Mulberry, roughleaf dogwood, and other plants that produce berries supply food and cover in warm weather. Wild grape and greenbrier provide browse for deer, and they also provide desirable forage for other animals. Switchgrass, ryegrass, sand lovegrass, bluestem, and other grasses provide food and cover in places where the forest is not too dense and grazing is moderate. Lespedeza, partridgepea, and other wild legumes are common in most areas. Also abundant are sunflower, ragweed, and other plants that produce seeds and forage.

Associations 3 and 6 along the Red River, and association 5 along Mud Creek and Walnut Bayou, provide good habitats for wildlife. The fields of corn and small grains are broken by areas of native vegetation, where the soils are not suitable for cultivation (fig. 20). The combination of food and cover is well suited to the needs of bobwhite and dove in these two associations. Generally there are a few hickory, pecan, elm, and Osage-orange trees, as well as indigobush, rose, and other shrubs. Johnsongrass, switchgrass, ryegrass, dropseed, and bluestem are common grasses, and deervetch, sunflower, bundleflower, and ragweed are other valuable plants.

Soil associations 4 and 7 do not provide as good habitats for wildlife as the other soil associations in the county, nor do they have as much wildlife. Hunting for game is only fair in these areas. Generally the soils are rolling, but they are strongly sloping to steep along the streams; the numbers of wildlife are greatest along the streams in the steeper areas. Some kinds of wildlife, however, live on the uplands in these associations in areas used mainly for range but where small grains and feed crops are also grown. In many of the eroded areas, native

grasses and some trees and shrubs make good habitats. Throughout the bottom lands and at the edges of the bottom lands in these two associations are many of the same kinds of trees and shrubs that grow along the streams in the uplands.

*Fish.*—Most fishing in this county is done in lakes and ponds, but each year some fish are taken from the Red River and from the lower reaches of its tributaries. The most common species of fish in the streams and lakes or ponds are largemouth bass, crappie, catfish, buffalo, carp, and sunfish, such as bluegill, redear, and goggle-eye. If the pond is deep enough and contains good water, it can be easily managed to produce a large amount of largemouth bass, bluegill, or redear. In the same ponds channel catfish grow well, but they seldom reproduce unless they are provided with special spawning facilities. Practices most commonly used to maintain yields are fertilizing the pond, controlling aquatic weeds, maintaining a steep shoreline, and eliminating shallow water. Intensive fishing, particularly of small sunfish, is necessary for the growth of the remaining fish. Otherwise the fish exhaust their supply of food and become stunted.

## Engineering Properties of Soils<sup>6</sup>

Some soil properties are of special interest to engineers because they affect the construction and maintenance of roads, airports, pipelines, building foundations, facilities for water storage, erosion control structures, drainage systems, and sewage disposal systems. The properties most important to the engineer are permeability to water, sheer strength, compaction characteristics, soil drainage, shrink-swell potential, texture, plasticity, and reaction. Depth of unconsolidated material, the height of the water table, and topography are also important.

The engineering interpretations reported here can be used for many purposes. It should be emphasized, however, that these interpretations may not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads and where the excavations are deeper than the depths of layers here reported. Even in these situations, the soil map is useful for planning more detailed field investigations and for suggesting the kinds of problems that may be expected.

Information in the report can be used by engineers to—

1. Make soil and land-use studies that will aid in selecting and developing sites for industries, businesses, residences, and recreational uses.
2. Make preliminary estimates of the engineering properties of soils that will help in planning agricultural drainage systems, farm ponds, irrigation systems, and diversion terraces.
3. Make preliminary evaluations of soil and ground conditions that will aid in selecting locations for highways, airports, pipelines, and cables and in planning detailed investigations of selected locations.
4. Locate probable sources of gravel and other construction material.
5. Correlate performance of engineering structures with soil mapping units to develop information

<sup>6</sup> By V. T. BERGSCHNEIDER, engineer, Soil Conservation Service.

for overall planning that will be useful in designing and maintaining the structures.

6. Determine the suitability of soils for cross-country movement of vehicles and construction equipment.
7. Supplement information obtained from other published maps, reports, and aerial photographs for the purpose of making maps and reports that can be used readily by engineers.
8. Develop other preliminary estimates for construction purposes that are pertinent to the particular area.

Some of the terms used by the soil scientist may be unfamiliar to the engineer, and some terms, such as soil, topsoil, sand, silt, and clay, may have special meanings in soil science. These terms, as well as other special terms, that are used in the soil survey report are defined in the Glossary at the back of this report. For more information on the various properties of the soils and for a more detailed description of their profiles, see the sections "Descriptions of the Soils" and "Genesis, Classification, and Morphology of the Soils."

### Engineering classification systems

Agricultural scientists of the U.S. Department of Agriculture classify soils according to texture.<sup>7</sup> In some ways this system of naming textural classes is comparable with the two systems used by engineers for classifying soils, that is, the system of the American Association of State Highway Officials (AASHO)<sup>8</sup> and the Unified system.<sup>9</sup> These systems are explained briefly in the following paragraphs.

**USDA Classification System.**—In the system used by the U.S. Department of Agriculture, the texture of the soil horizon (layer) depends on the proportional amount of the mineral particles of different sizes. The soil materials are classified as cobbles, gravel, sand, silt, and clay. Rarely is a soil made up of particles of only one size, but a particle size may be dominant in a soil so that the soil exhibits the characteristics of material composed of that particle size. For example, a soil consisting of 40 percent clay is called clay. Characteristically, it feels slick, sticky, and plastic when wet.

The texture of a soil is closely associated with workability, fertility, permeability, erodibility, and other important characteristics. Representative groups from finest to coarsest are (1) fine-textured soils (clay, silty clay, and sandy clay); (2) medium-textured soils (very fine sandy loam to silt); and (3) coarse-textured soils (loamy sand and sand).

**AASHO Classification System.**—Highway engineers use this system in grouping soils according to engineering properties as determined by performance of the soils in highways. In this system soils are placed in seven principal groups, designated as A-1 through A-7. The groups range from A-1, consisting of gravelly material of high

bearing capacity, to A-7, consisting of clayey material that has low strength when wet. Within each group the relative engineering value of the soil material is indicated by a group index number. Group indexes range from 0 for the best material to 20 for the poorest. The group index is shown in parentheses after the soil group symbol in table 7.

**Unified Classification System.**—In this system the soils are grouped on the basis of their texture and plasticity and their performance as material for engineering structures. The soil materials are identified as coarse grained, which are gravels (G) and sands (S); fine grained, which are silts (M) and clays (C); and highly organic soils (O). In this system clean sands are identified by the symbols SW and SP; sands that contain fines of silt and clay, by the symbols SM and SC; silts and clays that have a low liquid limit, by the symbols ML and CL; and silts and clays that have a high liquid limit, by the symbols MH and CH.

### Engineering interpretations of the soils

Three tables are given in this section. In the first (table 5), the soils are briefly described and the physical properties that affect engineering work are estimated. In the second (table 6), the suitability of the soils for various engineering uses is indicated. In the third (table 7), engineering test data are given for various soils that were sampled.

The estimated properties shown in table 5 are based on a typical profile for each soil series. If test data are available, the data shown are based on the test data obtained for the modal profile, that is, for the profile most typical of the soil as it occurs in the county. If tests were not made, the estimates shown are based on test data obtained from similar soils in this county and other counties or on past experience in engineering work. Since the estimates are for soils that have a modal profile, the soils in one series can be expected to vary considerably.

In the column that shows available water capacity are estimates, in inches per inch of soil depth, of the capillary water in the soil when that soil is wet to field capacity. When the soil is air dry, that is, when the wilting point of most common crops has been reached, this amount of water will wet the soil material to a depth of 1 inch without deeper percolation.

The column that gives reaction shows the degree of acidity or alkalinity of the soils in terms of pH values. The degrees of acidity or alkalinity, that is, the ranges in pH value and the terms used to express each range, are given in the Glossary.

The shrink-swell potential indicates the change in volume to be expected when the moisture content of the soil material changes. It is based on tests for volume change or on other physical properties of the soils that have been observed. As an example, the soil material from the A horizon of the San Saba clays is very sticky when wet, and it shrinks extensively when dry. Therefore, the shrink-swell potential for this horizon is given a rating of *high*. In contrast, the soil material from the A horizon of the Eufaula fine sands is structureless and nonplastic when either wet or dry. Therefore, the shrink-swell potential for this horizon is given a rating of *low*.

<sup>7</sup> SOIL SURVEY STAFF. SOIL SURVEY MANUAL. U.S. Dept. Agr. Handbook 18, 503 pp., illus. 1951.

<sup>8</sup> AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS. STANDARD SPECIFICATIONS FOR HIGHWAY MATERIALS AND METHODS OF SAMPLING AND TESTING. Ed. 8, 2 v., illus. 1961.

<sup>9</sup> WATERWAYS EXPERIMENT STATION, CORPS OF ENGINEERS. THE UNIFIED SOIL CLASSIFICATION SYSTEM. Tech Memo. 3-356, v. 1. 1953.

TABLE 5.—Brief description of the soils and their

Map symbol	Soil name	Description of soil and site	Depth from surface	Classification	
				USDA texture	Unified
Ax	Axtell loam.	A soil that has a medium-textured surface layer and a fine-textured subsoil and that formed mainly in sediments derived from the red beds. It is somewhat poorly drained, has poor internal drainage, and is occasionally flooded.	<i>Inches</i> 0 to 18 8 to 18 18 to 54	Loam..... Clay..... Silty clay loam.....	SM or ML.. CL or CH.. CL.....
Ba	Breaks-Alluvial land complex.	The breaks part consists of a steep land type on side slopes that have a gradient of less than 30 percent. Made up of soil material extremely variable in depth and texture. Fragments of limestone are strewn over the surface in most places, and large pieces of limestone edgerock occur in a few places. Alluvial land is a nearly level land type on valley floors. It is made up of medium-textured or fine-textured alluvial material that is deep or moderately deep; in a few places bedrock is at a depth of 3 feet or more.	( <sup>1</sup> )	Loam to clay.....	ML to CH..
Bv	Brewer-Vanoss complex.	The Brewer soil of this complex is somewhat poorly drained and has a medium-textured surface layer and a blocky, fine-textured subsoil. It formed in alluvium deposited mostly by the Red River and is above the level reached by overflow. This soil includes some areas that are moderately to severely saline, and Slickspots are common. For a description of the Vanoss soil, see Vanoss loam, 0 to 1 percent slopes.	0 to 8 8 to 65+	Loam..... Clay.....	ML or CL.. CL or CH..
ChB	Chickasha and Zaneis loams, 1 to 3 percent slopes.	The Chickasha soil of this complex is well drained and has a medium-textured surface layer and a moderately fine textured subsoil. It is in undulating to rolling areas of the uplands and formed in material derived from the red beds. For a description of the Zaneis soil, see Zaneis loam, 3 to 5 percent slopes.	0 to 15 15 to 80	Loam..... Clay loam.....	SM or ML.. CL.....
CmB	Claremore silt loam, 1 to 3 percent slopes.	A well-drained soil of the uplands. It has a medium-textured surface layer and a moderately fine textured subsoil. Limestone is at a depth of only 1½ to 2 feet.	0 to 10 10 to 19 19+	Silt loam..... Clay loam..... Limestone.....	ML or CL.. MH or CH.. ( <sup>2</sup> ).....
Cn	Clayey broken land.	A somewhat excessively drained, steep, fine textured or moderately fine textured land type of the uplands. It is shallow and has boulders strewn over the surface in many places.	0 to 10 10 to 30+	Clay to clay loam..... Silty clay.....	CL or CH.. CL or CH..
DcD	Denton clay, 5 to 8 percent slopes.	A deep soil that has a fine textured surface layer and a moderately fine textured subsoil. It formed in clayey material in undulating to rolling areas of the uplands. Depth to limestone is only 1 to 5 feet in some places.	0 to 12 12 to 40+	Clay..... Clay.....	CL..... CL or CH..
DdC	Denton-San Saba clays, 3 to 5 percent slopes.	For a description of the Denton soil, see Denton clay, 5 to 8 percent slopes, and for a description of the San Saba soil, see San Saba-Denton clays, 1 to 3 percent slopes.			

See footnotes at end of table.

*estimated physical and chemical properties*

Classification —Continued	Percentage passing sieve—			Available water capacity	Reaction	Shrink-swell potential	Permeability	Hydro- logic soil group			
	No. 4	No. 10	No. 200								
A-4-----	100	100	36 to 70	<i>Inches per inch of soil</i> 0.14	<i>pH</i> 5.0 to 6.0	Low-----	} Very slow-----	D			
A-7-----	100	100	80 to 90						0.17	5.0 to 6.0	Moderate to high-----
A-6 or A-7--	100	100	85 to 95						0.17	6.0 to 8.5	Moderate-----
A-4 or A-7--	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	0.12 to 0.17	5.0 to 8.0	Low to high-----	Slow to moderate-----	C			
A-4-----	100	100	55 to 85	0.14	6.0 to 6.5	Low-----	} Slow to moderate-----	D			
A-7-----	100	100	90 to 98						0.17	6.5 to 8.5	Moderate to high-----
A-4-----	100	100	40 to 70	0.14	6.5 to 7.5	Low-----	} Moderate to slow-----	C			
A-6-----	100	100	75 to 90						0.17	6.0 to 8.3	Moderate-----
A-4 or A-6--	100	100	75 to 90	( <sup>2</sup> )	5.5 to 6.5	Low to moderate-----	} Moderately slow-----	} C			
A-7-----	100	100	90 to 98						0.17	6.0 to 6.5	Moderate to high-----
( <sup>2</sup> )-----	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )						( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )-----
A-6 or A-7--	75 to 95	75 to 95	75 to 95	0.17	7.5 to 8.3	} Moderate to high-----	Slow-----	D			
A-7-----	90 to 98	90 to 98	90 to 98						0.17	7.5 to 8.3	
A-7-----	100	100	90 to 98	0.17	7.5 to 8.3	Moderate to high-----	} Slow-----	C			
A-7-----	100	100	90 to 98						0.17	8.0 to 8.3	High-----

TABLE 5.—*Brief description of the soils and their*

Map symbol	Soil name	Description of soil and site	Depth from surface	Classification	
				USDA texture	Unified
De	Denton-Tarrant complex.	The Tarrant soils of this complex are moderately fine textured or fine textured and are in areas of the uplands. They are only 5 to 15 inches thick over fractured limestone; small stones are scattered on the surface. For a description of the Denton soil, see Denton clay, 5 to 8 percent slopes.	<i>Inches</i> 0 to 15 15+	Clay loam..... Fragmented rock..	CL..... ( <sup>2</sup> ).....
DoB	Dougherty loamy fine sand, 0 to 3 percent slopes.	Deep, well-drained soils that have a coarse-textured surface layer and a moderately fine textured subsoil. Formed on uplands, mainly in old alluvium deposited by the Red River.	0 to 30 30 to 50 50 to 72+	Loamy fine sand ..	SM.....
DoC	Dougherty loamy fine sand, 3 to 5 percent slopes.			Sandy clay loam ..	SC or CL....
DoD	Dougherty loamy fine sand, 5 to 8 percent slopes.			Loamy fine sand...	SM.....
DuB2	Dougherty soils, 0 to 3 percent slopes, eroded.	Deep, well-drained, eroded soils that have a coarse-textured surface layer and a moderately fine textured subsoil. Formed on uplands in old alluvium deposited by the Red River.	0 to 8 8 to 27 27 to 54+	Loamy fine sand...	SM.....
DuC2	Dougherty soils, 3 to 5 percent slopes, eroded.			Sandy clay loam...	SC or CL....
				Loamy fine sand...	SM.....
DtB2	Durant clay loam, 1 to 3 percent slopes, eroded.	A soil that has a moderately fine textured surface layer and a blocky, fine-textured subsoil; formed on uplands in weakly calcareous, silty material weathered from clayey shale. Internal drainage is slow.	0 to 12 12 to 59+	Clay loam..... Clay.....	CL..... CL or CH....
DtB	Durant loam, 1 to 3 percent slopes.	A soil that has a medium-textured surface layer and a blocky, fine-textured subsoil; formed on uplands in weakly calcareous, silty material weathered from clayey shale. Internal drainage is slow.	0 to 9 9 to 70+	Loam..... Clay.....	ML or CL... CL or CH....
Et	Eroded loamy land.	Eroded loamy land is an eroded, moderately coarse textured to moderately fine textured land type underlain by moderately fine textured or fine textured material.	( <sup>1</sup> )	Fine sandy loam to clay.	( <sup>1</sup> ).....
EuC	Eufaula fine sand, hummocky.	A somewhat excessively drained, coarse-textured soil of the uplands; formed in old alluvium on benches along the Red River.	0 to 72+	Fine sand.....	SM.....
EuB	Eufaula fine sand, undulating.	A somewhat excessively drained soil of the uplands. It has a coarse textured surface layer and a moderately coarse textured subsoil. Formed in old alluvium on benches along the Red River.	0 to 42 42 to 55	Fine sand..... Fine sandy loam...	SM..... SM.....
Go	Gowen clay loam.	A deep, well-drained soil that is moderately fine textured; formed in a mixture of sediments of the prairies and loamy material of the uplands; on bottom lands that are occasionally flooded.	0 to 80	Clay loam.....	CL.....
Gm	Gowen loam.	A deep soil that has a medium-textured surface layer and a moderately fine textured subsoil; on bottom lands that are occasionally flooded.	0 to 40 40 to 72+	Loam..... Silty clay loam....	ML or CL... CL.....
Gw	Gowen soils, frequently flooded.	Soils made up of areas of intermingled Gowen clay loam and Gowen loam that are about 80 inches thick and are frequently flooded; Slickspot soils occur in a few places. For characteristics of these soils, other than hydrologic grouping, see Gowen clay loam and Gowen loam.	-----	-----	-----

See footnotes at end of table.



TABLE 5.—*Brief description of the soils and their*

Map symbol	Soil name	Description of soil and site	Depth from surface	Classification	
				USDA texture	Unified
LcB2	Labette clay loam, 1 to 3 percent slopes, eroded.	Deep, well-drained soil of the uplands. It has a moderately fine textured surface layer and a fine textured subsoil. Much of the surface layer has been lost through erosion. Depth to weathered limestone is about 4 feet in most places.	<i>Inches</i> 0 to 5 5 to 22 22 to 48 48+	Clay loam----- Clay loam----- Clay----- Limestone-----	CL----- CL----- CL or CH-- (?)-----
LbB	Labette loam, 1 to 3 percent slopes.	A deep, well-drained soil of the uplands. It has a medium-textured surface layer and a fine-textured subsoil. Depth to weathered limestone is about 4 feet in most places.	0 to 14 14 to 22 22 to 48 48+	Loam----- Clay loam----- Clay----- Limestone-----	ML or CL-- CL----- CL or CH-- (?)-----
Ld	Lela clay.	A nearly level, fine-textured soil of the bottomlands. It formed in alluvium washed from soils of the prairies. Somewhat poorly drained and has very slow internal drainage.	0 to 65+	Clay-----	MH or CH--
Ls	Lincoln soils.	Intermingled soils that have a surface layer that ranges from fine textured to coarse textured and that have a coarse-textured subsoil. They are on bottom lands. In most places these soils are excessively drained, but in local areas they are poorly drained. They are flooded occasionally.	0 to 8 8 to 56+	( <sup>1</sup> )----- Fine sand-----	( <sup>2</sup> )----- SM-SP----
Lv	Loamy alluvial land.	A fine-textured to moderately coarse textured land type along meandering streams on narrow bottom lands that are frequently flooded.	( <sup>1</sup> )	Fine sandy loam to clay loam.	( <sup>2</sup> )-----
Mr	Miller clay.	A deep, nearly level, fine-textured soil of the bottom lands; formed in fine-textured sediments derived from the red beds. Internal drainage very slow.	0 to 46+	Clay-----	MH or CH--
MsA	Minco fine sandy loam, 0 to 1 percent slopes.	Deep, well-drained, moderately coarse textured soils of the uplands; formed on old alluvial benches along the Red River.	0 to 65	Fine sandy loam---	SM or ML--
MsB	Minco fine sandy loam, 1 to 3 percent slopes.				
MsC	Minco fine sandy loam, 3 to 5 percent slopes.				
MtA	Minco loam, 0 to 1 percent slopes.	Deep, well-drained, medium-textured soil of the uplands; formed on old alluvial benches along the Red River.	0 to 80+	Loam-----	ML or CL--
Nc	Norwood clay loam.	Deep, well-drained, moderately fine textured soil on bottom lands that are occasionally flooded.	0 to 20 20 to 55	Clay loam----- Silty clay loam---	CL----- CL-----
Pr	Port loam.	Deep, well-drained, medium-textured soil on bottom lands that are occasionally flooded.	0 to 60	Loam-----	ML or CL--
Ps	Port soils, frequently flooded.	Deep, moderately well drained soils that are medium-textured and moderately fine textured and are on bottom lands that are frequently flooded.	0 to 50	Clay and clay loam.	CL-----
Pu	Pulaski fine sandy loam.	Deep, well-drained soil that is moderately coarse textured and is on bottom lands.	0 to 54 54 to 85+	Fine sandy loam--- Loamy fine sand---	SM or ML-- SM-----
Pv	Pulaski soils, frequently flooded.				

