Series 1959, No. 29 Issued August 1963

SOIL SURVEY

Roger Mills County Oklahoma

OUR SOIL * OUR STRENGTH

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

HOW TO USE THE SOIL SURVEY REPORT

THIS SURVEY of Roger Mills County will serve several groups of readers. It will help farmers and ranchers in planning the kind of management that will protect their soils and provide good yields; assist engineers in selecting sites for roads, buildings, ponds, and other structures; serve as a reference for students and teachers; help planning or development boards to decide on future development of the area; and add to our knowledge of soils.

Locating the soils

Turn to the index map at the back of this report to locate areas on the large map. The index is a small map of the county on which numbered rectangles have been drawn to show what part of the county each sheet of the large map represents. When you have found the correct sheet of the large map, you will note that the soil areas are outlined and that each soil is designated by a symbol. To locate your farm on the soil map, look for roads, streams, towns, and other familiar landmarks.

All areas marked with the same symbol are the same kind of soil. Suppose, for example, an area you have located on the map has the symbol CaB. The legend for the detailed map shows that this symbol identifies Carey silt loam, 1 to 3 percent slopes. This soil and all others mapped in the county are described in the section "Descriptions of Soils."

Finding information

Some readers will be more interested in one part of the report than in others.

Farmers, ranchers, and those who work with them will want to refer to the section "Descriptions of Soils" to learn about the soils on their farms and ranches. They can then turn to the section "Use and Management of Soils" to find how these soils can be managed and what yields can be expected. In the subsection "Management of Rangeland," the soils used mainly for grazing have been placed in range sites. Farmers who want to protect their fields, livestock, and homesteads from wind will want to read "Woodland and Windbreaks." Those interested in improving habitats for wildlife will find this information in the subsection "Wildlife." The "Guide to Mapping Units" at the back of the report gives the map symbol for each soil, the name of the soil, and the capability unit and range site in which it has been placed.

Engineers will find useful information in the section "Engineering Properties of the Soils," which evaluates the mapping units in terms of soil mechanics.

Students, teachers, and other users will find information about soils and their management in various parts of the report, depending on their particular interest. Those not familiar with the county may want to refer to the section "General Soil Map," which gives a broad summary of the soils in the county. They may also want to refer to the sections "General Nature of the County" and "Settlement and Use of the Land."

* * * * *

This soil survey was made as part of the technical assistance furnished by the Soil Conservation Service to the Upper Washita Soil Conservation District. The fieldwork was completed in 1959. Unless otherwise indicated, all statements refer to conditions at the time the survey was in progress.

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Contents

Series 1959, No. 29

Issued August, 1963

SOIL SURVEY OF ROGER MILLS COUNTY, OKLAHOMA

BY DENT L. BURGESS, JOE D. NICHOLS, AND ODOS G. HENSON, SOIL CONSERVATION SERVICE

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

ROGER MILLS COUNTY is on the western border of Oklahoma (fig. 1). It is bounded on the east by

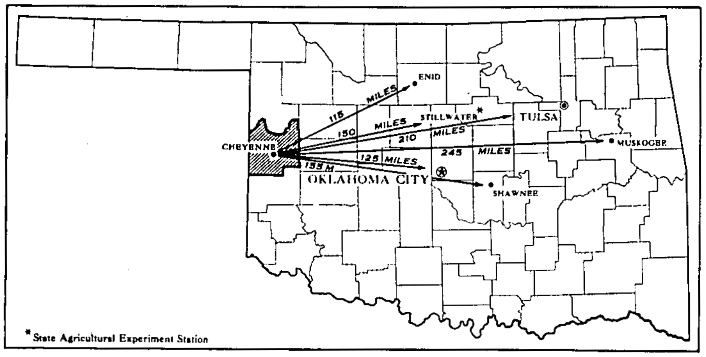

***Figure 1.*—Location of Roger Mills County in Oklahoma.**

Dewey and Custer Counties, on the south by Beckham County, and on the west by two counties in Texas—Hemphill and Wheeler. The South Canadian River flows along the northern border and forms the Roger Mills–Ellis County line. The length of the county from east to west is about 35 miles, and the width from north to south, about 32 miles. The total area, according to the U.S. Census of Agriculture for 1959, is 718,720 acres, or 1,123 square miles.