See footnotes at end of table.

estimated physical and chemical properties—Continued

Classification —Continued	Percentage passing sieve—			Available water capacity	Reaction	Shrink-swell potential	Permeability	Hydro- logic soil group
	ASSHO	No. 4	No. 10					
A-6----- A-6 or A-7-- A-7----- (2)-----	100 100 100 (2)	100 100 100 (2)	75 to 95 75 to 95 90 to 98 (2)	<i>Inches per inch of soil</i> 0.17 0.17 0.17 (2)	<i>pH</i> 6.0 to 6.5 6.5 to 7.5 7.5 to 8.3 (2)	Moderate----- Moderate----- High----- (2)-----	Moderately slow----- (2)-----	C
A-4----- A-6 or A-7-- A-7----- (2)-----	100 100 100 (2)	100 100 100 (2)	55 to 85 75 to 95 90 to 98 (2)	0.14 0.17 0.17 (2)	6.0 to 6.5 6.5 to 7.5 7.5 to 8.3 (2)	Low----- Moderate----- High----- (2)-----	Moderately slow----- (2)-----	C
A-7-----	100	100	90 to 98	0.17	7.5 to 8.5	High-----	Very slow-----	D
(2)----- A-3-----	(2) 100	(2) 100	(2) 5 to 10	(2) 0.05	(1) 7.0 to 8.3	Low-----	(2)----- {Slow to rapid-----	A
(2)-----	(2)	(2)	(2)	(2)	(2)	(2)-----	(2)-----	C
A-7-----	100	100	90 to 98	0.17	8.0 to 8.3	High-----	Very slow-----	D
A-4-----	100	100	40 to 60	0.12	6.0 to 7.5	Low-----	Moderate-----	B
A-4-----	100	100	70 to 90	0.14	6.0 to 7.5	Low-----	Moderate-----	B
A-6----- A-6-----	100 100	100 100	75 to 95 85 to 95	0.17 0.17	7.8 to 8.3 7.8 to 8.5	Moderate----- Moderate-----	Moderately slow-----	C
A-4-----	100	100	55 to 85	0.14	6.5 to 7.0	Low-----	Moderate-----	B
A-6 or A-7--	100	100	75 to 95	0.17	6.5 to 7.0	Moderate-----	Slow to moderately slow.	C
A-2 or A-4-- A-2-----	100 100	100 100	25 to 55 11 to 30	0.12 0.07	6.0 to 6.5 6.0 to 6.5	Low----- Low-----	Moderately rapid-----	B
A-2 or A-4--	100	100	25 to 55	0.12	6.0 to 6.5	Low-----	Moderately rapid-----	B

TABLE 5.—*Brief description of the soils and their*

Map symbol	Soil name	Description of soil and site	Depth from surface	Classification	
				USDA texture	Unified
ReB	Renfrow silt loam, 1 to 3 percent slopes.	Moderately well drained soil that has a medium-textured surface layer and a fine-textured subsoil; has slow internal drainage.	<i>Inches</i> 0 to 5 5 to 12 12 to 22 22 to 50	Silt loam----- Light clay----- Silty clay----- Heavy clay loam--	ML or CL-- CL----- CL or CH-- CL-----
Rk	Rocky broken land.	A land type that consists of steep escarpments of limestone and of the sloping areas associated with the escarpments. The limestone is underlain by soft sandstone. This land type is also influenced by limestone of the escarpments. Loose stones are on the surface below the escarpments.	( <sup>1</sup> )	Very fine sandy loam to clay loam.	( <sup>1</sup> )-----
Rn	Roebuck and Navasota clays.	Deep, poorly drained or somewhat poorly drained soils that are nearly level and are fine textured; formed in sediments derived from the red beds. On bottom lands that are frequently flooded for long periods.	0 to 72+	Clay-----	CH-----
Sy	Sandy broken land.	A steep, sandy land type that generally has slopes of more than 30 percent. It is on side slopes that are adjacent to the Red River in most places. Surface drainage is excessive, and internal drainage is rapid. Rocks crop out, and beds of clay are exposed in a few places.	( <sup>1</sup> )	Loamy sand to loam.	SM to ML--
SdB	San Saba-Denton clays, 1 to 3 percent slopes.	The Denton soil of this complex is on uplands and is deep and well drained. It has a fine-textured surface layer and subsoil. Depth to limestone is only 30 to 40 inches in many places.	0 to 11 11 to 40	Clay----- Clay-----	CL----- CL or CH--
		The San Saba soil is deep and moderately fine textured or fine textured, and it is on uplands. The surface layer is generally silty clay. This soil is moderately well drained and has very slow internal drainage.	0 to 45 45 to 65	Silty clay----- Clayey shale-----	CL or CH-- CH-----
Se	Slickspots and Saline land.	Droughty, fine-textured, somewhat poorly drained land types on bottom lands. The areas are flooded occasionally, and where swales occur, water is sometimes ponded. The water is absorbed slowly.	0 to 60+	Clay-----	CL to CH--
SbB	Stephenville fine sandy loam, 1 to 3 percent slopes.	Deep, well-drained soils that have a moderately coarse textured surface layer and a moderately fine textured subsoil and are on uplands. The surface layer becomes thinner as the slope increases.	0 to 18	Fine sandy loam---	SM-----
SbC	Stephenville fine sandy loam, 3 to 5 percent slopes.		18 to 36	Sandy clay loam---	SC or CL--
SbD	Stephenville fine sandy loam, 5 to 8 percent slopes.		36 to 80	Fine sandy loam---	SM-----
SbC2	Stephenville fine sandy loam, 1 to 5 percent slopes, eroded.				
Sw3	Stephenville-Windthorst complex, severely eroded.	For a description of the Stephenville soil, see the Stephenville fine sandy loams, and for a description of the Windthorst soils, see the Windthorst fine sandy loams.			
Ta	Tarrant soils.	Excessively drained, nearly level or gently sloping soils that are medium-textured or moderately fine textured. Hard limestone is at a depth of only 2 to 10 inches in these soils; the surface is strewn with stones, some of which are as much as 10 inches in diameter.	0 to 10 10+	Loam----- Limestone-----	ML or CL-- ( <sup>2</sup> )-----

See footnotes at end of table.

estimated physical and chemical properties—Continued

Classification —Continued	Percentage passing sieve—			Available water capacity	Reaction	Shrink-swell potential	Permeability	Hydro- logic soil group
	ASSHO	No. 4	No. 10					
A-4 -----	100	100	75 to 90	<i>Inches per inch of soil</i> 0.14	<i>pH</i> 6.5 to 7.5	Low -----	} Very slow -----	D
A-6 or A-7 --	100	100	85 to 95	0.17	6.5 to 7.0	Moderate -----		
A-7 -----	100	100	90 to 98	0.17	7.0 to 7.5	Moderate to high -----		
A-6 or A-7 --	100	100	75 to 95	0.17	7.8 to 8.3	Moderate to high -----		
(1) -----	(1)	(1)	(1)	(1)	(1)	(1) -----	(1) -----	C
A-7 -----	100	100	90 to 98	0.17	6.5 to 7.5	High -----	Very slow -----	D
A-2 or A-4 --	100	100	20 to 70	0.08 to 0.12	7.0 to 7.5	Low -----	Moderate to rapid --	B
A-7 -----	100	100	90 to 98	0.17	7.5 to 8.3	High -----	} Slow -----	} D
A-7 -----	100	90 to 100	90 to 98	0.17	8.0 to 8.3	High -----		
A-7 -----	100	100	90 to 98	0.17	7.8 to 8.3	High -----	} Very slow -----	}
A-7 -----	100	100	90 to 98	0.17	7.8 to 8.3	High -----		
A-6 to A-7 --	100	100	80 to 98	0.17	7.5 to 8.5	High -----	Very slow -----	D
A-2 -----	100	100	20 to 35	0.07	6.0 to 7.0	Low -----	} Moderate -----	B
A-6 -----	100	100	40 to 60	0.12	5.0 to 5.5	Low to moderate --		
A-2 or A-4 --	100	100	20 to 40	0.12	5.5 to 6.0	Low -----		
A-4 -----	100	100	55 to 85	0.14	8.0 to 8.3	Low -----	Moderately slow -----	} D
(2) -----	(2)	(2)	(2)	(2)	(2)	(2) -----	(2) -----	

TABLE 5.—*Brief description of the soils and their*

Map symbol	Soil name	Description of soil and site	Depth from surface	Classification	
				USDA texture	Unified
TfA	Teller fine sandy loam, 0 to 1 percent slopes.	Deep, well-drained soils that have a moderately coarse textured surface layer and a moderately fine textured subsoil; on uplands, generally in areas of high alluvial benches.	Inches 0 to 14 14 to 50 50 to 74+	Fine sandy loam...	SM.....
TfB	Teller fine sandy loam, 1 to 3 percent slopes.			Clay loam.....	CL or ML..
				Sandy clay loam..	SM-SC.....
TmA	Teller loam, 0 to 1 percent slopes.	Deep, well-drained soils that have a medium-textured surface layer and a moderately fine textured subsoil; on uplands, generally in areas of high alluvial benches.	0 to 8 8 to 100+	Loam.....	ML or CL..
TmB	Teller loam, 1 to 3 percent slopes.			Clay loam.....	CL or ML..
VaA	Vanoss loam, 0 to 1 percent slopes.	A deep soil of the uplands. It has a medium-textured surface layer and a moderately fine textured subsoil. This soil has good surface drainage and medium internal drainage.	0 to 24 24 to 65	Loam.....	ML or CL..
				Clay loam.....	CL.....
Vc	Vernon-Chickasha complex.	The Vernon soil of this complex is gently sloping to moderately sloping and has a moderately fine textured surface layer and a fine textured subsoil. It is on uplands and is shallow over beds of clay. Soil somewhat excessively drained and has slow or medium internal drainage. The Chickasha soil of this complex is well drained, moderately deep, and gently sloping to moderately sloping, and it has a medium-textured surface layer and a moderately fine textured subsoil. This soil is on uplands. Sandstone is at a depth of 2 to 3 feet in most places, but it crops out in some places.	0 to 6 6 to 15+	Clay loam.....	CL.....
				Clay.....	CL or CH..
			0 to 10 10 to 40 40+	Loam.....	ML or CL..
				Clay loam.....	CL.....
				Sandstone or clay..	(?).....
Vb	Vernon-Stephenville complex.	For a description of the Vernon soil, see the Vernon-Chickasha complex; for a description of the Stephenville soil, see the Stephenville fine sandy loams; and for a description of the Windthorst soils, which also occur in this complex, see the Windthorst fine sandy loams.			
Wa	Waurika loam.	A somewhat poorly drained, nearly level or gently sloping soil of the uplands. It has a medium-textured surface layer and a fine-textured subsoil.	0 to 10 10 to 45+	Loam.....	ML or CL..
				Clay.....	CH.....
Wb	Wet alluvial land.	A moderately coarse textured to moderately fine textured land type underlain by medium-textured to fine-textured material. It is on bottom lands, is very poorly drained, and has a high water table.	0 to 50+	Fine sandy loam to clay loam.	(1).....
WdC	Windthorst fine sandy loam, 1 to 5 percent slopes.	Deep, well-drained soils that have a moderately coarse textured surface layer and a fine-textured subsoil. On uplands, generally near the tops of ridges.	0 to 10 10 to 20 20 to 72	Fine sandy loam..	SM or ML..
WdC2	Windthorst fine sandy loam, 1 to 5 percent slopes, eroded.			Heavy clay loam..	CL.....
				Sandy clay.....	SC or CL..
Wn	Windthorst-Darnell complex.	The Darnell soil of this complex is somewhat excessively drained and is moderately coarse textured. It is on uplands. Sandstone is at a depth of only about 1 foot, but it crops out in some places. For a description of the Windthorst soil, see the Windthorst fine sandy loams.	0 to 12 12+	Fine sandy loam..	SM.....
				Sandstone.....	(?).....

See footnotes at end of table.



TABLE 5.—*Brief description of the soils and their*

Map symbol	Soil name	Description of soil and site	Depth from surface	Classification	
				USDA texture	Unified
WsD	Windthorst-Stephenville fine sandy loams, 5 to 12 percent slopes.	The soils of this complex have a fine-textured subsoil and are only about 8 inches thick over beds of sandy clay or over sandy shale. For a description of characteristics of the Windthorst soil, other than hydrologic grouping see the Windthorst fine sandy loams, and for a description of characteristics of the Stephenville soil, other than hydrologic grouping, see the Stephenville fine sandy loams.	<i>Inches</i>		
Ya	Yahola fine sandy loam.	A soil that has a moderately coarse textured surface layer in most places, but it has a medium-textured surface layer in some minor areas. In most places the subsoil is moderately coarse textured. Formed in stratified loam to sandy loam on bottom lands that are occasionally flooded. It is well drained and has rapid to medium internal drainage.	0 to 16 16 to 70	Fine sandy loam... Sandy loam.....	SM..... SM.....
ZaC	Zaneis loam, 3 to 5 percent slopes.	Well-drained soil that has a medium-textured surface layer and a moderately fine textured subsoil; formed in beds of sandy clay in undulating to rolling areas of the uplands.	0 to 6 6 to 11 11 to 36 36 to 53+	Loam..... Heavy loam..... Clay loam..... Sandy clay loam...	ML or CL... ML-CL... CL..... SC or CL...

<sup>1</sup> Variable.TABLE 6.—*Interpretations of*

Soil series and map symbol	Suitability as source of—				Soil features affecting—	
	Topsoil	Sand and gravel	Select grading material	Road fill	Highway location	Septic-tank filter fields
Axtell (Ax).....	Poor; does not support good growth of vegetation.	Unsuitable.....	Unsuitable; too clayey.	Poor; unstable when wet.	Poor internal drainage; nearly level.	Very slow permeability; subject to flooding.
Breaks-Alluvial land complex (Ba).	Poor; area is too limited in extent; extremely variable.	Unsuitable.....	Poor; area is too limited in extent.	Fair; much of the soil material has a high shrink-swell potential.	Steep; narrow valleys; depth to limestone is variable.	Slow to moderate permeability; shallow over bedrock; steep.
Brewer (Bv).....	Poor; thin surface layer underlain by heavy clay.	Unsuitable.....	Poor; clayey in most areas.	Poor; moderate to high shrink-swell potential; saline.	Poorly drained; nearly level.	Slow permeability; high water table in some seasons.
Chickasha (ChB,Vc).....	Good.....	Unsuitable.....	Fair.....	Fair to poor; unstable when wet.	Features are favorable.	Features are favorable.
Claremore (CmB).....	Poor; shallow over bedrock; stony in many places.	Unsuitable.....	Poor; soil material elastic; subsoil too clayey.	Poor; clayey material over limestone.	Limestone at a depth of about 1½ feet.	Bedrock near the surface; moderately slow permeability.

*estimated physical and chemical properties—Continued*

Classification —Continued	Percentage passing sieve—			Available water capacity	Reaction	Shrink-swell potential	Permeability	Hydro- logic soil group
	ASSHO	No. 4	No. 10					
				<i>Inches per inche of soil</i>	<i>pH</i>			C
A-4----- A-2 or A-4	100 100	100 100	36 to 50 20 to 40	0.12 0.07 to 0.12	8.0 to 8.3 8.0 to 8.3	Low----- Low-----	Moderately rapid-----	B
A-4----- A-4 or A-6-- A-6----- A-4 or A-6--	100 100 100 100	100 100 100 100	55 to 85 70 to 90 75 to 95 40 to 60	0.14 0.14 0.14 0.14	6.0 to 7.0 6.0 to 7.0 6.0 to 7.0 6.5 to 8.3	Low----- Low to moderate----- Moderate----- Low to moderate-----	Moderately slow-----	C

<sup>2</sup> Not estimated or not applicable.

*engineering properties of soils*

Soil features affecting—Continued						Soil cor- rosivity
Farm ponds		Agricultural drainage	Irrigation	Terraces and di- versions	Waterways	
Reservoir area	Embankment					
Banks unstable; turbid water; nearly level.	Poor stability; easily eroded.	Nearly level; poor internal drainage.	Nearly level; poor internal drain- age; low fer- tility.	Nearly level; poor stability; easily eroded; not arable.	Nearly level; easily eroded; droughty; low fertility.	Very high.
Deep natural storage area.	Limited material in some places; subject to cracking.	Well drained; not arable.	Not arable-----	Not arable-----	Steep; stony-----	Moderate.
Low seepage; turbid water.	Unstable soils; establishing vegetation is difficult.	Nearly level; very slow in- ternal drain- age; poor surface drain- age.	Very slow intake rate; thin sur- face layer.	Nearly level; areas of Slickspot soils are unstable.	Nearly level; con- tains areas of Slickspot soils; low fertility; droughty.	Very high.
Features are favorable.	Features are favorable.	Well drained----	Gently sloping; fairly thin surface layer.	Features are favorable.	Features are favorable.	Moderate.
Shallow over bed- rock; large amount of seepage.	Limited borrow material; high fills unstable.	Well drained----	Shallow over bed- rock.	Shallow over bed- rock.	Shallow over bed- rock; droughty.	Moderate.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbol	Suitability as source of—				Soil features affecting—	
	Topsoil	Sand and gravel	Select grading material	Road fill	Highway location	Septic-tank filter fields
Clayey broken land (Cn).	Poor; surface layer thin and clayey; stony in many places.	Unsuitable.....	Unsuitable; clayey; stony in many places.	Poor; highly plastic soil material.	Steep; unstable soil material.	Steep; slow permeability.
Darnell (Wn)-----	Poor; material limited.	Unsuitable.....	Poor; material limited; stony.	Fair to good; sandstone near the surface.	Rolling to steep; stony.	Shallow over bedrock; rolling to steep.
Denton (DcD, DdC, De, SdB).	Poor; clayey; stony in many places.	Unsuitable.....	Unsuitable; clayey material; stony.	Poor; moderate to high shrink-swell potential; unstable when wet.	Moderate to high shrink-swell potential; limestone at a depth of 2 to 5 feet in some places; nearly level to strongly sloping.	Slow permeability; shallow over bedrock.
Dougherty (DoB, DoC, DoD, DuB2, DuC2).	Poor; surface layer is easily eroded; subsoil has low fertility.	Unsuitable.....	Good throughout entire profile.	Good where slopes are stabilized.	Easily eroded; gently sloping to strongly sloping.	Features are favorable.
Durant (DtB, DtB2)---	Fair; soil material is somewhat clayey; surface layer is thin; has Slickspot soils in some places.	Unsuitable.....	Unsuitable; clayey material in most places.	Poor; high shrink-swell potential; Slickspot soils in some places; unstable when wet.	Slow internal drainage; unstable.	Very slow permeability.
Eroded loamy land (Et).	Poor; limited surface soil.	Unsuitable.....	Poor; areas of suitable material are spotty.	Poor to good; many different kinds of material.	Gently sloping to moderately sloping; well drained.	Very slow permeability.
Eufaula (EuB, EuC)---	Poor; sandy; low fertility.	Unsuitable.....	Fair; lacks binder.	Good where slopes are stabilized.	Gently sloping in some places; escarpments in other places; easily eroded.	Inadequate as a filter.
Gowen (Gm, Go, Gw)---	Good; entire profile is suitable, except in areas of Slickspot soils.	Unsuitable.....	Fair to unsuitable; fair where the surface layer is loam; unsuitable where the surface layer is clay loam.	Fair to poor; unstable when wet.	Frequently flooded in some places.	Subject to flooding; moderately slow permeability.
Labette (LbB, LcB2)---	Good.....	Unsuitable.....	Unsuitable; too clayey.	Poor; unstable when wet.	Gently sloping; underlain by weathered limestone; unstable subsoil.	Moderately slow permeability; shallow over bedrock.
Lela (Ld)-----	Poor; too clayey.	Unsuitable.....	Unsuitable; too clayey.	Poor; very high shrink-swell potential; unstable when wet.	Nearly level; very slow internal drainage; poor surface drainage; highly plastic.	Very slow permeability.

properties of soils—Continued

Soil features affecting—Continued						Soil cor-rosivity
Farm ponds		Agricultural drainage	Irrigation	Terraces and di-versions	Waterways	
Reservoir area	Embankment					
Depth to lime-stone extremely variable.	Area where bor-row material can be procured is limited; out-crops of rock.	Not arable; well drained.	Not arable.....	Not arable.....	Stony; low fertil-ity; establishing vegetation is difficult.	Moderate.
Depth limited by bedrock near the surface; moderate or large amount of seepage.	Areas where bor-row material can be procured are limited; easily eroded.	Not arable.....	Not arable.....	Not arable.....	Not arable.....	Low.
Outerops of lime-stone in some places.	Subject to crack-ing; unstable.	Well drained....	Slow intake rate; variable slopes.	Outerops of lime-stone in some places.	Outerops of lime-stone in some places; estab-lishing vegeta-tion is difficult.	Moderate.
Features are fa-vorable.	Easily eroded.....	Well drained....	Rapid intake rate; low fertility; subject to wind erosion.	Subject to wind erosion; low surface runoff.	Subject to wind erosion and eas-ily eroded by water; low fer-tility.	Moderate to high.
Turbid water.....	Unstable.....	Well drained....	Very slow intake rate; thin sur-face layer.	Areas of Slickspot soils are unsta-ble.	Areas of Slickspot soils are unsta-ble; droughty; establishing vegetation is difficult.	Moderate to high.
Large amount of silt received from higher areas.	Unstable soils in some places.	Well drained....	Not arable.....	Not arable.....	Low fertility; establishing vegetation is difficult.	Moderate to high.
Large amount of seepage.	Large amount of seepage; easily eroded.	Somewhat ex-cessively drained.	Rapid intake rate; low water-hold-ing capacity; low fertility.	Low surface run-off; subject to wind erosion.	Low fertility; sub-ject to wind erosion and gully erosion.	Low.
Features are fa-vorable.	Features are fa-vorable.	Well drained; nearly level; frequently flooded in some places.	Features are fa-vorable.	Nearly level.....	Nearly level; fre-quently flooded in some places.	Moderate.
Depth to bedrock is variable.	Limited borrow material in some places; subject to cracking.	Well drained....	Gently sloping; slow intake rate; thin sur-face layer.	Features are favorable.	Features are favorable.	Moderate.
Features are favorable.	Unstable.....	Nearly level; very slow in-ternal drain-age; poor sur-face drainage.	Very slow inter-nal drainage; very slow in-take rate.	Nearly level; sub-ject to cracking.	Nearly level; sub-ject to crack-ing.	High.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbol	Suitability as source of—				Soil features affecting—	
	Topsoil	Sand and gravel	Select grading material	Road fill	Highway location	Septic-tank filter fields
Lincoln (Ls)-----	Good to poor; good in loamy part of profile.	Good sand below a depth of 30 inches in most places.	Entire profile is good.	Good where slopes are stabilized.	Occasionally flooded; nearly level.	Subject to flooding; inadequate as a filter.
Loamy alluvial land (Lv).	Poor to good; must be selected locally.	Contains local deposits of gravel suitable for road surfacing.	Poor to good; must be selected locally.	Good to fair; variable material.	Frequently flooded.	Subject to flooding.
Miller (Mr)-----	Poor; fertile, but clayey.	Unsuitable-----	Unsuitable; too clayey.	Poor; high shrink-swell potential; unstable when wet.	Poorly drained; nearly level; highly plastic.	Very slow permeability.
Minco (MsA, MsB, MsC, MtA).	Good where the surface layer is loam; poor where the surface layer is fine sandy loam.	Unsuitable-----	Good where the surface layer is fine sandy loam; fair where the surface layer is loam.	Good; sloping areas of fine sandy loam must be stabilized.	Nearly level or gently sloping; well drained; easily eroded in some sloping areas.	Features are favorable.
Navasota (Rn)-----	Poor; too clayey.	Unsuitable-----	Unsuitable; too clayey.	Poor; high shrink-swell potential; unstable when wet.	Nearly level; frequently flooded; poorly drained; highly plastic.	Subject to flooding; very slow permeability.
Norwood (Nc)-----	Good-----	Unsuitable-----	Unsuitable; too clayey.	Poor; unstable when wet.	Nearly level; occasionally flooded.	Subject to flooding.
Port (Pr, Ps)-----	Good-----	Unsuitable-----	Fair; elastic material.	Good to fair; requires close control of moisture.	Nearly level; occasionally to frequently flooded.	Subject to flooding.
Pulaski (Pu, Pv)-----	Fair; somewhat sandy; low fertility.	Unsuitable-----	Good-----	Good if slopes are stabilized.	Nearly level; occasionally to frequently flooded.	Subject to flooding.
Renfrow (ReB)-----	Poor; suitable material is too limited.	Unsuitable-----	Unsuitable; too clayey.	Poor; moderate to high shrink-swell potential; unstable when wet.	Gently sloping; poor internal drainage.	Very slow permeability.
Rocky broken land (Rk).	Poor; shallow and stony.	Unsuitable-----	Poor; shallow over bedrock; stony.	Poor; mostly rock and clayey soil material.	Steep; outcrops of rock.	Steep rock escarpments.
Roebuck (Rn)-----	Poor; clayey; fertile.	Unsuitable-----	Unsuitable; too clayey.	Poor; high shrink-swell potential.	Frequently flooded; poorly drained; nearly level; unstable.	Subject to flooding; very slow permeability.

properties of soils—Continued

Soil features affecting—Continued						Soil cor-rosivity
Farm ponds		Agricultural drainage	Irrigation	Terraces and di-versions	Waterways	
Reservoir area	Embankment					
Large amount of seepage.	Large amount of seepage; easily eroded.	In some de-pressions drainage is needed; some areas are oc-casionally flooded.	Rapid intake rate; low water-holding capac-ity; some areas are occasionally flooded.	Nearly level; on bottom lands.	Nearly level; on bottom lands.	Low.
Features are favorable.	Features are favorable.	Well drained----	Consists of small broken areas; subject to dam-age by flooding.	Small areas-----	Small, narrow areas that are frequently flooded.	Moderate.
Features are favorable.	High shrink-swell potential; sub-ject to crack-ing; unstable.	Nearly level; very slow internal drainage.	Very slow intake rate; poor in-ternal drainage.	Nearly level; on bottom lands.	Nearly level; sub-ject to crack-ing.	High.
A large amount of seepage in some areas.	Easily eroded-----	Well drained----	Rapid intake rate; fair water-holding capacity.	Easily eroded by water and sub-ject to wind erosion.	Subject to wind erosion and easily eroded by water.	Low.
Features are favorable.	Low strength; subject to cracking.	Nearly level; poorly drained; fre-quently flooded.	Nearly level; very slow in-take rate; poor internal drain-age; frequently flooded.	Nearly level; sub-ject to crack-ing.	Nearly level; sub-ject to crack-ing; droughty.	High.
Features are favorable.	Features are favorable.	Well drained; occasionally flooded.	Features are favorable.	Nearly level-----	Nearly level-----	Moderate.
Features are favorable.	Features are favorable.	Well drained; frequently flooded in some places.	Occasionally to frequently flooded.	Nearly level-----	Nearly level; frequently flooded in some some places.	Moderate.
A large amount of seepage in some places.	Easily eroded; a large amount of seepage in some places.	Well drained; frequently flooded in some places.	Frequently flooded in some places; high in-take rate; low water-holding capacity.	On bottom lands; frequently flooded in some places.	Easily eroded; nearly level.	Moderate.
Turbid water-----	Features are favorable.	Moderately well drained in most places.	Slow intake rate; thin surface layer.	Features are favorable.	Droughty; sub-soil has low fertility.	Moderate.
Depth to lime-stone extremely variable; steep.	Area where bor-row material can be procured is limited in some places; outcrops of rock.	Not arable; well drained.	Not arable-----	Not arable-----	Stony-----	Low.
Features are favorable.	High shrink-swell potential; sub-ject to crack-ing.	Nearly level; very slow in-ternal drain-age; fre-quently flooded.	Very slow intake rate; frequently flooded.	Nearly level; on bottom lands; frequently flooded.	Nearly level; sub-ject to crack-ing.	High.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbol	Suitability as source of—				Soil features affecting—	
	Topsoil	Sand and gravel	Select grading material	Road fill	Highway location	Septic-tank filter fields
Sandy broken land (Sy).	Poor; variable texture; shallow over bedrock.	Unsuitable.....	Poor; limited material.	Good to fair....	Steep.....	Steep.....
San Saba (SdB, DdC)---	Poor; too clayey.	Unsuitable.....	Unsuitable; too clayey.	Poor; high shrink-swell potential.	Highly plastic; poor internal drainage.	Very slow permeability.
Slickspots and Saline land (Se).	Poor; clayey and saline.	Unsuitable.....	Unsuitable; clayey and saline.	Poor; high shrink-swell potential; unstable.	Occasionally flooded; poor internal drainage; unstable.	Very slow permeability; subject to flooding.
Stephenville (SbB, SbC, SbC2, SbD, Sw3, WsD, Vb).	Fair to poor; somewhat sandy; not fertile.	Unsuitable.....	Good.....	Good if material from all layers is mixed.	Gently sloping to moderately steep; road cuts easily eroded.	Features are favorable.
Tarrant (Ta, De)-----	Poor; material limited.	Unsuitable.....	Poor; material limited; stony.	Fair; limestone near the surface.	Limestone near the surface.	Shallow over limestone.
Teller (TfA, TfB, TmA, TmB).	Good in loamy layers; poor in sandy layers.	Unsuitable.....	Good in sandy layers; fair in loamy layers.	Good.....	Road cuts easily eroded.	Features are favorable.
Vanoss (VaA, Bv)-----	Good throughout the profile.	Unsuitable.....	Fair; elastic.....	Good.....	Road cuts easily eroded.	Moderate percolation rate.
Vernon (Vb, Vc)-----	Poor; too clayey.	Unsuitable.....	Unsuitable; too clayey.	Poor; highly plastic.	Highly plastic; poor internal drainage.	Very slow permeability; clayey shale in sloping areas.
Waurika (Wa)-----	Poor; heavy clay near the surface.	Unsuitable.....	Poor; surface layer limited; subsoil too clayey.	Poor; high shrink-swell potential; unstable.	Poor internal drainage; poor surface drainage in nearly level areas; lateral seepage around perimeter; highly plastic.	Very slow permeability; seasonal high water table.
Wet alluvial land (Wb).	Poor; low fertility; high water table.	Unsuitable.....	Poor; high water table.	Poor; high water table.	Nearly level; high water table.	High water table; subject to flooding.
Windthorst (WdC, WdC2, Wn, WsD, Sw3).	Poor; surface layer is somewhat sandy, thin, and low in fertility.	Unsuitable.....	Poor; soil material is elastic and is limited.	Poor; unstable when wet.	Gently sloping to moderately steep; lateral seepage along clay.	Slow permeability.
Yahola (Ya)-----	Poor; somewhat sandy; easily eroded.	Unsuitable.....	Good throughout profile.	Good where slopes are stabilized.	Occasionally flooded.	Subject to flooding.
Zaneis (ZaC, ChB)-----	Good.....	Unsuitable.....	Unsuitable.....	Poor; unstable when wet.	Features are favorable.	Moderately slow permeability.

properties of soils—Continued

Soil features affecting—Continued						Soil cor-rosivity
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways	
Reservoir area	Embankment					
Steep-----	Variable material..	Steep; not arable.	Steep; not arable..	Steep-----	Steep; sandy-----	Low.
Features are favorable.	Subject to crack- ing; subject to sliding in slop- ing areas.	Well drained----	Very slow intake rate.	Features are favorable.	Establishing vegetation is difficult.	Moderate.
Turbid water; nearly level.	Poor stability; saline soil.	Nearly level; occasionally flooded; poor internal drainage.	Not arable-----	Nearly level; not arable.	Nearly level; droughty.	Very high.
Features are favorable.	Easily eroded-----	Well drained----	Gently sloping to moderately steep; low fertility.	Features are favor- able; not arable in steeper areas.	Easily eroded; low fertility.	High.
Shallow over limestone.	Shallow over lime- stone; areas where borrow material can be procured are limited.	Not arable; well drained.	Not arable-----	Not arable-----	Stony; shallow over limestone.	Low.
Features are favorable.	Easily eroded-----	Well drained----	Features are favorable.	Features are favorable.	Subject to gully erosion.	Moderate.
Features are favorable.	Easily eroded-----	Well drained----	Features are favorable.	Nearly level-----	Subject to gully erosion.	Moderate.
Features are favorable.	High shrink-swell potential; estab- lishing vegeta- tion is difficult.	Not arable-----	Not arable-----	Not arable-----	Droughty; estab- lishing vegeta- tion is difficult.	Moderate.
Turbid water-----	Areas of Slickspot soils are com- mon; establish- ing vegetation is difficult; unstable.	Nearly level; very slow internal drainage.	Very slow intake rate; high water- holding capa- city; clay near the surface.	Nearly level; areas of Slick- spot soils are unstable.	Droughty; low fertility; con- tains areas of Slickspot soils.	High.
High water table..	Unstable; high water table.	High water table.	Not arable-----	Not arable-----	Not applicable---	Low.
Features are favorable.	Features are favorable.	Well drained----	Thin surface layer; not arable in steeper areas.	Features are favor- able, but steep and stony soils are not arable.	Hazard of erosion is severe; low fertility.	High.
Moderate or a large amount of seepage; banks unstable.	Easily eroded; large amount of seepage.	Well drained; occasionally flooded.	Occasionally flooded; moder- ate intake rate.	Nearly level-----	Occasionally flooded; nearly level.	Moderate.
Features are favorable.	Features are favorable.	Well drained----	Gently sloping; thin surface layer.	Features are favorable.	Features are favorable.	Moderate.

TABLE 7.—Engineering

[Tests performed by the Oklahoma Department of Highways in accordance with standard

Soil name and location	Parent material	Oklahoma report No.	Depth	Horizon	Shrinkage	
					Limit	Ratio
Claremore silt loam: 350 feet S. of corner of S½ sec. 27, T. 6 S., R. 1 E. (Modal profile)	Material weathered from ferruginous limestone of the Goodland formation.	SO-4757	<i>Inches</i> 0 to 10	A1-----	17	1. 75
		SO-4758	10 to 19	B2-----	11	1. 96
Denton clay: 400 feet W. and 50 feet N. of SE. corner of SW¼ sec. 3, T. 7 S., R. 2 E. (Modal profile)	Marl with interbedded limestone.	SO-4761	0 to 11	A1-----	13	1. 92
		SO-4762	11 to 16	B1-----	10	2. 02
		SO-4763	16 to 40+	C1-----	14	1. 93
Dougherty loamy fine sand: 500 feet N. of SW. corner of NW¼ sec. 14, T. 7 S., R. 2 W. (Modal profile)	Old sandy alluvium.	SO-4764	0 to 26	A-----	( <sup>4</sup> )	( <sup>4</sup> )
		SO-4765	26 to 45	B2-----	14	1. 88
		SO-4766	45 to 72+	C-----	15	1. 84
Durant loam: NW. corner of SW¼SW¼ sec. 28, T. 7 S., R. 2 E. (Modal profile)	Material weathered from limestone and interbedded clayey shale.	SO-4776	0 to 16	A-----	22	1. 69
		SO-4777	16 to 66	B-----	10	1. 98
		SO-4778	66 to 80+	C-----	10	2. 05
Eufaula fine sand: SW. corner of SE¼ sec. 26, T. 7 S., R. 2 W. (Modal profile)	Old sandy alluvium-----	SO-4755	0 to 55	A-----	( <sup>4</sup> )	( <sup>4</sup> )
		SO-4756	55 to 72+	B2-----	( <sup>4</sup> )	( <sup>4</sup> )
Minco loam: 500 feet W. and 50 feet S. of NE. corner of sec. 28, T. 7 S., R. 3 W. (Modal profile)	Old sandy sediments from the Red River.	SO-4767	0 to 22	A1-----	20	1. 68
		SO-4768	22 to 72	C-----	20	1. 70
		SO-4769	72 to 80+	D-----	16	1. 81
Navasota clay: NW¼NE¼ sec. 4, T. 7 S., R. 1 W. (Modal profile)	Alluvium-----	SO-4779	0 to 12	A1-----	10	2. 01
		SO-4780	12 to 72	C-----	9	2. 03
San Saba clay: 250 feet E. and 50 feet N. of SW. corner of NE¼ sec. 1, T. 7 S., R. 1 E. (Modal profile)	Material weathered from marl and interbedded thin layers of limestone.	SO-4759	0 to 30	A-----	11	2. 00
		SO-4760	30 to 65+	C1-----	9	2. 07
Teller loam: SW¼NW¼ sec. 36, T. 6 S., R. 1 E. (Modal profile)	Old sandy alluvium-----	SO-4773	0 to 8	A-----	20	1. 68
		SO-4774	8 to 40	B2-----	15	1. 85
		SO-4775	40 to 100+	C-----	19	1. 69
Windthorst fine sandy loam: NW¼NW¼ sec. 19, T. 6 S., R. 2 E. (Modal profile)	Weathered from sandstone and interbedded shale.	SO-4770	0 to 10	A-----	( <sup>4</sup> )	( <sup>4</sup> )
		SO-4771	10 to 60	B-----	11	1. 98
		SO-4772	60 to 72+	C-----	10	2. 04

<sup>1</sup> According to Designation: T 88-57, "Mechanical Analysis of Soils," in "Standard Specifications for Highway Materials and Methods of Sampling and Testing," pt. 2, Ed. 8 (1961), published by AASHTO. Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 mm. in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 mm. in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soils.

<sup>2</sup> Based on "The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes," AASHTO Designation M 145--

test data

procedures of the American Association of State Highway Officials (AASHO)]

Volume change from field moisture equivalent	Mechanical analysis <sup>1</sup>						Liquid limit	Plasticity index	Classification	
	Percentage passing sieve—			Percentage smaller than—					AASHO <sup>2</sup>	Unified <sup>3</sup>
	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074mm.)	0.05 mm.	0.005 mm.	0.002 mm.				
29 85	100 100	99 99	85 94	65 83	27 55	23 52	37 60	12 25	A-6(9)----- A-7-5(18)-----	ML-CL. MH.
56 77 52	100 95 93	99 93 87	94 88 82	82 81 76	37 43 39	32 36 30	43 53 43	16 19 16	A-7-6(11)----- A-7-5(14)----- A-7-6(11)-----	ML-CL. MH. ML-CL.
( <sup>4</sup> ) 15 6	100 100 100	97 97 98	29 37 31	17 28 20	5 19 13	4 17 12	( <sup>4</sup> ) 20 18	( <sup>4</sup> ) 4 1	A-2-3(0)----- A-4(0)----- A-2(0)-----	SM. SM-SC. SM.
10 63 64	<sup>5</sup> 96 ----- 100	95 100 99	85 94 94	63 81 82	17 45 50	14 40 45	28 47 55	4 23 31	A-4(8)----- A-7-6(15)----- A-7-6(19)-----	ML-CL. CL. CH.
( <sup>4</sup> ) ( <sup>4</sup> )	100 100	97 94	21 17	11 10	3 5	2 4	( <sup>4</sup> ) ( <sup>4</sup> )	( <sup>4</sup> ) ( <sup>4</sup> )	A-2-3(0)----- A-2-3(0)-----	SM. SM.
3 8 15	----- ----- 100	100 100 99	90 91 82	67 67 65	13 17 24	11 15 20	23 25 25	2 4 6	A-4(8)----- A-4(8)----- A-4(8)-----	ML. ML-CL. ML-CL.
73 76	100 100	99 99	95 91	93 85	63 54	53 45	60 58	30 33	A-7-5(20)----- A-7-6(20)-----	MH-CH. CH.
68 76	----- 100	100 99	95 96	82 86	44 50	40 46	47 61	20 34	A-7-6(13)----- A-7-6(20)-----	ML-CL. CH.
6 32 12	----- ----- -----	100 100 100	86 92 96	58 74 83	13 31 23	10 28 21	23 32 30	1 11 8	A-4(8)----- A-6(8)----- A-4(8)-----	ML. CL. ML-CL.
( <sup>4</sup> ) 61 61	100 100 100	99 99 99	53 78 80	33 59 63	7 39 36	5 36 33	( <sup>4</sup> ) 47 44	( <sup>4</sup> ) 23 22	A-4(4)----- A-7-6(15)----- A-7-6(14)-----	ML. CL. CL.