Cheyenne is the county seat and the largest town. It is near the center of the county and is about 125 miles west of Oklahoma City and about 150 miles southwest of Stillwater.

General Nature of the County

This section will be useful mainly to persons not familiar with Roger Mills County. It describes the relief and drainage, the climate, and the water supply.

Relief and Drainage

The topography of Roger Mills County is mostly rolling, but there are some smooth areas and some areas that are rough and broken. The altitude ranges from 2,600 feet at Antelope Hills in the northwestern part of the county to 1,700 feet in the southeastern part where the Washita River flows into Custer County.

The Washita River flows through the central part and drains about three-fourths of the county. The South Canadian River drains a strip about 5 to 6 miles wide along the northern border. Tributaries of the North Fork Red River drain the southern part.

Climate

The climate of Roger Mills County is subhumid, temperate, and continental. It is characterized by hot summers, mild winters, relatively high wind velocities, and wide fluctuations in rainfall. Table 1, compiled from records

TABLE 1.—*Temperature and precipitation at Hammon, Roger Mills County, Okla.*

[Elevation, 1,700 feet]

Month	Temperature [1]			Precipitation [2]			
	Average	Absolute maximum	Absolute minimum	Average	Driest year (1952)	Wettest year (1923)	Average snowfall
	°F.	°F.	°F.	Inches	Inches	Inches	Inches
January	36. 8	85	−18	0. 77	0. 40	0. 00	3. 5
February	41. 3	91	−9	. 74	. 83	. 56	2. 6
March	49. 3	97	−4	1. 51	2. 01	2. 03	2. 2
April	59. 1	96	18	2. 94	4. 09	3. 56	. 3
May	67. 4	104	32	3. 91	1. 75	6. 81	([3])
June	77. 4	113	41	3. 62	. 95	7. 70	([3])
July	82. 7	110	52	1. 80	. 79	. 38	0
August	82. 1	115	42	2. 20	1. 08	1. 45	0
September	73. 2	108	32	3. 18	. 25	12. 27	([3])
October	61. 3	98	14	2. 61	([3])	9. 58	. 1
November	48. 6	90	8	1. 29	1. 52	1. 02	. 8
December	38. 1	83	−6	1. 07	1. 08	. 64	2. 5
Year	59. 8	115	−18	25. 64	14. 75	46. 00	12. 0

[1] Average temperature based on a 41-year record, through 1955; highest temperature based on a 36-year record and lowest temperature, on a 35-year record, through 1952.

[2] Average precipitation based on a 41-year record, through 1955; wettest and driest years based on a 38-year record, in the period 1914–55; snowfall based on a 37-year record, through 1952.

[3] Trace.

of the United States Weather Bureau at Hammon, Oklahoma, gives temperature and precipitation data typical of the county.

Precipitation in the county varies so widely from year to year that it is misleading to state that a certain amount of precipitation is "normal" (fig. 2). Records at Hammon indicate that only 26 times in 45 years has the annual rainfall been within 5 inches above or 5 inches below the