49. Oklahoma Department of Highways classification procedure further subdivides the AASHO A-2-4 subgroup into the following: A-2-3(0) when the plasticity index (PI) indicates nonplastic (NP); A-2(0) when PI is NP to 5; and A-2-4(0) when PI is 5 to 10.

<sup>3</sup> Based on the Unified Soil Classification System, Tech. Memo. No. 3-357, v. 1, Waterways Experiment Station, Corps of Engineers, March 1953. SCS and BPR have agreed that all soils having plasticity indexes within 2 points from A-line are to be given a borderline classification. Examples of borderline classifications obtained by this use are SM-SC, ML-CL, and MH-CH.

<sup>4</sup> Nonplastic.

<sup>5</sup> For sample No. SO-4776, 99 percent passed a No. 4 sieve and 100 percent passed a 3/4-inch sieve.

In table 5 permeability refers only to movement of water downward through undisturbed soil material. The estimates are for the soils in place and are based on soil structure and porosity. Estimates were not made where there was a plowpan, surface crusting, or other artificial restrictions to the movement of water in the soil. The numerical values, expressed in inches per hour for each rating, are given in the Glossary.

For the hydrologic soil groups, the entire thickness of the soil profile shown in the table is considered. The soils are classified in the four hydrologic groups—A, B, C, or D—on the basis of intake of water at the end of a storm of long duration. Before this storm, the soil must have been wet enough for swelling to have taken place and it must have lacked the protection of a plant cover. Group A consists mostly of sandy soils that have low runoff potential; group D consists mostly of clays that have high runoff potential. The runoff potential for soils in groups B and C is greater than that for soils in group A and less than that for soils in group D.

For some soils named in table 6, the basis for determining the suitability ratings and the soil features that affect engineering practices was information from table 7. For other soils, data from actual tests on similar soils or field experience with similar soils was used as a basis. Most of the soil features named as affecting engineering practices are detrimental or undesirable, but desirable features have also been given if they are of great importance. All of the practices named in table 6 are commonly used in this county.

For topsoil, normally only the surface layer of a soil is given a rating, and the rating given depends largely upon the texture and thickness of the surface layer. The thickness of the surface layer is important because it determines whether removing the material suitable for topsoil is economical or wise. Material for topsoil is suitable only if it can be worked into a good seedbed for seeding or sodding, but it must be clayey enough to protect steep areas from erosion.

The suitability of soil material for select grading material depends mostly on the grain size of the particles and on the kind of binding material. Soils that are mostly sand are good if a binder is added for cohesion. Clays are not suitable, because they compress under a load and rebound when unloaded.

For road fill, every kind of soil material is used. If sandy clay, sandy clay loam, and some other kinds of soil material are used, there are few problems in placing and compacting the material. Clay, however, has a high shrink-swell potential. It requires special compaction techniques and careful moisture control, both during and after construction. Sand compacts well but is difficult to confine. The ratings given in table 6 reflect the ease with which these problems are overcome.

Soil corrosivity correlates closely with the physical and chemical properties of the soils. Metal, concrete, and other structural materials corrode when they are buried in a soil, but a given material corrodes more rapidly in some soils than in others. The rate of corrosion depends on the characteristics of the soil. Untreated steel pipe was used to obtain the ratings for soil corrosivity shown in table 6.

Table 7 shows actual data from tests made by the State Highway Department on soil samples that were collected while the soil survey was taking place. Samples were

taken from selected soils in the county. Test data for some of the other soils have been published in other soil survey reports for counties in Oklahoma.

## ***Genesis, Classification, and Morphology of Soils***

The purpose of this section is to present the outstanding morphologic characteristics of the soils of Love County and to relate them to the factors of soil formation. Physical and chemical data are limited for these soils, and the discussion of soil genesis and morphology is correspondingly incomplete. The first part of the section deals with the environment of the soils; the second, with the classification of soils; and the third with the morphology of the soils.

### **Factors of Soil Formation**

Soil is produced by the action of soil-forming processes on material deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time the forces of soil development have acted on the soil material.

Climate and vegetation are the active factors of soil genesis. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and vegetation are conditioned by relief. The parent material also affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed for the changing of the parent material into a soil profile. The amount of time may be much or little, but some time is always required for horizon differentiation. Usually a long time is required for the development of distinct horizons.

The factors of soil genesis are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one unless conditions are specified for the other four. Many of the processes of soil development are unknown.

#### ***Parent material***<sup>10</sup>

The parent material of a soil greatly influences the characteristics of that soil. Soils formed in recent alluvium, for example, are likely to vary in such characteristics as color, texture, and structure because the parent material is variable. Other soils may be less variable in characteristics because they formed in material weathered from the underlying rocks.

The rocks that provided the parent material for some of the soils in this county are of different ages. Those nearest the surface are mainly of Lower Cretaceous age. Rocks of both Permian and Pennsylvanian ages occur in the western part of the county. The rocks of Permian and

<sup>10</sup> Mainly from BULLARD, FRED M., and REDFIELD, JOHN S. OIL AND GAS IN OKLAHOMA—LOVE AND MARSHALL COUNTIES. Okla. Geol. Survey Bul. 40, v. 3. March 1930.

Pennsylvanian ages in the southwestern part of the county are mostly covered by alluvium deposited by the Red River and Mud Creek. Rocks of Pennsylvanian age and older material of the Criner Hills and vicinity cover a small area near Overbrook in the northeastern part of the county. In a few places Goodland limestone crops out in areas of San Saba and Durant soils.

Trinity sand, which represents the Trinity division, underlies much of this county. It consists of beach sand or of near-shore deposits left by the waters of the Comanchean Sea, which encroached upon the land from the southeast. The basal member of this formation consists of beds of red shale and sandstone of Paleozoic age, similar to the material in the Permian red beds. Because of the slow transgression of the sea, the shale and sandstone were worn smooth. Upon their weathered surface, the Trinity sand was deposited in about the same position as that in which it now lies. The sand that blew along the shoreline of the Comanchean Sea probably provided part of the parent material for the Dougherty and Eufaula soils.

Trinity sand is extremely variable. It consists mainly of fine, noncoherent, white to yellow pack sand and of local coarse-textured conglomerate, but it contains a few lentils of clay and shale. It contains beds of red or blue shale or a thin layer of calcareous sandstone in a few places. Silicified or carbonized wood is abundant. The Conglomerate contains quartz pebbles that range from the size of a pea to 3 inches in diameter. The Windthorst and Stephenville soils formed mainly in material weathered from the Trinity formation.

Just above the Trinity sand are rocks of the Fredericksburg group, represented in this area by Goodland limestone. This limestone is white, semicrystalline, and massive, and it is about 25 feet thick. In places it has a gently sloping surface that has weathered to form the parent material of the Tarrant and Claremore soils. In other places throughout the county, this limestone crops out in a narrow, sinuous band and is mapped as Rocky broken land.

Above the Goodland limestone, is a layer of yellowish-green clay, about 35 feet thick. This is the Kiamichi formation. Near the top of the Kiamichi formation are two or three thin ledges of a hard, yellowish limestone made up mainly of oystershells. The San Saba and Denton soils and some soils of the Breaks-alluvial land complex formed in material derived from the Kiamichi formation.

The Duck Creek formation lies immediately above the Kiamichi clay. It consists of approximately 100 feet of limestone and of gray to bluish, calcareous shaly clay.

Just above the Duck Creek formation is Fort Worth limestone, which consists of 40 to 50 feet of alternating beds of white limestone and of bluish-gray shale. The Duck Creek and Fort Worth formations are in the trough of the Marietta syncline, and they occur in an oblong area that surrounds the town of Marietta. The Denton and Lobette soils and some soils of the Breaks-alluvial land complex formed mainly in material weathered from these two formations.

The Denton formation lies just above the Duck Creek formation. It consists of brownish-yellow clay that contains thin layers of brown, ripple-marked sandstone and lenses of sandstone. The top of the formation is marked by a layer, about 1 foot thick, of hard brownish-yellow sandy limestone made up mainly of oystershells similar to

those of the Kiamichi formation. The weathering of the soft clay beneath the breccia of hard shells allows slumping of the breccia. As a result of the slumping the breccia has broken into large slabs that stand at many different angles.

The Weno formation consists of yellowish-brown clay that contains thin lenses and layers of soft, yellow sand. The Weno formation, like the Denton, is in a roughly circular area in the trough of the Marietta syncline southeast of Marietta. The Durant and Waurika soils formed mainly in material weathered from the Denton and Weno formations.

### *Climate*

The climate of this county is continental. The summers are hot and are generally dry. As a rule, the winters are mild. The greatest amount of rain is received in spring, and only a small amount is received in fall and winter. Detailed information about the average temperatures and distribution of rainfall are given in the section "General Nature of the County" near the back of this report.

Climate has greatly influenced the soils of the county. The amount of precipitation is great enough that most of the medium-textured or moderately coarse textured soils in which internal drainage is medium or better support woody vegetation. Under woody vegetation, leaching takes place more rapidly than under grasses. As a result, an A2 horizon has developed in many of these soils. Leaching has also made most of the soils slightly to medium acid. Many of the moderately fine textured and fine textured soils that formed mainly in highly calcareous sediments have been leached until they now have a neutral or slightly acid surface layer.

Freezing and thawing have only slightly affected the weathering and formation of the soils because the soils are frozen for only short periods and to a depth of only a few inches. The high temperatures in summer and the mild climate in winter promote rapid decomposition of organic matter; thus, most soils contain less organic matter than similar soils in a cooler climate.

### *Plants and animals*

Grasses and other herbaceous plants, trees, and shrubs, micro-organisms, earthworms, and insects and various other forms of plant and animal life live on and in the soil. They are active agencies in soil-forming processes. The nature of the changes that these various agencies bring about depends, among other things, on the kinds of life and the life processes peculiar to each. The kinds of plants and animals that live on and in the soils are determined by environmental factors, including climate, parent material, relief, age of the soil, and the associated organisms. These factors are interrelated.

Climate and parent material probably affect the type of vegetation more than the other factors. In the parts of Love County where the parent material weathered mainly from sandstone, sandy shale, or alluvial material, trees and shrubs are the dominant vegetation in most places. Soils that are covered by this kind of vegetation for a long period of time generally have a distinct, light-colored A2 horizon. Under a cover of trees, the leaves that fall on the surface provide most of the organic matter that is returned to the soil. They remain on or near the surface, and as a result, organic matter is not incorporated deep into the

soil. The activity of micro-organisms, insects, and earthworms is limited mainly to the organic matter lying on the surface or immediately beneath the surface of the soil.

Where the parent material is too clayey or too calcareous for the growth of trees or where the moisture relationship is unfavorable for trees, the soils of this county generally support mid or tall grasses. Only on those soils that are salty, that are shallow over bedrock, or that contain a claypan, is the cover mostly short grasses. Where the soils are covered by grass, the roots of the grass are continually drying and are replaced by new ones. Through the decay of these roots, organic matter and plant nutrients are distributed deep in the soil. Therefore, soils formed under grass do not have a light-colored A2 horizon. In soils formed under grass, micro-organisms, insects, and earthworms are active throughout the profile.

### **Relief**

The relief of the soils ranges from nearly level to very steep. Relief modifies the effects of climate and vegetation. In some steep areas, for example in areas of Clayey broken land, much water runs off, and consequently geologic erosion keeps almost even pace with the weathering of rocks and the formation of soils. In such areas the soil material is constantly removed or is shifted, and it does not remain in place long enough for a profile of genetically related horizons to form.

On the other hand, many nearly level soils that formed in older parent material have genetically related horizons. An example is the claypan horizon in Waurika loam. A claypan is formed when clay accumulates in the subsoil over a long period of time. In many soils of depressions there is a light-grayish, thin horizon just above the claypan. The claypan absorbs water slowly, and as a result, most of the rainfall runs off.

The gently to moderately sloping soils have varying amounts of accumulated clay in their subsoil. The differences in the amount of clay are caused by differences in the texture of the parent material as well as differences in the slope.

Differences in slope generally affect temperature and the amount of moisture within the soil. Temperature and the amount of moisture within the soil, in turn, affect the type and amount of vegetation. The amount of runoff generally is greater on a steep slope than on a gentle one, and the velocity of the water is more rapid. The amount of runoff is influenced greatly, however, by the amount and kind of vegetation and by the texture of the soil.

### **Time**

Time is important for the development of a soil profile from parent material, but the development of a soil profile depends on the other four factors of soil formation as well. The degree to which a profile has developed depends on the intensity with which the different soil-forming factors have been active, on the length of time they have been active, and on the nature of the material from which the soils formed.

If the factors of soil formation have not operated long enough for the formation of distinct horizons, the soil is considered young, or immature. In contrast, soils that have been in place for a long time and that have approached equilibrium with their environment tend to have well-defined horizons and are considered mature. Waurika

loam, for example, is an old soil formed in material weathered from soft, calcareous shale of Lower Cretaceous age. During the process of its development, the shale weathered to clay loam, and a profile formed that was similar to that of Denton clay loam. Not much of the surface layer was lost through erosion of this nearly level soil. Over a long period of time, the clay in the surface layer was carried downward when water moved downward through the profile. The clay accumulated in the subsoil, and as a result, the profile became more like that of Durant loam. Over another long period of time, the subsoil became so dense, the internal drainage became so slow, and the water remained on the top of the subsoil so long that the color of the lower part of the surface layer became light grayish brown. The soil thus formed is classified as Waurika loam.

### **Classification and Morphology of Soils**

Soils are placed in narrow classes for the organization and application of knowledge about their behavior within farms, ranches, or counties. They are placed in broad classes for study and comparisons of large areas, such as continents. In the comprehensive system of soil classification followed in the United States, the soils are placed in six categories, one above the other. Beginning at the top, the six categories are order, suborder, great soil group, family, series, and type.

In the highest category, the soils of the whole country are grouped into three orders, whereas thousands of soil types are recognized in the lowest category. The suborder and family categories have never been fully developed and thus have been little used. Attention has been given largely to the classification of soils into soil types and series within counties or comparable areas and to the subsequent grouping of series into great soil groups and orders. Subdivisions of soil types into phases provide finer distinctions significant to soil use and management. Soil series, soil type, and soil phase are defined in the section "How This Soil Survey Was Made."

Classes in the highest category of the classification scheme are the zonal, intrazonal, and azonal orders. In the zonal order are those soils with evident, genetically related horizons that reflect the predominant influence of climate and living organisms in their formation. In the intrazonal order are soils that have evident, genetically related horizons that reflect the dominant influence of a local factor of topography or parent material over the effects of climate and living organisms. In the azonal order are soils that lack distinct, genetically related horizons, commonly because of youth, resistant parent material, or steep topography.

Table 8 gives the order and great soil group to which the soil series in the county belongs. It also shows the parent material of the soils in each series, and the relief, physiographic position, drainage, and native vegetation.

#### **Great soil groups**

In the zonal order in this county are the Red-Yellow Podzolic and Reddish Prairie great soil groups; in the intrazonal order are the Grumusol and Planosol great soil groups; and in the azonal order are the Alluvial and Lithosol great soil groups. Definitions of these great soil groups are given in the following paragraphs.

The Red-Yellow Podzolic great soil group consists of soils that have a thin surface layer of litter and acid humus; a thin organic-mineral A1 horizon; a thicker, light-colored, leached A2 horizon; a thick, red, yellowish-red, or yellowish-brown B horizon that shows some accumulation of clay and sesquioxides; and a fairly sandy C horizon. These soils formed under a deciduous, coniferous, or mixed forest in a humid, warm-temperate climate. In this county the soils of the Red-Yellow Podzolic great soil group are those of the Dougherty, Eufaula, Stephenville, and Windthorst series.

Soils of the Reddish Prairie great soil group have a dark reddish-brown, slightly acid to medium acid surface layer that grades through somewhat finer textured reddish material to the parent material. These soils formed mainly under tall grasses in a humid to subhumid, warm-temperate climate. In this county the soils of the Reddish Prairie great soil group are those of the Brewer, Chickasha, Claremore, Durant, Labette, Minco, Renfrow, Teller, Vanoss, and Zaneis series.

Grumusols are a group of soils that have a profile rather high in content of clay, relatively uniform in texture, and marked by signs of local soil movement resulting from shrinking and swelling as the soils become wet and then dry out. Many of these soils have a thick, dark A horizon over a limy C horizon. Others are uniform in general appearance, except for the signs of churning. These soils

formed in parent material that is high in content of clay or in content of alkaline material, or from rocks that provided abundant clay and alkaline material when they weathered. Soils of this group occur chiefly in a tropical or subtropical climate where wet and dry seasons alternate. In this county the soils of the Grumusol great soil group are those of the Denton, Lela, and San Saba series.

Planosols are a group of soils that have an eluviated surface layer underlain by a B horizon that is more strongly illuviated, cemented, or compacted than that of associated normal soils. These soils formed in nearly level upland areas under grass or forest vegetation in a humid or subhumid climate. In this county the Axtell and Waurika soils are in the Planosol great soil group.

The Alluvial great soil group consists of soils made up of transported and relatively recently deposited material, and characterized by a weak modification, or by no modification, of the original material by soil-forming processes. The Alluvial soils in this county are those of the Gowen, Lincoln, Miller, Navasota, Norwood, Port, Pulaski, Roebuck, and Yahola series.

Lithosols are soils that have little or no profile development. They consist mainly of partly weathered fragments of rock, of very shallow soils over rock, or of nearly bare rock. Most, but not all, Lithosols are rolling and steep; some are nearly level, and others are gently sloping to rolling.

TABLE 8.—The soil series of Love County classified by higher categories, and some of the factors that have contributed to the morphology of the soils.

ZONAL ORDER

Great soil group and soil series	Parent material	Relief and physiographic position	Drainage	Native vegetation
Red-Yellow Podzolic soils:				
Dougherty-----	Sandy alluvium or pack sand.	Nearly level to sloping; on high benches along the Red River and on the sides of valleys.	Well drained; slow runoff and medium internal drainage.	Oak trees with an understory of dwarf oaks and mid and tall grasses.
Eufaula-----	Alluvium, mainly of fine sand.	Gently sloping to moderately steep; in hummocky or undulating areas.	Somewhat excessively drained or excessively drained; slow runoff and rapid internal drainage.	Oak trees with an understory of dwarf oaks and mid and tall grasses.
Stephenville-----	Material weathered from soft sandstone.	Gently sloping to rolling; on the uplands.	Well drained; medium runoff, and medium internal drainage.	Oak and hickory trees with an understory of mid and tall grasses.
Windthorst-----	Sandy claybeds-----	Gently sloping to rolling; on the uplands.	Well drained; medium runoff, and medium internal drainage.	Oak trees with an understory of mid and tall grasses.
Reddish Prairie soils:				
Brewer-----	Silty clay alluvium-----	Nearly level; on benches high above the Red River.	Somewhat poorly drained; slow internal drainage.	Mainly short grasses, but some mid grasses.
Chickasha-----	Brownish material weathered from sandstone, and clay loam of the red beds.	Gently sloping; in gently rolling uplands or in slightly convex areas of the uplands.	Well drained; medium runoff; medium internal drainage.	Mid and tall grasses.
Claremore-----	Ferruginous limestone----	In gently sloping or slightly convex areas of the uplands.	Well drained; rapid runoff, and medium internal drainage.	Mid and tall grasses.
Durant-----	Material weathered from calcareous shale.	Gently sloping; mainly in concave areas in gently rolling uplands.	Moderately well drained; medium runoff and slow internal drainage.	Mid and tall grasses.

TABLE 8.—*The soil series of Love County classified by higher categories, and some of the factors that have contributed to the morphology of the soils—Continued*

## ZONAL ORDER—Continued

Great soil group and soil series	Parent material	Relief and physiographic position	Drainage	Native vegetation
Reddish Prairie soils—Continued				
Labette.....	Material weathered from limestone or from calcareous shale.	Gently sloping; mainly in slightly convex areas in the uplands.	Well drained; medium runoff and medium internal drainage.	Mid and tall grasses.
Minco.....	Sandy alluvium, mainly from the red beds.	Nearly level; mainly on high benches along the Red River.	Well drained; slow runoff and medium internal drainage.	Mid and tall grasses and a few oak, elm, and hickory trees.
Renfrow.....	Red, calcareous, clayey material weathered from the red beds.	Gently sloping; mainly in slightly convex areas in the uplands.	Moderately well drained; medium runoff and slow internal drainage.	Mid and short grasses.
Teller.....	Alluvium washed from sandy clay loams to clay loams.	Nearly level to gently sloping; on benches high above the Red River.	Well drained; medium runoff and medium internal drainage.	Mainly tall grasses, but some oaks, hickory trees, and elms.
Vanoss.....	Sandy clay loam alluvium.	Nearly level; on benches high above the Red River.	Well drained; medium runoff; medium internal drainage.	Mid and tall grasses.
Zaneis.....	Sandy clay of the red beds.	Gently rolling; mainly in slightly convex areas in the uplands.	Well drained; medium runoff and medium internal drainage.	Mid and tall grasses.

## INTRAZONAL ORDER

Grumusols:				
Denton.....	Material weathered from marl.	Gently sloping to moderately steep; in rolling uplands.	Well drained; medium runoff and medium internal drainage.	Mid and tall grasses.
Lela.....	Alluvium washed from clayey prairie soils.	Nearly level; on low benches along streams that drain deep clayey soils of the prairie.	Somewhat poorly drained; slow internal drainage.	Mid and tall grasses.
San Saba.....	Material weathered from calcareous clayey shale.	Gently sloping; mainly in slightly concave areas in the uplands.	Moderately well drained; medium runoff and slow internal drainage.	Mid and tall grasses.
Planosol:				
Axtell.....	Alluvium of sandy clay...	Nearly level; on low benches.	Somewhat poorly drained; very slow internal drainage.	Post oaks and mid and tall grasses.
Waurika.....	Material weathered from clayey shale.	Nearly level; mainly in slightly concave areas of the uplands.	Somewhat poorly drained; very slow internal drainage.	Mainly short grasses, but some mid grasses.

## AZONAL ORDER

Alluvial soils:				
Gowen.....	Loam to clay loam alluvium washed from soils of the prairie and from loamy timbered soils of the uplands.	Nearly level; on bottom lands and subject to occasional to frequent overflow.	Well drained; medium internal drainage.	Bottom-land hardwoods and an understory of mid and tall grasses.
Lincoln.....	Calcareous sandy alluvium, mainly from the red beds.	Nearly level; on bottom lands and subject to overflow.	Mainly somewhat excessively drained, but some areas excessively drained.	Ranges from cedar and short grasses to bottom-land hardwoods with an understory of mid and tall grasses.
Miller.....	Calcareous clayey alluvium, mainly from the red beds.	Nearly level; on bottom lands and subject to occasional overflow.	Moderately well drained; very slow internal drainage.	Bottom-land hardwoods and an understory of mid and tall grasses.

TABLE 8.—The soil series of Love County classified by higher categories, and some of the factors that have contributed to the morphology of the soils—Continued

AZONAL ORDER—Continued

Great soil group and soil series	Parent material	Relief and physiographic position	Drainage	Native vegetation
Alluvial soils—Continued				
Navasota-----	Clayey alluvium washed from soils underlain by red beds and from timbered soils.	Nearly level; on bottom lands and subject to overflow.	Poorly drained; very slow internal drainage.	Bottom-land hardwoods and an understory of mid and tall grasses.
Norwood-----	Calcareous loamy alluvium washed mainly from the red beds.	Nearly level; on bottom lands and subject to occasional overflow.	Well drained; medium internal drainage.	Bottom-land hardwoods and an understory of mid and tall grasses.
Port-----	Loamy alluvium, mainly from the red beds.	Nearly level; on bottom lands and subject to occasional overflow.	Well drained; medium internal drainage.	Bottom-land hardwoods and an understory of mid and tall grasses.
Pulaski-----	Sandy alluvium washed mostly from soils underlain by sandstone of Cretaceous age.	Nearly level; on bottom lands and subject to occasional to frequent overflow.	Well drained; medium internal drainage.	Bottom-land hardwoods and an understory of mid and tall grasses.
Roebuck-----	Neutral to calcareous clayey alluvium, mainly from the red beds.	Nearly level; on bottom lands and subject to frequent overflow.	Somewhat poorly drained; very slow internal drainage.	Bottom-land hardwoods and an understory of mid and tall grasses.
Yahola-----	Calcareous sandy alluvium, mainly from the red beds.	Nearly level; on bottom lands and subject to occasional overflow.	Well drained; rapid to medium internal drainage.	Bottom-land hardwoods and an understory of mid and tall grasses.
Lithosol:				
Darnell-----	Material weathered from hard sandstone.	Moderately sloping to very steep; on the crowns of hills or near the top of slopes.	Somewhat excessively drained; rapid runoff and medium internal drainage.	Blackjack and post oaks with mid and tall grasses growing between them.
Tarrant-----	Material weathered from limestone, mainly Goodland limestone of the Cretaceous period.	Mostly gently sloping; in areas above escarpments.	Excessively drained; medium to very rapid runoff and medium internal drainage.	Mostly short grasses, but some mid grasses.
Vernon-----	Material weathered from clayey shale or clayey material of the red beds.	Gently sloping to steep; in areas of rolling erosional uplands.	Somewhat excessively drained; rapid runoff and medium internal drainage.	Short and mid grasses.

**Descriptions of the soil series**

In the following pages the soil series in the county are described in alphabetic order. For each series a detailed description of a typical profile is given.

**AXTELL SERIES**

In the Axtell series are deep, somewhat poorly drained soils that have a light-colored, medium-textured to moderately coarse textured surface layer and a fine-textured subsoil that has blocky structure. These soils formed in old clayey alluvium, mainly from the red beds. The native vegetation was mostly a cover of post oak with mid and tall grasses growing between the trees, but it included a few other oaks and other hardwoods.

The Axtell soils have a more clayey B2t horizon than the Windthorst soils. Also they occur on low benches instead of on the more rolling uplands.

A representative profile of Axtell loam 700 feet west and 650 feet south of the northeast corner of the SE<sup>1</sup>/<sub>4</sub> of section 10, T. 7 S., R. 3 W.:

A1—0 to 4 inches, grayish-brown (10YR 5/2) light loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and fine, granular structure; friable when moist, slightly hard when dry; roots numerous; pH 5.5; clear boundary; 3 to 8 inches thick.

A2—4 to 8 inches, pale-brown (10YR 6/3) light loam, brown (10YR 4/3) when moist; structureless; friable when moist, slightly hard when dry; pH 5.5; abrupt boundary; 3 to 10 inches thick.

B2t—8 to 18 inches, reddish-brown (2.5YR 5/4) light clay, reddish brown (2.5YR 4/4) when moist; peds coated with films of dark reddish brown (2.5YR 3/4); strong, medium to fine, subangular blocky structure; very firm when moist, extremely hard when dry; roots few; pH 5.1; clear boundary; 8 to 20 inches thick.

B31—18 to 28 inches, yellowish-red (5YR 5/6) light silty clay loam, yellowish red (5YR 4/6) when moist; weak, medium to fine, blocky structure; friable when moist, hard when dry; pH 8.0 (moderately alkaline but non-calcareous); clear boundary; 0 to 15 inches thick.

B32—28 to 44 inches, reddish-brown (5YR 5/4) heavy silty clay loam, reddish brown (5YR 4/4) when moist; structureless; extremely firm when moist, extremely hard when dry; pH 8.0; many splotches where crystals occur below a depth of 34 inches; clear boundary; 0 to 20 inches thick.

IIC—44 to 54 inches +, reddish-brown (5YR 4/4) silty clay, dark reddish brown (5YR 3/4) when moist; strong, medium, blocky structure; extremely firm when moist, extremely hard when dry; few splotches where crystals occur; calcareous.

The A1 and A2 horizons are fairly uniform in texture and color, but the color of the B2t horizon ranges from reddish brown (2.5YR 5/4) to dark reddish brown (5YR

3/4). The texture of the soil material below the B2t horizon ranges from clay to fine sandy loam.

#### BREWER SERIES

In the Brewer series are dark-colored, somewhat poorly drained soils that have a medium-textured surface layer and a grayish, fine-textured, blocky subsoil. These soils formed in alluvium under a cover of mostly short and some mid grasses. They are mostly along the Red River but lie above the level reached by overflow.

The profile of the Brewer soils is similar to that of the Waurika soils, but the Brewer soils formed in alluvium instead of residual material and do not have an A2 horizon. In many places the Brewer soils occur with Vanoss soils. The Brewer soils have a more clayey, plastic B2t horizon than the Vanoss soils.

A representative profile of Brewer loam 600 feet west and 250 feet south of the northeast corner of the SE $\frac{1}{4}$  of section 1, T. 8 S., R. 1 E.:

- A1—0 to 8 inches, grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) when moist; massive; friable when moist, hard when dry; pH 6.2; abrupt boundary; 5 to 10 inches thick.
- B2t—8 to 34 inches, dark-gray (10YR 4/1) light clay, very dark gray (10YR 3/1) when moist; moderate, medium and fine, blocky structure; very firm when moist, very hard when dry; faintly mottled with brown; pH 7.5; gradual boundary; 12 to 30 inches thick.
- B3—34 to 50 inches, grayish-brown (2.5Y 5/2) light clay, dark grayish brown (2.5Y 4/2) when moist; moderate, medium and fine, blocky structure; very firm when moist, very hard when dry; faintly mottled with olive yellow; few calcareous concretions; gradual boundary; 15 to 20 inches thick.
- C—50 to 65 inches +, light yellowish-brown (2.5Y 6/4) clay, light olive brown (2.5Y 5/4) when moist; very firm when moist, extremely hard when dry; distinctly mottled with gray and brown; few small splotches where calcareous material occurs.

The texture of the A1 horizon ranges from loam to silt loam, and the color of that horizon ranges from gray (10YR 5/1) to grayish brown (10YR 5/2) or dark grayish brown (10YR 4/2). The texture of the B2t horizon ranges from light to heavy clay, and the color of that horizon ranges from dark gray (10YR 4/1) to very dark grayish brown (10YR 3/2). In places Slickspot soils occupy as much as 5 percent of an area.

#### CHICKASHA SERIES

The Chickasha series consists of deep, well-drained, dark-colored soils that have a medium-textured surface layer and a brownish, moderately fine textured subsoil. These soils formed under a cover of native mid and tall grasses in material weathered from sandy shale or weakly consolidated sandstone of the red beds. The Chickasha soils occur with the Zaneis soils. Their B2t horizon is more brownish and less reddish than that of the Zaneis soils.

A representative profile of Chickasha loam 1,850 feet south of the northeast corner of the NW $\frac{1}{4}$  of section 20, T. 6 S., R. 3 W., and 50 feet west of the road:

- A1—0 to 12 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, medium to fine, subangular blocky structure; friable when moist, hard when dry; numerous pores; pH 6.0; gradual boundary; 8 to 18 inches thick.

B1—12 to 20 inches, dark yellowish-brown (10YR 4/4) clay loam, dark yellowish-brown (10YR 3/4) when moist; faint, fine mottles of yellowish red (5YR 4/6); few small cherty pebbles 2 to 5 millimeters in diameter; few small iron concretions 2 to 5 millimeters in diameter; weak, medium, subangular blocky structure; friable when moist, hard when dry; pH 6.0; gradual boundary; 5 to 11 inches thick.

B2t—20 to 36 inches, brownish-yellow (10YR 6/6) clay loam, yellowish brown (10YR 5/6) when moist; distinctly mottled with common, fine, yellowish-red (5YR 5/8) mottles; weak to moderate, medium, subangular blocky structure; friable when moist, hard when dry; few small pebbles 2 to 5 millimeters in diameter; pH 6.5; gradual boundary; 10 to 30 inches thick.

C1—36 to 52 inches, brownish-yellow (10YR 6/8) clay loam, yellowish brown (10YR 5/8) when moist; prominent coarse mottles of brown (10YR 5/3) in 30 to 50 percent, by volume, of the soil material; friable when moist, hard when dry; few iron concretions; pH 6.5; weakly consolidated, weathered heavy clay loam from the Permian red beds.

C2—52 to 80 inches +, light brownish-gray (10YR 6/2) clay loam; prominent medium mottles of brown (10YR 5/3) and strong brown (7.5YR 5/6); pH 7.5.

In many places in cultivated fields, the texture of the surface layer is fine sandy loam instead of loam, as the result of winnowing by wind. The color of the surface layer ranges from brown (7.5YR 5/2) to dark yellowish brown (10YR 4/4) or dark grayish brown (10YR 4/2). The texture of the B horizons ranges from sandy clay loam to clay loam. In some places the value and chroma are slightly higher than those shown in the profile described.

#### CLAREMORE SERIES

In the Claremore series are dark-colored, well-drained soils that have a medium-textured surface layer and a moderately fine textured, friable subsoil. These soils are shallow over limestone, and they formed in material weathered from ferruginous limestone of the Cretaceous period. The native vegetation was a cover of mid and tall grasses.

The Claremore soils have a less clayey, more friable B2t horizon and a thinner solum than the Labette soils. They occur with the Tarrant soils, but they have a thicker solum than those soils.

A representative profile of Claremore silt loam 50 feet east and 450 feet south of the northwest corner of SW $\frac{1}{4}$  SE $\frac{1}{4}$  of section 27, T. 6 S., R. 1 E.:

A1—0 to 10 inches, reddish-brown (5YR 4/3) silt loam, dark reddish brown (5YR 3/3) when moist; moderate, medium and fine, granular structure; friable when moist, hard when dry; numerous roots; many worm casts; pH 6.0; gradual boundary; 7 to 12 inches thick.

B2t—10 to 19 inches, reddish-brown (2.5YR 4/4) heavy clay loam, dark reddish brown (2.5YR 3/4) when moist; moderate, medium and fine, subangular blocky and fine granular structure; friable when moist, very hard when dry; many roots; many worm casts; pH 6.1; clear boundary; 6 to 20 inches thick.

R—19 inches +, white ferruginous limestone.

The texture and color of the A1 and B2t horizons are fairly uniform, but the thickness of the solum varies greatly within short distances. In most places the solum is about 19 inches thick, but it is more than 30 inches thick in a few places.

#### DARNELL SERIES

The Darnell series consists of light-colored, somewhat excessively drained soils that have a moderately coarse

textured surface layer and are shallow over sandstone. These soils formed over hard sandstone under a cover of blackjack and post oaks with an understory of mid and tall grasses. The Darnell soils of this county have a few large sandstone boulders on the surface. In a few places in Lake Murray State Park, sandstone crops out in ridges.

The Darnell soils occur with Stephenville and Windthorst soils. Their solum is thinner than those of these associated soils.

A representative profile of Darnell fine sandy loam 400 feet southeast of the intersection of Scenic Highway 77 and the Buzzards Roost Picnic Area road and 50 feet north of the road in section 4, T. 6 S., R. 2 E.:

A1—0 to 6 inches, grayish-brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium and fine, granular structure; very friable when moist, soft when dry; many roots; few cherty pebbles; pH 6.5; clear boundary; 2 to 8 inches thick.

A2—6 to 12 inches, very pale brown (10YR 7/3) fine sandy loam, pale brown (10YR 6/3) when moist; granular structure; friable when moist, soft when dry; contains many fragments of sandstone ranging from 1 to 6 centimeters in diameter; pH 6.0; gradual boundary; 4 to 8 inches thick.

R—12 to 20 inches +, sandstone.

The color of the surface layer ranges from grayish brown (10YR 5/2) to dark brown (10YR 3/3).

#### DENTON SERIES

The Denton series is made up of deep, very dark gray to nearly black soils that are well drained and have a moderately fine textured or fine textured surface layer. These soils formed in calcareous clayey material weathered from marl of the Cretaceous period. Many of the areas, however, are underlain by limestone, and small pieces of limestone are on the surface in some places. The native vegetation was a cover of mid and tall grasses.

The Denton soils are better drained and are more brownish and less grayish than the San Saba soils. Also, their structure is more granular.

A representative profile of Denton clay 400 feet west and 50 feet north of the southeast corner of the SW $\frac{1}{4}$  of section 3, T. 7 S., R. 1 E.:

A1—0 to 11 inches, very dark gray (10YR 3/1) light clay, black (10YR 2/1) when moist; granular structure; plastic when wet, hard when dry; calcareous; clear boundary; 8 to 17 inches thick.

AC—11 to 16 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) when moist; about 20 percent, by volume, grayish-brown (10YR 5/2), partly weathered clayey shale; moderate, medium, subangular blocky structure; very firm when moist, plastic when wet, hard when dry; highly calcareous; clear boundary; 4 to 10 inches thick.

C—16 to 40 inches +, light yellowish-brown (10YR 6/4) light clay, yellowish brown (10YR 5/4) when moist, grading to very pale brown (10YR 8/3) at a depth of about 40 inches; granular to moderate, medium and fine, subangular blocky structure; friable when moist, sticky when wet; highly calcareous.

The color of the A1 horizon is fairly uniform, but it ranges from very dark gray (10YR 3/1) to black (10YR 2/1). The texture of the surface layer ranges from clay loam to clay. In a few places small fragments of limestone are on the surface. The solum of this soil on the steeper slopes is 5 to 8 inches thinner than that for which a profile is described.

#### DOUGHERTY SERIES

In the Dougherty series are deep, light-colored, well-drained soils that have a coarse-textured surface layer and a moderately fine textured subsoil. These soils formed mainly in old alluvium or pack sand under a cover of oaks with an understory of dwarf oaks and mid and tall grasses.

The Dougherty soils have thinner A horizons and a less sandy B2t horizon than the Eufaula soils. They are more sandy than the Stephenville soils.

A representative profile of Dougherty loamy fine sand 500 feet north of the southwest corner of NW $\frac{1}{4}$  of section 14, T. 7 S., R. 2 W.:

A1—0 to 7 inches, grayish-brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) when moist; single grain; very friable when moist, soft when dry; numerous roots; pH 7.0; clear boundary; 5 to 12 inches thick.

A2—7 to 26 inches, light-brown (7.5YR 6/4) light loamy fine sand, brown (7.5YR 5/4) when moist; single grain; very friable when moist, soft when dry; many roots; pH 5.5; gradual boundary; 10 to 30 inches thick.

B2t—26 to 45 inches, yellowish-red (5YR 5/6) light sandy clay loam, yellowish red (5YR 4/6) when moist; weak, prismatic structure that breaks to medium and fine subangular blocky; friable when moist, hard when dry; few roots; pH 5.5; diffuse boundary; 15 to 30 inches thick.

C—45 to 72 inches +, brownish-yellow (10YR 6/6) loamy fine sand, yellowish brown (10YR 5/6) when moist; single grain; very friable when moist, soft when dry; pH 6.0.

The texture of the A1 horizon is fairly uniform, but the color ranges from light yellowish brown (10YR 6/4) to grayish brown (10YR 5/2). The color is yellowish red (5YR 5/6) in fields where there has been considerable erosion, because part of the B2t horizon has been mixed into the A horizon by tillage. The texture of the B2t horizon ranges from fine sandy loam that is sticky when wet to sandy clay loam. The color of the B2t horizon ranges from strong brown (7.5YR 5/8) to yellowish red (5YR 4/6); the areas where the B2t horizon are more yellowish are in the northern part of the county.

#### DURANT SERIES

The soils of the Durant series are dark-colored, deep, moderately well drained soils that have a medium-textured or moderately fine textured surface layer. They formed in material weathered from weakly calcareous silty shale of the Cretaceous period. The native vegetation was tall and mid grasses.

The Durant soils have a less distinct boundary between the A and B horizons than do the Waurika soils. They are more grayish and have a more blocky, less friable B2t horizon than the Labette soils. The Durant soils have a lighter colored, thinner A1 horizon than the San Saba soils, and they also have a well-defined B2t horizon that is lacking in the San Saba soils.