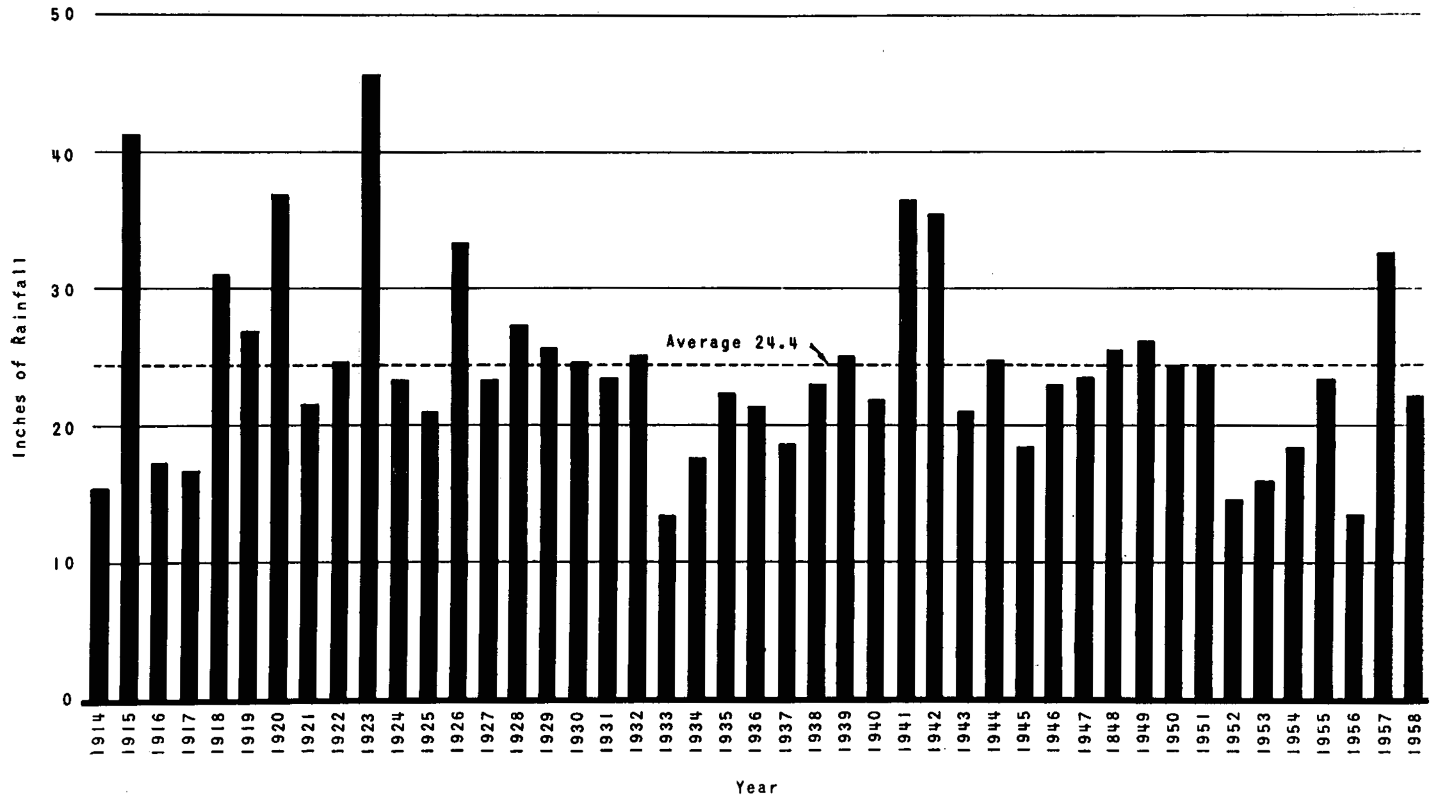

Figure 2.—**Annual precipitation at Hammon, Oklahoma, from 1914 to 1958.**

average of 24.4 inches. Twice in this 45-year period, the annual rainfall was less than 14 inches, and twice it was more than 40 inches. There were 11 years in which rainfall was less than 20 inches. Twice it was less than 20 inches for 2 consecutive years, and once for 3 consecutive years. There were several years when rainfall was too low for the economic production of crops. The average precipitation shown in figure 2 is slightly less than that shown in table 1 because figure 2 covers a 45-year period through 1958 and table 1 covers a shorter period.

The average monthly distribution of precipitation as recorded at Cheyenne, Oklahoma, is shown in figure 3.

Rains of high intensity often cause the erosion of unprotected soils and the overflow of the Washita River and its tributaries. Hailstorms have also caused some damage 18 times during the past 35 years.

Temperatures of more than 100° F. are common in summer, and a high of 115° has been reached. Winter temperatures are fairly mild. The average is 38.7°. The prevailing wind generally is from the southwest, but occasionally a shift to the north causes a rapid drop in temperature and a cold spell that usually lasts about 2 or 3 days. A low of −18° has been recorded.