A representative profile of Durant loam 1,200 feet north and 100 feet east of the southwest corner of section 13, T. 7 S., R. 2 E.:

A1—0 to 9 inches, dark grayish-brown (10YR 4/2) heavy loam, very dark brown (10YR 2/2) when moist; in cultivated areas the uppermost 5 inches is massive; very hard when dry; grades from strong, thin, platy structure in plowsole to very weak granular structure below; pH 6.0; gradual boundary; 5 to 12 inches thick.

- AB—9 to 12 inches, dark grayish-brown (10YR 4/2) heavy clay loam, very dark grayish brown (10YR 3/2) when moist; strong, medium, blocky structure; very firm when moist, very hard when dry; pH 6.5; clear boundary; 2 to 4 inches thick.
- B21t—12 to 14 inches, dark-brown (7.5YR 4/2) clay, dark brown 7.5YR 3/2) when moist; weak, very fine, blocky structure; extremely hard when dry; continuous clay skins; pH 6.5; gradual boundary; 2 to 4 inches thick.
- B22t—14 to 33 inches, brown (7.5YR 5/3) clay, brown (7.5YR 4/3) when moist; common fine mottles of reddish brown or yellowish red and some gray streaks; at a depth of about 21 inches, the streaks are reddish brown (2.5YR 5/3) or (2.5YR 4/3) when moist, and there are fewer reddish mottles; moderate to weak, medium, blocky structure; very firm when moist, extremely hard when dry; continuous clay skins; pH 7.0; diffuse boundary; 15 to 30 inches thick.
- B3—33 to 70 inches +, yellowish-brown (10YR 5/4) clay, dark yellowish brown (10YR 4/4) when moist; becomes light yellowish brown at a depth of about 50 inches, and there are spots and streaks of strong brown; in the upper part of the horizon are many iron concretions and many hard and soft calcareous concretions, but the soil mass is noncalcareous; the lower part is calcareous.

The texture of the A1 horizon ranges from light silt loam or loam to light clay loam. The color of the A1 horizon ranges from grayish brown (10YR 5/2) to very dark grayish brown (10YR 3/2). The color of the B2t horizon ranges from hue 7.5YR to 10YR of dark brown mottled with yellowish brown, to grayish brown or brown if the mottles are absent. In a few places there are areas of Slickspot soils, mainly in the more gently sloping areas.

#### EUFULA SERIES

In the Eufaula series are deep, somewhat excessively drained or excessively drained soils that are light colored and coarse textured. These soils formed in old alluvium or pack sand under a cover of oaks with an understory of dwarf oaks and mid and tall grasses.

The Eufaula soils have thicker A horizons than the Dougherty soils. Also their B horizons are less clayey.

A representative profile of Eufaula fine sand, undulating, 100 feet south of the northwest corner of the NE $\frac{1}{4}$  of Section 21, T. 7 S., R. 2 W.:

- A1—0 to 6 inches, dark grayish-brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; very friable when moist, slightly hard when dry; many roots; pH 6.5; clear boundary; 4 to 10 inches thick.
- A2—6 to 38 inches, pink (7.5YR 7/4) fine sand, brown (7.5YR 5/4) when moist; single grain; very friable when moist, loose when dry; pH 6.5; diffuse boundary; 25 to 45 inches thick.
- B1—38 to 42 inches, reddish-yellow (5YR 6/6) loamy fine sand, yellowish red (5YR 5/6) when moist; structureless; very friable when moist, soft when dry; pH 6.5; clear boundary; 2 to 8 inches thick.
- B2t—42 to 55 inches +, yellowish-red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) when moist; structureless; very friable when moist, slightly hard when dry; pH 6.0.

The texture of the A1 horizon ranges from loamy fine sand to fine sand, and the color of that horizon ranges from brown (7.5 YR 5/4) to dark grayish brown (10YR 4/2). The color of the A2 horizon ranges from pink (7.5YR 7/4) to reddish brown (5YR 5/3), but the most recent sediments are the most reddish. In about 20 to 30 percent of the acreage, these soils have a B2t horizon that contains streaks of fine sandy loam to sandy clay loam.

In the rest of the acreage, the soils have a B2t horizon of fine sandy loam below a depth of about 30 inches.

#### GOWEN SERIES

Moderately fine textured to medium-textured, gray to dark grayish-brown, friable, well-drained soils make up the Gowen series. These soils are on bottom lands and are occasionally to frequently flooded. They formed in mixed sediments washed from the San Saba, Durant, Windthorst, and Stephenville soils. The native vegetation was bottom-land hardwoods with an understory of mid and tall grasses.

The Gowen soils are less clayey than the Lela soils. Also they have a more brownish color.

A representative profile of Gowen loam 50 feet east and 2,000 feet south of the northwest corner of section 22, T. 6 S., R. 1 E.:

- A1—0 to 12 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, granular structure; friable when moist, slightly hard when dry; many worm casts; pH 6.5; gradual boundary; 7 to 15 inches thick.
- AC—12 to 40 inches, very dark gray (10YR 3/1) heavy loam, black (10YR 2/1) when moist; moderate, medium, subangular blocky structure; friable when moist, hard when dry; few worm casts; pH 6.2; gradual boundary.
- C—40 to 72 inches +, dark-gray (10YR 4/1) light silty clay loam, very dark gray (10YR 3/1) when moist; massive; friable when moist, hard when dry; faintly mottled with dark grayish brown (10YR 4/2); many streaks where lime occurs and these become more numerous with increasing depth; calcareous.

The color of the A1 horizon is fairly uniform, but the texture ranges from light loam to clay loam or silty clay loam. In many areas the C horizon is not mottled.

#### LABETTE SERIES

In the Labette series are dark-colored, deep, friable, well-drained, brownish soils that have a medium-textured surface layer and a fine-textured subsoil. These soils formed in material weathered from calcareous shale or soft limestone of the Cretaceous period. The native vegetation was mid and tall grasses.

The Labette soils occur with the Durant soils, but they have a less clayey, less blocky, more brownish, and unmottled subsoil. They have a thicker solum than the Claremore soils, and their B2t horizons are more clayey and less friable. The Labette soils are less reddish, less sandy, and less friable than the Zaneis soils, and they formed in a different kind of material.

A representative profile of Labette loam 1,500 feet north and 50 feet east of the southwest corner of section 13, T. 7 S., R. 1 E.:

- A11—0 to 5 inches, dark-brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) when moist; moderate, medium and fine, granular structure; friable when moist, hard when dry; numerous roots; few worm casts; pH 6.0; gradual boundary; 4 to 10 inches thick.
- A12—5 to 14 inches, dark-brown (7.5YR 4/2) heavy loam, dark brown (7.5YR 3/2) when moist; weak, medium and fine, subangular blocky structure; friable when moist, hard when dry; numerous roots; many worm casts; pH 6.0; gradual boundary; 8 to 10 inches thick.
- B21t—14 to 22 inches, reddish-brown (5YR 4/4) heavy clay loam, dark reddish brown (5YR 3/4) when moist; moderate, medium, subangular blocky structure; firm when moist, extremely hard when dry; few roots; pH 7.0; gradual boundary; 7 to 10 inches thick.

B22t—22 to 36 inches, light clay that is reddish brown (5YR 4/3) either moist or dry and is faintly mottled with yellowish red (5YR 5/8); moderate, medium, blocky structure; firm when moist, extremely hard when dry; many iron concretions; few small fragments of limestone; gradual boundary; 10 to 16 inches thick.

B3—36 to 48 inches, yellowish-red (5YR 4/6) either moist or dry light clay faintly mottled with reddish brown (2.5YR 4/4); moderate, medium, blocky structure; very firm when moist, extremely hard when dry; clay films numerous; many iron concretions and numerous limestone concretions; calcareous; abrupt boundary; 10 to 16 inches thick.

R—48 to 50 inches +, partly weathered limestone.

The texture of the A1 horizon ranges from loam to light clay loam. The color of that horizon ranges from brown (7.5YR 5/2) or dark brown (7.5YR 4/2) to reddish brown (5YR 5/3). The texture of the B2t horizons ranges from heavy clay loam to clay, and the color of those horizons ranges from reddish brown (5YR 4/3) to yellowish red (5YR 5/6).

#### LELA SERIES

In the Lela series are dark-colored, somewhat poorly drained soils that have a fine-textured surface layer and a plastic, fine-textured subsoil. These soils formed in alluvium deposited above the level ordinarily reached by overflow. They are on benches along small streams that drain areas of San Saba and Durant soils of the prairie. The native vegetation was a cover of mid and tall grasses.

The soil material below the surface layer in the Lela soils has less granular structure and is more plastic than that in the San Saba soils, and the Lela soils are on benches instead of on rolling uplands. They are more clayey and more plastic than the Gowen soils, and they have less granular structure.

A representative profile of Lela clay 1,000 feet west and 300 feet north of the southeast corner of section 31, T. 7 S., R. 3 E.:

A1—0 to 24 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) when moist; weak, fine, blocky structure grading to medium, subangular blocky; very firm when moist, hard when dry; pH 7.0; gradual boundary; 12 to 30 inches thick.

AC—24 to 32 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) when moist; strong, medium, blocky structure; very firm when moist, extremely hard when dry; pH 8.0; gradual to diffuse boundary; 6 to 20 inches thick.

C1—32 to 40 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) when moist; strong, medium, blocky structure; very firm when moist, extremely hard when dry; few lime concretions; weakly calcareous.

C2—40 to 65 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) when moist; massive; extremely hard when dry; numerous lime concretions; highly calcareous.

The texture of the A1 horizon ranges from clay to heavy clay loam. The color of that horizon is almost uniform but ranges from dark gray (10YR 4/1) to black (10YR 2/1). A few minor areas are calcareous to the surface, but the modal profile is noncalcareous to a depth of 20 to 40 inches.

#### LINCOLN SERIES

The Lincoln series consists of dark-colored, somewhat excessively drained or excessively drained soils that have a coarse-textured to fine-textured surface layer and a coarse-textured subsoil. These soils are on bottom lands. The alluvial material in which they formed was derived

mainly from the red beds. The vegetation varies a great deal, as a result of variations in the soils. It ranges from cedar or short grasses in the more droughty areas to bottom-land hardwoods and mid and tall grasses in the areas that have more favorable moisture.

The Lincoln soils have a more sandy subsoil than the Yahola soils. They are more reddish than the Pulaski soils, and unlike those soils, they are calcareous.

A representative profile of Lincoln loam about 1,100 feet south and 400 feet west of the northeast corner of section 31, T. 7 S., R. 3 W.:

A1—0 to 8 inches, reddish-brown (5YR 4/4) loam, dark reddish brown (5YR 3/4) when moist; weak, granular structure; friable when moist, hard when dry; highly calcareous; clear boundary; 5 to 20 inches thick.

AC—8 to 11 inches, reddish-brown (5YR 5/4) heavy loam, reddish brown (5YR 4/4) when moist; structureless; friable when moist, hard when dry; highly calcareous; clear boundary; 2 to 6 inches thick.

C—11 to 56 inches +, light reddish-brown (5YR 6/4) fine sand, reddish brown (5YR 5/4) when moist; structureless; nonsticky when wet, loose when dry; highly calcareous.

The texture of the A1 horizon ranges from loamy fine sand to clay. The color of that horizon ranges from light reddish brown (2.5YR 6/4) to reddish brown (5YR 4/4). The underlying material is highly stratified, but the dominant texture is fine sand with thin strata of finer textured material.

#### MILLER SERIES

The Miller series consists of deep, reddish-brown soils that have a surface layer of tough, plastic clay. These soils are somewhat poorly drained to moderately well drained and are generally calcareous. They formed in fine-textured sediments of red beds. The native vegetation was bottom-land hardwoods with an understory of mid and tall grasses.

The Miller soils occur with the Norwood soils, but they are more clayey than those soils. They are more reddish and less grayish than the Navasota soils, and they are calcareous.

A representative profile of Miller clay 400 feet east of the southwest corner NW $\frac{1}{4}$ NE $\frac{1}{4}$  of section 1, T. 8 S., R. 1 W.:

A1—0 to 14 inches, reddish-brown (2.5YR 4/3) clay, dark reddish brown (2.5YR 3/3) when moist; weak, very fine, blocky structure; very firm when moist, very hard when dry; calcareous; gradual boundary; 8 to 20 inches thick.

C—14 to 46 inches +, reddish-brown (2.5YR 5/4) clay, dark reddish brown (2.5YR 3/4) when moist; weak, medium and fine, blocky structure; very firm when moist, very hard when dry; calcareous.

The color of the A1 horizon is fairly uniform, but it ranges from weak red (2.5YR 4/2) to yellowish red (5YR 4/3). The texture ranges from clay to clay loam.

#### MINCO SERIES

The Minco series consists of deep, well-drained, dark-colored soils that have a medium-textured to moderately coarse textured surface layer but do not have a B horizon. These soils formed in old alluvium under a cover of native tall and mid grasses with a few oak, elm, and hickory trees. They are mainly on low benches along the Red River.

The Minco soils do not have the clay loam B horizon that is typical of the Vanoss and Teller soils. They are less sandy and are darker colored than the Dougherty and Eufaula soils.

A representative profile of Minco fine sandy loam 200 feet south and 25 feet west of the northeast corner of the SE $\frac{1}{4}$ NW $\frac{1}{4}$  of section 3, T. 8 S., R. 1 W.:

- A1—0 to 12 inches, dark-brown (7.5YR 4/2) fine sandy loam, dark brown (7.5YR 3/2) when moist; moderate, medium and fine, granular structure; very friable when moist, slightly hard when dry; pH 6.1; gradual boundary; 10 to 18 inches thick.
- AC—12 to 32 inches, reddish-brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) when moist; weak, medium, prismatic structure breaking to moderate, medium and fine, granular; very friable when moist, slightly hard when dry; pH 6.5; gradual boundary; 15 to 30 inches thick.
- C1—32 to 52 inches, yellowish-red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) when moist; weak, medium, prismatic structure breaking to moderate, medium and fine, granular structure; very friable when moist, hard when dry; pH 7.5; gradual boundary.
- C2—52 to 65 inches, brown (10YR 5/3) fine sandy loam (high in content of coarse sand), brown (10YR 4/3) when moist; friable when moist, hard when dry; pH 7.0; underlying strata more sandy than this horizon.

The texture of the A1 horizon ranges from loam to light fine sandy loam. The color of that horizon ranges from dark brown (7.5YR 4/2) to dark yellowish brown (10YR 4/4).

#### NAVASOTA SERIES

In the Navasota series are poorly drained, grayish soils that have a fine-textured surface layer. These soils are on bottom lands and are too frequently flooded for cultivation. They formed in fine-textured sediments washed mainly from red beds. The native vegetation was bottom-land hardwoods with an understory of mid and tall grasses.

The Navasota soils occur with the Roebuck soils. They are more grayish and are less reddish and more mottled than the Roebuck soils.

A representative profile of Navasota clay 1,320 feet west and 380 feet south of the northeast corner of section 4, T. 7 S., R. 1 W.:

- A1—0 to 12 inches, mainly dark reddish-gray (5YR 4/2) clay, dark reddish brown (5YR 3/2) when moist; very dark gray (10YR 3/1) moist clay makes up about 8 percent, by volume, of the soil mass; weak to moderate, medium, subangular blocky structure; very plastic when wet, very hard when dry; pH 7.0; clear boundary; 8 to 20 inches thick.
- C1—12 to 50 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) when moist; weak, medium, blocky structure; very plastic when wet, extremely hard when dry; peds have prominent slickensides; pH 8.0 (moderately alkaline, but noncalcareous); gradual boundary; 20 to 50 inches thick.
- C2—50 to 72 inches, very dark gray (10YR 3/1) silty clay, black (10YR 2/1) when moist; massive; very plastic when wet, extremely hard when dry; few splotches where salt occurs, and these larger and more numerous with increasing depth; few faint mottles of grayish brown; calcareous.

The texture of the A1 horizon ranges from heavy clay to heavy silty clay loam, and the color of that horizon ranges from dark reddish brown (5YR 2/2) or dark reddish gray (5YR 4/2) to dark grayish brown (2.5Y 4/2). The color of the C horizons ranges from mottled dark gray or very dark gray to mottled gray.

#### NORWOOD SERIES

In the Norwood series are reddish-brown, friable, calcareous, well-drained soils of the bottom lands. The surface layer of these soils is moderately fine textured. These soils formed in moderately fine textured sediments of red beds. They are seldom flooded. The native vegetation was bottom-land hardwoods with an understory of mid and tall grasses.

The Norwood soils occur with the Miller soils but are less clayey than the Miller soils. They also occur with the Yahola soils but are less sandy than those soils.

A representative profile of Norwood clay loam 50 feet north of a fence near the center of the NE $\frac{1}{4}$  of section 1, T. 8 S., R. 1 W.:

- A1—0 to 20 inches, reddish-brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) when moist; strong, medium, granular structure; firm when moist, hard when dry; prominent clay films on the surfaces of some peds; many pores; few worm casts; horizon contains a few, very thin, stratified layers of loam; calcareous; gradual boundary; 8 to 30 inches thick.
- O1—20 to 55 inches, reddish-brown (5YR-5/4) heavy silty clay loam, dark reddish brown (5YR 3/4) when moist; weak, medium and fine, subangular blocky structure; friable when moist, hard when dry; at a depth of 44 inches contains a layer of loam less than 4 inches thick; calcareous; gradual boundary.
- C2—55 to 60 inches +, reddish-brown (5YR 4/4) light loam, dark reddish brown (5YR 3/4) when moist; very friable when moist, slightly hard when dry; calcareous.

The general range of texture in the A1 horizon is from silty clay loam to clay loam, but the A1 horizon contains thin layers of fine sandy loam and loam in many places. The color of the A1 horizon ranges from dark reddish brown (5YR 3/3) to reddish brown (5YR 5/4).

#### PORT SERIES

Deep, well-drained, dark-colored soils of the bottom lands make up the Port series. These soils have a medium-textured surface layer. They formed in alluvium deposited by small streams that mainly drain areas of soils derived from red-bed material. The native vegetation was bottom-land hardwoods with an understory of mid and tall grasses.

The Port soils are somewhat similar to the Norwood soils, but they are not calcareous. They are less sandy than the Yahola and Pulaski soils.

A representative profile of Port loam 350 feet east and 525 feet north of the southwest corner of the NE $\frac{1}{4}$  of section 33, T. 6 S., R. 3 W.:

- A1—0 to 18 inches, reddish-brown (5YR 4/4) loam, dark reddish brown (5YR 3/4) when moist; weak, medium and fine, subangular blocky structure; friable when moist, slightly hard when dry; few worm casts; some stratification of heavy loam; pH 6.5; gradual boundary; 12 to 20 inches thick.
- AC—18 to 35 inches, reddish-brown (5YR 4/4) heavy loam, dark reddish brown (5YR 3/4) when moist; weak, medium and fine, subangular blocky structure; friable when moist, hard when dry; pH 6.5; gradual boundary; 12 to 25 inches thick.
- C1—35 to 50 inches, reddish-brown (5YR 4/3) heavy loam, dark reddish brown (5YR 3/3) when moist; moderate, fine, granular structure; friable when moist, hard when dry; porous; pH 7.0; stratified with layers of clay loam that are generally less than 1 inch thick; gradual boundary.

C2—50 to 60 inches, reddish-brown (5YR 4/4) heavy loam, dark reddish brown (5YR 3/4) when moist; massive; friable when moist, hard when dry; stratified with clay loam.

The color of the A1 horizon ranges from reddish brown (5YR 4/3) to strong brown (7.5YR 5/6), but the texture is fairly uniform, considering the fact that these soils are frequently flooded. The underlying material is stratified, and its texture ranges from light loam to heavy loam.

#### PULASKI SERIES

The Pulaski series consists of deep, well-drained soils that have a moderately coarse textured surface layer. These soils are on bottom lands. They formed in alluvium deposited by small streams that mainly drain areas of timbered soils. The native vegetation was bottom-land hardwoods with an understory of mid and tall grasses.

The Pulaski soils are better drained than Wet alluvial land, with which they occur. They are less reddish than the Port or Yahola soils.