The average length of the growing season is 209 days. The average date of the last frost in spring is April 2, and the average date of the first in fall is October 28. The latest killing frost was recorded on April 17, and the earliest on October 8.

The average wind velocity in the county is 14 miles per hour. The strongest winds occur in spring. They may severely damage sandy soils that are not protected by growing vegetation or by crop residues. Strong winds and high temperatures dry the surface soil and cause plants to lose moisture rapidly.

Several destructive tornadoes have occurred in the county, and winds of 60 miles per hour are common during thunderstorms.

Water

Although the water supply is adequate for present needs throughout most of the county, much of the water is hard because it contains dissolved gypsum. Wells, ranging in depth from 20 to 200 feet, furnish water for livestock. The shallower wells are along streams, and the deeper ones are on the uplands. Generally, windmills are used to raise the water. Farm ponds also furnish water for livestock, and flood-prevention structures store water both for livestock and for irrigation.

Settlement and Use of the Land

Roger Mills County was part of the territory claimed by LaSalle for Spain in 1682. This territory was granted to France in 1800 and, as part of the Louisiana Purchase, was acquired by the United States from France in 1803. In 1804 it was set aside as Indian territory. By 1870 the Indians were leasing much of the acreage to cattlemen for range.

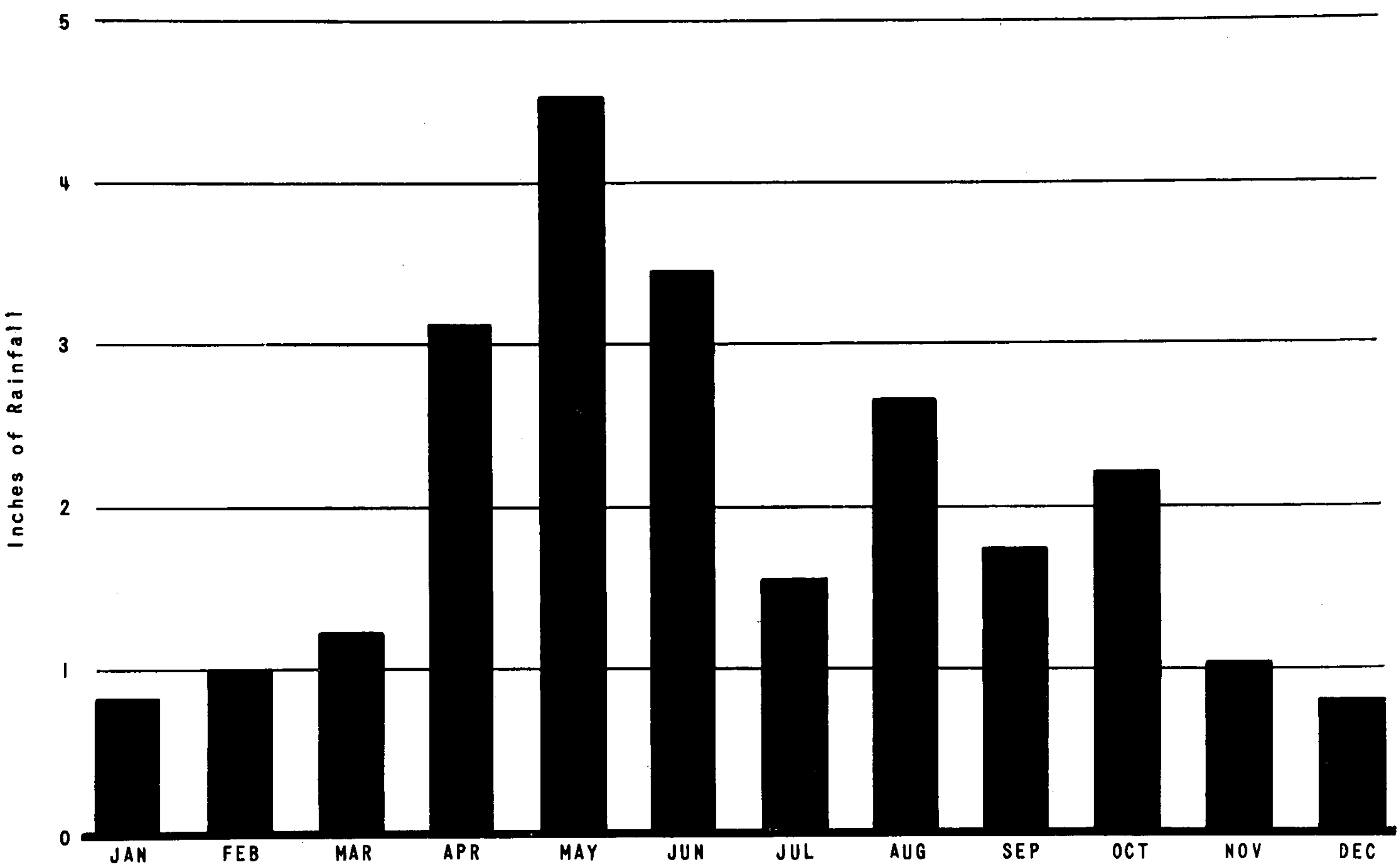

Figure 3.—**Average monthly distribution of precipitation at Cheyenne, Okla., from 1931 to 1955.**

This territory was opened for settlement on April 19, 1892. Many claims were made by cattlemen from Texas who wanted land for range. The area was named Roger Mills in 1893, in honor of Roger Q. Mills, a Congressman from Texas. When a fencing law abolished open range in the area, the cattlemen moved out.

From 1910 to 1913, several railroads were built—one in the eastern part of the county, one along the Washita River, and another from Strong City to Cheyenne. In 1928, the railroad to Cheyenne was extended to Pampa, Texas. Packsaddle Bridge across the South Canadian River was built in 1930.

Much of Roger Mills County was permanently settled during the years 1905 through 1909, when rainfall was plentiful. At that time most of the population lived on farms. Droughts and mismanagement of the soils resulted in considerable erosion of the soils by wind and water. Much of the acreage that was formerly used for cultivated crops is now in range. About half the population now live in the towns, but agriculture is still the principal source of income in the county.

Present Cultural Facilities

Because of the decrease in the rural population, all rural elementary schools except one have been consolidated with schools at Cheyenne, Crawford, Berlin, Reydon, and Hammon. Students living in rural areas are transported to and from these consolidated schools by school buses. Some of the former school buildings are now used as community centers or as meeting places for clubs and other organizations.

Churches of various denominations are located in the towns, and there are a few churches in rural areas.

Weekly newspapers are published at Cheyenne and at Hammon.

Reservoirs formed by the upstream flood prevention structures provide places for fishing, boating, and water skiing. Quail hunting is popular, and there is also some duck hunting in nearby areas. There is a golf course near Cheyenne.

Industry in the county is almost entirely limited to the processing of agricultural products.

Highways and dirt roads serve the county. The important highways are U.S. Highway No. 283 and State Highways Nos. 6, 30, 33, 47, and 152. Some of the dirt roads are impassible for short periods during rainy seasons, particularly those in the eastern part of the county where the soils are more clayey.

The Panhandle and Santa Fe Railroad crosses the county from east to west and serves Hammon, Strong

City, Cheyenne, and Reydon. The Missouri-Kansas-Texas Railroad passes through the extreme eastern part of the county and serves Hammon. Most of the milk from dairies is transported by truck to Amarillo, Texas. A small airport is used principally for private planes.

Telephone service is available in most parts of the county, and all towns and most rural sections have electricity.

Upstream Flood Prevention Program [1]

Although the average annual rainfall in Roger Mills County is about 24 inches, the amount of rainfall varies greatly from year to year. Rains are sometimes of such intensity that the Washita River and its tributaries overflow. One of the most devastating floods in the history of the county occurred during the severe drought of the 1930's, when the county was considered part of the dust bowl.