A representative profile of Pulaski fine sandy loam 125 feet north and 625 feet west of the southeast corner of the NE $\frac{1}{4}$  of section 35, T. 7 S., R. 2 W.:

A1—0 to 6 inches, brown (7.5YR 5/3) fine sandy loam, dark brown (7.5YR 3/3) when moist; structureless; very friable when moist, soft when dry; pH 6.5; plowed boundary; 5 to 30 inches thick.

AC—6 to 54 inches, reddish-brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) when moist; structureless; very friable when moist, slightly hard when dry; porous; pH 6.0; diffuse boundary; 10 to 43 inches thick.

C—54 to 85 inches +, reddish-yellow (5YR 6/8) loamy fine sand, yellowish red (5YR 5/8) when moist; structureless; very friable when moist, soft when dry; pH 6.0.

The color of the AC and C horizons ranges from reddish brown (5YR 5/3) to brown (10YR 5/3). The texture of the A1 horizon is fairly uniform, considering the fact that these soils are normally flooded.

#### RENFROW SERIES

In the Renfrow series are dark-colored, moderately well drained, reddish soils that have a medium-textured surface layer and a reddish, fine-textured subsoil. These soils formed under a cover of native mid and short grasses in weakly calcareous, clayey material of the red beds.

The Renfrow soils occur with the Zaneis soils. They have a profile that is similar to that of the Zaneis soils, but their B horizon is more clayey.

A representative profile of Renfrow silt loam 1,320 feet east of the northwest corner of the SW $\frac{1}{4}$  of section 17, T. 6 S., R. 3 W.:

A1—0 to 5 inches, reddish-brown (5YR 4/4) silt loam, dark reddish brown (5YR 3/4) when moist; moderate, medium and fine, granular structure; friable when moist, slightly hard when dry; few cherty pebbles; pH 6.8; gradual boundary; 3 to 8 inches thick.

B1—5 to 12 inches, reddish-brown (2.5YR 4/4) light clay, dark reddish brown (2.5YR 3/4) when moist; weak, medium and fine, subangular blocky structure; firm when moist, very hard when dry; many small cherty pebbles; pH 6.5; gradual boundary; 5 to 10 inches thick.

B21t—12 to 22 inches, reddish-brown, (2.5YR 4/4) silty clay, dark reddish brown (2.5YR 3/4) when moist; moderate, medium, blocky structure; plastic when wet, firm when moist, very hard when dry; few concretions of calcium carbonate; few small cherty pebbles; pH 7.4; gradual boundary; 8 to 12 inches thick.

B22t—22 to 40 inches, red (2.5YR 5/6) heavy clay loam, red (2.5YR 4/6) when moist; weak, medium and fine, blocky structure; firm when moist, very hard when dry; few cherty pebbles; numerous splotches where lime occurs; calcareous; gradual boundary; 15 to 50 inches thick.

C—40 to 50 inches +, red (2.5YR 4/8) clay loam, dry or moist, intermixed with splotches of yellowish brown (10YR 5/6) and light gray (10YR 7/1); pH 8.0 (moderately alkaline but noncalcareous).

The texture of the A1 horizon ranges from loam or silt loam to heavy loam, and the color of that horizon ranges from reddish brown (2.5YR 4/4) to dark brown (7.5YR 3/2). The texture of the B2t horizons ranges from light clay to clay or silty clay. The depth to calcareous material ranges from 20 to 30 inches.

#### ROEBUCK SERIES

In the Roebuck series are deep, somewhat poorly drained, dark-colored soils that have a fine-textured surface layer. These soils are on bottom lands. They formed in alluvium deposited by small streams that drain prairie areas where the soils were derived from red beds. The Roebuck soils are generally neutral to slightly calcareous. The native vegetation was bottom-land hardwoods with an understory of mid and tall grasses.

The Roebuck soils are more frequently flooded than the Miller soils. Also they are less well drained.

A representative profile of Roebuck clay 1,200 feet west of the section line and 1,000 feet south of the northeast corner of the SE $\frac{1}{4}$  of section 10, T. 7 S., R. 3 W.:

A1—0 to 16 inches, dark reddish-gray (5YR 4/2) clay, dark reddish brown (5YR 3/2) when moist; moderate, medium and fine, granular structure; very firm when moist, very hard when dry; numerous roots; pH 7.0; gradual boundary; 10 to 20 inches thick.

AC—16 to 26 inches, reddish-brown (5YR 4/4) silty clay, dark reddish brown (5YR 3/4) when moist; moderate, medium and fine, subangular blocky structure; very firm when moist, very hard when dry; pH 6.7; gradual boundary; 8 to 12 inches thick.

C1—26 to 42 inches, reddish-brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) when moist; weak, medium and fine, subangular blocky structure; firm when moist, very hard when dry; pH 7.0; gradual boundary.

C2—42 to 50 inches, reddish-brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) when moist; structureless; very firm when moist, extremely hard when dry; pH 7.0.

In places the A1 horizon contains thin layers of loam, but in general the texture of the A1 horizon is between clay and silty clay. The areas where there are thin layers of loam occur near the present or abandoned stream channels.

#### SAN SABA SERIES

The San Saba series consists of soils that have a nearly black, moderately fine textured or fine textured surface layer and are moderately well drained. These soils formed in material weathered from calcareous clayey shale or marl of the Cretaceous period. The native vegetation was a thick stand of mid and tall grasses.

San Saba soils have a slightly less clayey, more friable, and less plastic subsoil than the Lela soils, and they occur on the lower part of slopes and in valleys instead of on old, nearly level alluvial benches. San Saba soils are generally darker colored than the Denton soils, and they have a thicker A horizon, have less granular structure, and are less well drained.

A representative profile of San Saba silty clay 250 feet east of the southwest corner of the NE $\frac{1}{4}$  of section 1, T. 7 S., R. 1 E., and 50 feet north of the road:

- A1—0 to 30 inches, black (10YR 2/1) both dry and moist silty clay; strong, medium and fine, subangular blocky structure; the peds have distinct slickensides; very firm when moist, very hard when dry, and slightly plastic when wet; few fragments of limestone 3 millimeters in diameter; few iron concretions 1 millimeter in diameter; slightly calcareous; diffuse boundary; 8 to 35 inches thick.
- AC—30 to 45 inches, dark-gray (2.5Y 4/1) silty clay, very dark gray (2.5Y 3/1) when moist; upper part of horizon shows streaks that were originally cracks filled with material from the A1 horizon; massive, but a few peds of irregular shape; very firm when moist, very hard when dry; many white to yellowish-brown soft segregations of calcium carbonate; many iron concretions about 1 millimeter in diameter; calcareous; gradual boundary; 15 to 30 inches thick.
- C—45 to 65 inches +, grayish-brown (2.5Y 5/2) clayey shale, dark grayish brown (2.5Y 4/2) when moist; massive; very firm when moist, very hard when dry; numerous white to yellowish-brown, soft segregations of calcium carbonate; few iron concretions 1 millimeter in diameter; calcareous.

The texture of the A1 horizon ranges from clay loam to light silty clay, but the color is a fairly uniform very dark gray (10YR 3/1) to black (10YR 2/1). The thickness of the A1 horizon varies greatly within a distance of 1 to 2 rods because of the gilgai relief. In about 30 percent of the acreage, these soils are noncalcareous to a depth of about 15 inches.

#### STEPHENVILLE SERIES

In the Stephenville series are deep, well-drained, light-colored soils that have a moderately coarse textured surface layer and a moderately fine textured subsoil. These soils formed in material weathered from weakly consolidated sandstone, mainly of the Trinity formation, Cretaceous period. The native vegetation was blackjack oak, post oak, and hickory trees with an understory of mid and tall grasses.

The Stephenville soils have a less clayey B2t horizon than the Windthorst soils. Their A horizons are less sandy than those of the Dougherty soils.

A representative profile of Stephenville fine sandy loam 50 feet west and 600 feet south of the northeast corner of section 5, T. 6 S., R. 1 E.:

- A1—0 to 7 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; very friable when moist, slightly hard when dry; numerous roots; pH 6.7; clear boundary; 4 to 8 inches thick.
- A2—7 to 18 inches, pale-brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) when moist; single grain; very friable when moist, soft when dry; many roots; pH 6.2; clear boundary; 7 to 15 inches thick.
- B2t—18 to 36 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) when moist; weak, medium to coarse, prismatic structure breaking to medium subangular blocky; friable when moist, hard when dry; slight discoloration in uppermost 2 inches of horizon; pH 5.2; gradual boundary; 8 to 15 inches thick.
- B3—36 to 48 inches, reddish-yellow (7.5 YR 6/8) fine sandy loam, strong brown (7.5YR 5/8) when moist; 5 percent, by volume, consists of yellow (10YR 7/8) fine sandy loam in seams or streaks; weak, fine, subangular blocky structure; very friable when moist, slightly hard when dry; pH 5.6; gradual boundary; 8 to 15 inches thick.

C—48 to 80 inches +, yellow (10YR 7/8) fine sandy loam (pack sand), brownish yellow (10YR 6/8) when moist; pH 5.6.

The texture of the A1 horizon is uniformly fine sandy loam, but the color of that horizon is lighter and less grayish in some places than that in the profile described. This is because plowing has mixed the A1 and A2 horizons. Where erosion has removed part of the A1 horizon and plowing has mixed part of the B horizon with the surface layer, the present surface layer is more reddish than the original one. The color of the A2 horizon ranges from pale brown (10YR 6/3) or grayish brown (10YR 5/2) to light yellowish brown (10YR 6/4), and the color of the B2t horizon ranges from light reddish brown (2.5YR 6/4) to yellowish red (5 YR 4/8).

#### TARRANT SERIES

In the Tarrant series are dark-colored, excessively drained soils that have a medium-textured or moderately fine textured surface layer. These soils formed in material weathered from limestone of the Cretaceous period, and they are shallow over hard limestone. In some areas as much as 30 percent of the surface is covered with fragments of limestone. The native vegetation was mainly short grasses, but there were a few clumps of mid grasses.

The Tarrant soils occur with the Claremore soils. Their profile is somewhat similar to that of the Claremore soils, but it is thinner.

A representative profile of Tarrant loam 400 feet west of the section line and 2,275 feet south of the northeast corner of section 24, T. 7 S., R. 1 W., and about 20 feet south of the road:

- A1—0 to 8 inches, reddish-brown (5YR 4/3) loam, dark reddish brown (5YR 3/3) when moist; weak to moderate, fine, granular structure; very friable when moist, slightly hard when dry; many roots; many worm casts; numerous small fragments of limestone; calcareous; abrupt boundary; 4 to 10 inches thick.
- AC—8 to 10 inches limestone fragments, 4 to 6 centimeters in diameter, in a matrix of reddish-brown (5YR 4/3) loam; 2 to 4 inches thick.
- R—10 inches +, consolidated limestone bedrock.

The texture of the A1 horizon ranges from loam to clay loam. The color of that horizon ranges from reddish brown (5YR 4/3) to very dark grayish brown (10YR 3/2).

#### TELLER SERIES

Deep, well-drained, dark-colored soils are in the Teller series. These soils have a medium-textured or moderately coarse textured surface layer and a moderately fine textured subsoil. They formed in old alluvium, mainly from red beds. The native vegetation was tall and mid grasses and a thin stand of oaks.

The Teller soils have a more reddish and less brownish B2t horizon than the Vanoss soils. They lack the lighter colored A2 horizon that is typical of the Stephenville and Dougherty soils.

A representative profile of Teller fine sandy loam 300 feet west of the Turner School and even with the shop building in the NE $\frac{1}{4}$  of section 20, T. 7 S., R. 1 W.:

- A1—0 to 14 inches, reddish-brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) when moist; weak, fine and medium, prismatic structure; very friable when moist, soft when dry; numerous pores; few worm casts; pH 5.8; clear boundary; 8 to 18 inches thick.

B2t—14 to 50 inches, yellowish-red (5YR 5/6) light clay loam (high in sand), yellowish red (5YR 4/6) when moist; weak, fine and medium, prismatic structure; very friable when moist, hard when dry; pores numerous in the upper part but becoming fewer with increasing depth; the content of sand becomes greater with increasing depth; pH 5.8; gradual boundary; 10 to 40 inches thick.

C—50 to 74 inches +, red (2.5YR 5/8) sandy clay loam, red (2.5YR 4/8) when moist; massive; very friable when moist and hard when dry; pH 7.0.

The texture of the A1 horizon ranges from heavy loam or light clay loam to fine sandy loam, and the color of that horizon ranges from reddish brown (5YR 4/4) to yellowish brown (10YR 5/6). The texture of the B2t horizon ranges from heavy loam to clay loam, and the color of that horizon ranges from reddish brown (2.5YR 4/4) to reddish yellow (5YR 6/6).

#### VANOSS SERIES

In the Vanoss series are dark-colored, well-drained soils that have a medium-textured surface layer and a brownish, moderately fine textured subsoil. These soils formed in alluvium. In this county they are on low benches above the level reached by ordinary overflow. The native vegetation was a cover of native mid and tall grasses.

The Vanoss soils have a less reddish, more brownish B2t horizon than the Teller soils. They are about the same color as the Minco soils, but unlike those soils, they have a well-defined B2 horizon.

A representative profile of Vanoss loam 1,400 feet east of the northwest corner of the SW $\frac{1}{4}$  of section 4, T. 8 S., R. 3 E., and 50 feet south of the corner:

A1—0 to 8 inches, dark yellowish-brown (10YR 4/4) loam grading toward sandy loam, yellowish brown (10YR 3/4) when moist; weak, fine, granular structure; very friable when moist, slightly hard when dry; pH 7.0; plowed boundary; 5 to 15 inches thick.

B1—8 to 24 inches, dark-brown (7.5YR 4/4) heavy loam, dark brown (7.5YR 3/4) when moist; moderate, medium and fine, granular structure; friable when moist, slightly hard when dry; pH 6.5; gradual boundary; 10 to 18 inches thick.

B2t—24 to 40 inches, yellowish-brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) when moist; faintly mottled with strong brown; moderate, medium and fine, granular structure; friable when moist, hard when dry; few iron concretions 2 millimeters in diameter; pH 6.5; gradual boundary; 16 to 40 inches thick.

C—40 to 65 inches +, brownish-yellow (10YR 6/6) clay loam high in sand, yellowish brown (10YR 5/6) when moist; friable when moist, hard when dry; few splotches of strong brown (7.5YR 5/6); pH 6.5.

The texture of the A1 horizon ranges from loam to fine sandy loam. The B1 horizon is absent in some areas. The color of the B2t horizon ranges from yellowish brown (10YR 5/4) or dark yellowish brown (10YR 4/4) to dark brown (7.5YR 4/4). In some areas the B2t horizon is distinctly mottled with grayish brown and its texture is heavy clay loam to a clay loam high in content of sand.

#### VERNON SERIES

In the Vernon series are dark-colored, somewhat excessively drained soils that have a medium-textured surface layer and that are shallow over fine-textured, reddish, calcareous clay beds. These soils formed in clayey material of the red beds. The native vegetation was a cover of mid and short grasses.

A representative profile of Vernon clay loam 150 feet east and 775 feet north of the southwest corner of section 10, T. 6 S., R. 3 W.:

A1—0 to 6 inches, reddish-brown (2.5YR 4/4) clay loam, dark reddish brown (2.5YR 3/4) when moist; moderate, medium and fine, subangular blocky structure; firm when moist, hard when dry; few iron concretions 2 to 3 millimeters in diameter; many roots; pH 7.0; gradual boundary; 4 to 8 inches thick.

AC—6 to 15 inches, reddish-brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) when moist; mottled with red (2.5YR 4/6); strong, medium, subangular blocky structure, becoming coarse blocky with increasing depth; firm when moist, extremely hard when dry; weakly calcareous, and contains a few concretions of calcium carbonate; gradual boundary; 2 to 14 inches thick.

C—15 inches +, about the same color as the AC horizon, but pale-olive (5Y 6/3) clayey material is intermixed; coarse blocky structure; contains slickensides; slightly calcareous but little visible lime.

The texture throughout the profile ranges from clay loam to light clay, but the color is a fairly uniform reddish brown. The thickness of the solum ranges from 6 to 22 inches. The A1 horizon is calcareous in areas where the reaction has not been affected by runoff from soils lying higher up the slope. The Vernon soil of the Vernon-Stephenville complex is calcareous in most places, but the Vernon soil of the Vernon-Chickasha complex is generally noncalcareous.

#### WAURIKA SERIES

The Waurika series consists of dark-colored, somewhat poorly drained soils that have a medium-textured surface layer and a grayish, fine-textured subsoil. These soils formed under a cover of native mid and short grasses in material weathered from clayey formations of the Cretaceous period.

The profile of the Waurika soils is similar to that of the Brewer soils, but the Waurika soils formed in clayey residual material, and the Brewer soils formed in alluvium. The Waurika soils occur with the Durant soils, but they have a finer textured B2t horizon than the Durant soils, their B2t horizon has more blocky structure, and they have an abrupt boundary between the A2 and B2t horizons.

A representative profile of Waurika loam 1,200 feet south and 1,650 feet west of the northeast corner of section 3, T. 8 S., R. 2 E.:

A1—0 to 8 inches, gray (10YR 5/1) loam, dark gray (10YR 4/1) when moist; weak, medium, granular structure to structureless; friable when moist, hard when dry; pH 6.0; abrupt boundary; 7 to 12 inches thick.

A2—8 to 10 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) when moist; strong, medium to fine, subangular blocky structure; friable when moist, hard when dry; numerous roots; porous; peds coated with a grayish filament; pH 6.0; abrupt boundary; about 2 inches thick.

B2t—10 to 30 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) when moist; medium blocky structure; extremely firm when moist, extremely hard when dry; few roots; pH value is 7.0 in upper part but grades to 8.0 at a depth of 30 inches; gradual boundary; 10 to 26 inches thick.

B3—30 to 45 inches +, grayish-brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) when moist; medium blocky structure; extremely firm when moist, extremely hard when dry; pH 8.0 but numerous splotches where salts occur; 12 to 20 inches thick.

The texture of the A horizons ranges from loam to silt loam, and the color of those horizons ranges from gray (10YR 5/1) to dark grayish brown (10YR 4/2). In many places the lower 2 inches of the A1 horizon has grayish coatings on the surfaces of peds and the A2 horizon is absent. Depth to an accumulation of salts ranges from 24 to 50 inches.

#### WINDTHORST SERIES

In the Windthorst series are deep, well-drained, light-colored soils that have a moderately coarse textured surface layer and a fine-textured subsoil. These soils formed under a cover mainly of post oak and an understory of mid and tall grasses, in material weathered from sandy shale.

In many places the Windthorst soils occur with the Stephenville soils, but they have more clayey B2t horizons than the Stephenville soils. The Windthorst soils have thicker A horizons and less clayey and less blocky B2t horizons than the Axtell soils.

A representative profile of Windthorst fine sandy loam 450 feet east and 950 feet south of the northwest corner of section 19, T. 6 S., R. 2 E.:

- A1—0 to 5 inches, grayish-brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; very friable when moist, soft when dry; numerous roots; pH 6.5; clear boundary; 3 to 6 inches thick.
- A2—5 to 10 inches, very pale brown (10YR 7/4) fine sandy loam, yellowish brown (10YR 5/4) when moist; single grain; very friable when moist, soft when dry; many roots; pH 6.1; abrupt boundary; 4 to 10 inches thick.
- B21t—10 to 20 inches, yellowish-red (5YR 5/6) heavy clay loam, (5YR 4/6) when moist; strong, medium and fine, blocky structure; very firm when moist, very hard when dry; few roots; pH 5.5; gradual boundary; 5 to 12 inches thick.
- B22t—20 to 32 inches, reddish-yellow (7.5YR 6/8), both dry and moist, light sandy clay mottled with brown to red; red material that has a hue of 2.5YR makes up less than 5 percent of horizon; strong, medium and fine, blocky structure; very firm when moist, very hard when dry; pH 5.6; gradual boundary; 8 to 15 inches thick.
- B23t—32 to 60 inches, yellowish-brown (10YR 5/6), both dry and moist, light sandy clay; many distinct mottles of red to reddish brown with occasional streaks of grayish brown; strong, medium and fine, blocky structure; many cherty pebbles; very firm when moist, very hard when dry; pH 6.0; gradual boundary; 15 to 30 inches thick.
- C—60 to 72 inches, reddish-yellow (5YR 6/6), partly weathered sandy shale, yellowish red (5YR 5/6) when moist.

The texture of the A1 horizon is a fairly uniform fine sandy loam, but that horizon contains a few sandstone pebbles in some places. The color of the A1 horizon ranges from very dark brown (10YR 2/2) to grayish brown (10YR 5/2), and the color of the A2 horizon ranges from very pale brown (10YR 7/3) to yellowish brown (10YR 5/4). The texture of the B2 horizon ranges from sandy clay to heavy clay loam.

#### YAHOLA SERIES

In the Yahola series are dark-colored, highly calcareous, well-drained soils that have a moderately coarse textured or medium-textured surface layer and a medium-textured to moderately coarse textured subsoil. These soils are on bottom lands. They formed in sediments that originated mainly from red beds. These soils support a cover of

bottom-land hardwoods and an understory of mid and tall grasses.

The Yahola soils are less sandy below a depth of 15 inches than the Lincoln soils. They are more sandy throughout the profile than the associated Norwood soils.

A representative profile of Yahola fine sandy loam 700 feet east of the northwest corner of the SW $\frac{1}{4}$ SW $\frac{1}{4}$  of section 2, T. 8 S., R. 1 E.:

- A1—0 to 16 inches, reddish-brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) when moist; very weak, medium and fine, granular structure; very friable when moist, slightly hard when dry; calcareous; no visible concretions of calcium carbonate; diffuse boundary; 8 to 25 inches thick.
- AC—16 to 20 inches, light reddish-brown (5YR 6/4) loamy fine sand, reddish brown (5YR 5/4) when moist; structureless; very friable when moist, slightly hard when dry; calcareous.
- C1—20 to 42 inches, reddish-brown (2.5YR 5/4) light fine sandy loam, reddish brown (2.5YR 4/4) when moist; structureless; very friable when moist, slightly hard when dry; calcareous.
- C2—42 to 60 inches, reddish-brown (5YR 5/4) loam, reddish brown (5YR 4/4) when moist; very friable when moist, slightly hard when dry; calcareous; gradual boundary.
- C3—60 to 70 inches +, reddish-yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 4/6) when moist; very friable when moist, soft when dry; calcareous.

The texture of the A1 horizon ranges from loam to fine sandy loam, and the color of that horizon ranges from reddish brown (5YR 4/3) to strong brown (7.5YR 5/6). The texture below the AC horizon ranges from loam or very fine sandy loam to a coarser material.

#### ZANEIS SERIES

In the Zaneis series are dark-colored, well-drained soils that have a reddish, medium-textured surface layer and a reddish, moderately fine textured subsoil. These soils formed under a cover of native mid and tall grasses in material weathered from sandstone or sandy shale of the red beds.

The Zaneis soils have a more reddish B2t horizon than the Chickasha soils with which they are associated. They have a less clayey B2t horizon than the Renfrow soils.

A representative profile of Zaneis loam near the northwest corner of the SW $\frac{1}{4}$  of section 4, T. 6 S., R. 3 W.:

- A1—0 to 6 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 3/4) when moist; weak, medium, granular structure; very friable when moist, slightly hard when dry; pH 6.1; plowed boundary; 4 to 14 inches thick.
- B1—6 to 11 inches, reddish-brown (5YR 4/3) heavy loam, dark reddish brown (5YR 3/3) when moist; moderate, fine, subangular blocky structure; friable when moist, hard when dry; pH 6.1; gradual boundary; 3 to 10 inches thick.
- B2t—11 to 25 inches, reddish-brown (2.5YR 4/4) clay loam, dark reddish brown (2.5YR 3/4) when moist; moderate, fine and medium, subangular blocky structure; firm when moist, hard when dry; pH 6.1; gradual boundary; 12 to 20 inches thick.
- B3—25 to 36 inches, red (2.5YR 5/6) clay loam that is high in content of sand, red (2.5YR 4/6) when moist; 5 percent of material splotted with black; few iron concretions 2 to 5 millimeters in diameter; prismatic structure breaking to weak, medium and coarse, subangular blocky; pH 6.1; gradual boundary; 6 to 15 inches thick.
- C1—36 to 43 inches, red (2.5YR 5/6) sandy clay loam, red, (2.5YR 4/6) when moist; coarse, prismatic structure;

5 to 10 percent, by volume, consists of iron concretions 2 to 5 millimeters in diameter; friable when moist, hard when dry; faintly mottled with small brown spots; pH 6.7; gradual boundary.

C2-43 to 53 inches +, reddish-brown (5YR 5/4) weathered sandy clay of the Permian red beds, reddish brown (5YR 4/4) when moist; mottled with yellowish brown and black; weakly calcareous.

In a few areas where this soil has been winnowed by wind, the texture of the A1 horizon is very fine sandy loam. The color of the A1 horizon ranges from dark brown (7.5YR 4/4) or brown (7.5YR 5/4) to reddish brown (5YR 5/4).

### General Nature of the County

This section of the report tells about the climate and water supply in the county. It also gives facts about the history and agriculture and briefly discusses the natural resources and industries.

### Climate <sup>11</sup>

Love County has a temperate, continental climate characteristic of the southwestern Great Plains. Warm, moist masses of air from the Gulf of Mexico greatly influence the weather of the county. Colder air from the north frequently produces rapid and significant fluctuations in daily and seasonal temperatures, cloudiness, wind, and precipitation. Table 9 gives facts about temperatures and precipitation in the county. Table 10 shows the probability that

<sup>11</sup> By STANLEY G. HOLBROOK, State climatologist, U.S. Weather Bureau.

temperatures of 16°, 20°, 24°, 28°, and 32° will occur in spring after the dates indicated or in fall before the dates indicated.

The seasonal characteristics are well defined, but changes between seasons are more gradual. Winters are short, open, and mild except for an occasional rapidly moving "norther." Although these storms produce a rapid drop in temperature, their severity lasts only a few days before warmer winds from the south bring milder temperatures. Spring is the most variable season. In spring winds reach their highest velocity and the intensity of precipitation is the greatest. Spring is also the season when severe local storms and tornadoes occur most frequently. In summer the hot days are moderated by occasional showers. There are also pleasant nights when the breezes are cool and the humidity is moderately low. The long periods of open and more pleasant weather in fall are interspersed with spells of moderate to heavy soaking rains.

The average annual temperature for Love County is 65° F.; the average range in daily temperature is 23°. Temperatures of 90° or higher have occurred each month from March through October, and they prevail on an average of 100 days per year. Temperatures of 100° or more occur on 25 days per year. The warmest spell on record lasted for 31 days in July and August of 1956. During that time a record high of 112° was set on August 16. In the 21 years that records of temperature have been kept at Marietta, the temperature has dropped to zero or below on only 3 days. These days were in January of 1943 and in January of 1947; a record low of 3° below zero was reached on the morning of January 4, 1947. Winter cold spells do not last long. The temperature has dropped below freezing on an average of only 28 days per year,

TABLE 9.—Temperature and precipitation data

[Based on records of temperature for the period 1940 to 1961 and on records for precipitation for the period 1937 to 1961, kept by the U.S. Weather Bureau at Marietta, Okla.]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—		Average total	One year in 10 will have—		Days with snow cover of 1 inch or more	Average depth of snow on days with snow cover 1 inch or more
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Less than—	More than—		
	°F.	°F.	°F.	°F.	Inches	Inches	Inches	Number	Inches
January	55	32	73	15	1.79	0.4	4.0	2	2
February	59	36	76	20	2.47	.4	5.4	2	2
March	66	42	81	24	2.70	.3	5.8	1	2
April	76	52	88	36	4.31	1.4	12.8	0	-----
May	82	60	93	47	5.75	2.5	11.3	0	-----
June	91	69	100	59	4.17	.3	8.6	0	-----
July	96	72	106	66	2.65	.4	7.4	0	-----
August	97	71	107	62	2.06	.3	3.9	0	-----
September	90	63	100	50	2.71	0	5.5	0	-----
October	79	53	92	38	3.59	( <sup>1</sup> ) 0	8.2	0	-----
November	66	41	82	25	2.21	0	5.7	0	-----
December	57	34	73	21	2.21	.1	5.2	1	-----
Year	77	52	<sup>2</sup> 106	<sup>3</sup> 9	36.62	23.0	48.0	6	2

<sup>1</sup> Trace.

<sup>2</sup> Average annual highest temperature.

<sup>3</sup> Average annual lowest temperature.

TABLE 10.—*Probabilities of last freezing temperatures in spring and first in fall in Love County, Okla.*  
 [Based on data from Ardmore, Okla., and Gainesville, Tex.]

Probability	Dates for given probability and temperature at—				
	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower
Spring:					
1 year in 10 later than.....	February 28.....	March 9.....	March 23.....	April 3.....	April 13
2 years in 10 later than.....	February 18.....	March 1.....	March 15.....	March 27.....	April 8
5 years in 10 later than.....	January 31.....	February 12.....	March 1.....	March 15.....	March 28
Fall:					
1 year in 10 earlier than.....	November 30.....	November 25.....	November 16.....	November 2.....	October 24
2 years in 10 earlier than.....	December 7.....	December 2.....	November 23.....	November 9.....	October 30
5 years in 10 earlier than.....	December 21.....	December 16.....	November 6.....	December 22.....	November 10

and only on 1 day per year has it failed to rise above freezing.

The average annual precipitation is 36.62 inches in this county. However, the amount of precipitation received in any 1 year has ranged from 20.49 inches in 1956, a year of low rainfall, to 50.26 inches in 1945, a year of high rainfall. Seasonal precipitation is well distributed, and the amount is generally great enough for most agricultural purposes. Spring is the wettest season; about 35 percent of the annual precipitation is received in spring, about 24 percent in summer, about 23 percent in fall, and about 18 percent in winter. In the 24 years that records of precipitation have been kept at Marietta, only in 6 separated months has no measurable amount of precipitation been received. The greatest monthly total rainfall was 15 inches, received in October 1941. Daily amounts of 3 to 5 inches occur in about 2 years out of 5. The greatest daily amount of rainfall was 5.83 inches, measured during the 24 hours ending at 7 a.m. on October 13, 1937.

The average amount of snowfall received annually at Marietta since November 1937 has been 5 inches. Also since November 1937, a measurable amount of snow has fallen in four winters out of five. Although snow is not a major source of moisture in winter, several snowfalls may be expected each year. The largest amount of snowfall in any one season was 10.7 inches, which fell in the 1946 to 1947 season. The largest amount of snowfall received in a 24-hour period was 7.5 inches, which fell on March 1, 1942. The greatest depth of snow on the ground was 7 inches, which fell on February 7, 1961. Snow does not remain on the ground for more than a few days, and it is more of a nuisance than an operational hazard.

Records of wind are not kept in this county, but general interpolations can be made from data recorded at Oklahoma City, Wichita Falls, and Dallas. The prevailing winds are southerly, except during January and February when they are northerly. Average windspeed can be expected to range from nearly 10 miles per hour in summer to 15 miles per hour in March and April.

In spring violent squall lines and severe thunderstorms are common. In these storms there are strong winds of 25 to 45 miles per hour and occasional gusts ranging up to 75 miles per hour. Damage from these winds is limited mostly to broken limbs, damaged roofing, and interrupted utility service, except when the winds are accompanied by hail or intense rain. These winds are rarely severe enough

to produce violent duststorms or significant erosion. Tornadoes, the most severe storms in the county, have occurred 7 times, mostly in open country. The damage in the worst ones was limited to a few thousand dollars. There have been only 1.4 tornadoes per 100 square miles during the past 87 years of record.

Fortunately, the risk of crop losses from hail is low in this county; only seven-tenths of 1 percent of the crops that are insured have been hailed out annually. Elsewhere in the State, for the 30-year period ending in 1953, the risk of a hailstorm that would damage crops ranged from five-tenths of 1 percent in the counties in the eastern part of the State to 10½ percent in the counties in the extreme western part.

In summer other crop losses and other economic losses are occasionally caused by drought and parching winds. Evaporation caused by the combined action of hot, dry winds and high temperatures deplete the supply of moisture received and stored in summer. Average annual lake evaporation is 57.5 inches, and 69 percent of this evaporation occurs during the growing season, May to October. July and August are the months when the largest amount of moisture is lost, and plants that grow in summer may be harmed to the extent that they are unable to recover from the damage caused by hot, dry winds.

The average dates of freezing temperatures of various intensities, as shown in table 10, indicate that the freeze-free period in this county is 227 days. The growing season is generally long enough so that crops have time to mature, unless heavy rains or hail-outs make late replanting necessary. Freezes have occurred as late as April 20; the temperature dropped to 31 degrees on that date in 1953. Freezing temperatures have also been recorded as early in fall as October 8; the temperature dropped to 30 degrees on that date in 1952.

Love County has a climate and distribution of weather that are favorable to the general sequence of agricultural operations, except for occasional slowups after periods of heavy rain. The average monthly temperature and precipitation in fall are generally favorable for the preparation of a seedbed, as well as for the seeding, germination, and growth of small grains that normally are planted during that season. In fall, reserves of moisture are built up for the growth of plants in fall and winter pastures and for crops in newly planted fields. Moisture is ample for roots to develop to the extent that the plants can withstand

winter cold and possible freezeouts. In spring the mild temperatures and supply of moisture from good rains are also favorable for the preparation of the seedbed and for the planting of row crops. They are also favorable for the growth of plants that form stalks and for the maturing of small grains.

## Water Supply

In most parts of the county, the amount of water supplied by shallow wells was adequate for the household needs of the early settlers. After electric pumps and modern water systems were installed, however, this supply was no longer adequate in many communities. Wells supply enough water for irrigation in only a few areas on the benches along the Red River. Some artesian wells along Walnut Bayou supply a small amount of water, and if these wells are pumped, they do not produce much more. This water comes from a layer of fine sandy material in the Trinity formation.

In some areas deep wells produce a large amount of water. For example, wells about 800 feet deep supply water for the city of Marietta. Also, near Burneyville, a well 238 feet deep supplies water for a recreational development, including a lodge and a golf course.

Farm ponds furnish water for the livestock in the county. There are now 1,225 farm ponds in the county. Approval of the construction of the Upper Bayou and the Lower Bayou Watershed Projects would also make available about 40 lakes for irrigation, recreation, fishing, and hunting.

## Additional Facts About the County <sup>12</sup>

Early in the 1870's a number of settlers lived in and near the small village of Marietta in what is now Love County. At that time this small village consisted of a hotel, a blacksmith shop, one store, a livery stable, and a few houses.

Most of the early settlers practiced subsistence farming and produced on the farm almost everything used in the home. Late in the 19th century they began to plow and to plant the soil of the bottom lands to corn. Yields were better than the settlers had expected.

After the area was opened for settlement, other settlers moved into the county. They plowed the soils of the prairies and planted corn, small grains, and cotton, the main cash crop. Cotton was grown so extensively that at one time 21 cotton gins were in the county, and 5 of these were in the town of Marietta. The corn that was grown was ground into cornmeal for home use or was fed to hogs that were to be butchered. The oats were fed to the horses and mules.

For a number of years, farming methods did not improve much from the practices used by the early settlers. Soils were tilled up and down the slopes, and little was done to protect or improve the soils. In 1935 the first terraces were built on the prairie near Marietta, but these

terraces were only partly successful because the builders lacked the experience needed to design them. At that time, most farmers still did not spread barnyard manure on their fields or plant the newly introduced vetch or common or Korean lespedeza. As a result, depletion of the soils continued in most cultivated areas. In the economic depression of the thirties, many farmers abandoned their farms and moved away.

In 1939 the Love County Soil Conservation District was established by a small group of farmers and the county agent. Through this organization, commercial fertilizer was made available at cost and technical assistance was offered in laying out terraces and waterways and in planting grass in the waterways. In 1959, a total of 305,967 acres in 1,088 farms was included in the district.

Cotton became a less important crop when the agricultural controls of the early thirties cut the cotton acreage by more than half. The acreage was further reduced in the early forties when many farmers began to plant peanuts as a cash crop. Since that time, production of cotton has steadily declined because of the low fertility of the soils and the damage from erosion. Only two cotton gins remain in the county; one of these is in the town of Marietta, and the other is in Belleville.

Today the raising of livestock is the major farming and ranching enterprise in the county. In 1959 only about 8 percent of the acreage in farms consisted of land from which crops were harvested. Among the crops grown for feeding livestock or for home use are corn, forage crops, and vegetables. About 30 percent of the acreage in the county is still in trees, and the rest is used mainly for cultivated crops, pasture, or range. Some irrigation has been developed along the Red River.

The production of oil and gas is a major industry in this county. In 1961, there were 172 oil wells and gas wells in the county, and the allowable daily production was 2,926 barrels of oil. The quarrying of limestone is another major industry. The limestone is crushed and used as a fill for roadbeds. The supply appears to be unlimited.

Resources that provide recreation are abundant in this county. Texoma and Murray Lakes attract a large number of tourists. Recreational activities available at these lakes are fishing, boating, boat racing, and water skiing. In addition to the larger lakes, many farm ponds and small lakes are available for fishing and other kinds of recreation. About 8,900 acres in the Hickory Creek Game Management Area is accessible to the public, and hunting for deer, quail, geese, and squirrel is permitted in season.

## Glossary

**Alluvium.** Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

**Acidity.** See Reaction, soil.

**Available water-holding capacity.** The capacity of a soil to hold water in a form available to plants. The amount of moisture held in a soil between field capacity, or about one-third atmosphere of tension, and the wilting coefficient, or about 15 atmospheres of tension.

**Bench.** A shelflike embankment of earth that has a level or nearly level top and a steep or vertical downhill face.

**Bottom-land hardwood.** Species of pecan, oak, elm, hickory, willow, ash, and cottonwood.

<sup>12</sup> Much of the historical information in this section was supplied by J. CLAUDE BRANNAN, chairman of the State Soil Conservation Board, and much of the information about natural resources was supplied by FRED COLLINS, work unit conservationist, Soil Conservation Service.

**Clay.** As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

**Claypan.** A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

**Colluvium.** Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

**Concretions.** Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

**Consistence, soil.** The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

*Loose.*—Noncoherent; will not hold together in a mass.

*Friable.*—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

*Firm.*—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

*Plastic.*—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

*Sticky.*—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

*Hard.*—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

*Soft.*—When dry, breaks into powder or individual grains under very slight pressure.

*Cemented.*—Hard and brittle; little affected by moistening.

**First bottom.** The normal flood plain of a stream, subject to frequent or occasional flooding.

**Loam.** Soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand.

**Microrelief.** Minor surface configurations of the land.

**Mottling.** Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common, and many*; size—*fine, medium, and coarse*; and contrast—*faint, distinct, and prominent*. The size measurements are these: *Fine*, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium*, ranging from 5 to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

**Ped.** An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

**Permeability.** The quality of a soil horizon that enables water or air to move through it. These rates in inches per hour are expressed in words as follows:

Very slow	Less than 0.05	Moderately rapid	2.50 to 5.00
Slow	0.05 to 0.20	Rapid	5.00 to 10.00
Moderately slow	0.20 to 0.80	Very rapid	Over 10.00
Moderate	0.80 to 2.50		

**Plasticity index.** The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

**Plowpan.** A compacted layer formed in the soil immediately below the plowed layer.

**Poorly graded.** A soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles in poorly graded soil material, density can be increased only slightly by compaction.

**Profile, soil.** A vertical section of the soil through all its horizons and extending into the parent material.

**Reaction, soil.** The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		pH
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

**Saline soil.** A soil that contains soluble salts in amounts that impair the growth of plants but that does not contain excess exchangeable sodium.

**Sand.** Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

**Second bottom.** The first terrace above the normal flood plain of a stream.

**Sheet erosion.** The removal of a fairly uniform layer of soil or material from the land surface by the action of rainfall and runoff water.

**Silt.** Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

**Slickspots.** Small areas in a field that are slick when wet because they contain excess exchangeable sodium, or alkali.

**Slope.** The rise or fall in 100 feet of horizontal distance expressed in words as follow:

Nearly level	0 to 1 percent
Gently sloping	1 to 3 percent
Moderately sloping	3 to 5 percent
Strongly sloping	5 to 8 percent
Moderately steep	8 to 12 percent
Steep	12 to 14 percent

**Soil.** A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting upon parent material, as conditioned by relief over periods of time.

**Substratum.** Any layer lying beneath the solum, or true soil; the C or D horizon.

**Texture, soil.** The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

**Topsoil.** A presumed fertile soil material, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

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