In 1944, Congress authorized the Flood Prevention Program on the Washita River. By 1948, a few small detention structures, scattered throughout the county, proved that the structures would work, but it was not certain that the watershed program would successfully control floods on an entire stream. Consequently, the Washita River and its tributaries were subdivided into 64 major tributaries, or subwatersheds, 12 of which are wholly or partly in Roger Mills County. Then a watershed plan was developed for one of these tributaries, Sandstone Creek. By November 1952, the detention structures on Sandstone Creek were completed, and the rest of the program for this watershed was in effect (fig. 4). The results were so impressive that flood-prevention plans are now being developed for the entire Washita drainage area in the county, a tract amounting to 504,309 acres.

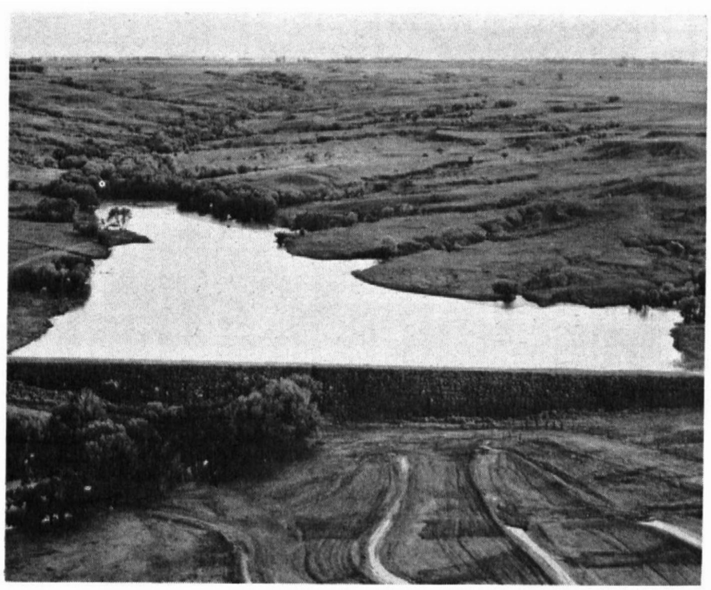

Figure 4.—**Typical detention structure on Sandstone Creek.**

With the completion of the planned program, 290,501 acres of land will be behind 105 detention structures. These structures will store 4,969 surface acres of water. They will have a total flood storage of 180,718 acre-feet and will protect a flood-plain area of 22,356 acres, in addition to the flood plains of the Washita River.

Although the reduction of flood damage is the principal purpose of the program, many additional benefits are derived. The water table has risen, and streams flow the year round, even in dry years. Water from the streams and from the reservoirs can be used to water cattle and to irrigate crops.

The reservoirs are also used for recreational purposes. Fishing, boating, and water skiing have become popular sports in the county, and areas in the vicinity of the reservoirs make excellent camping sites.

Agriculture [2]

Agriculture is the principal source of income in Roger Mills County. In recent years, the trend in agriculture has been toward livestock farming. This subsection gives some statistics on the farms in the county, as reported by the U.S. Census of Agriculture.

Land in farms

Table 2 shows the land in farms in the county and the number and average size of farms for stated years. The average size of farms has been steadily increasing for the past 50 years and has almost doubled since 1940.

TABLE 2.—*Land in farms*

Item	1940	1950	1959
Land in farms .... acres..	695, 914	718, 332	677, 822
Proportion of land in farms..percent..	96. 7	99. 9	94. 3
Number of farms	1, 819	1, 275	921
Average size of farms .... acres..	382. 6	563. 4	736. 0
Number of farms by size:			
Less than 100 acres	222	103	49
100 to 179 acres	545	248	123
180 to 259 acres	183	128	74
260 to 499 acres	552	441	283
500 to 999 acres	216	223	226
1,000 acres or more	101	132	166

Farm tenure

Table 3 shows farm tenure in the county for stated years. In 1959, more than 80 percent of the farms in the county were operated by full or part owners.

The proportion of farms operated by tenants decreased from 45.7 percent in 1940 to 24.2 percent in 1950, and by 1959 it had declined to 16.2 percent.

[1] By L. L. MALES, vice-chairman, Upper Washita Soil Conservation District Board of Supervisors.

[2] By STEWART H. JESSEE, agricultural economist, Soil Conservation Service.

TABLE 3.—*Farm tenure*

Item	1940	1950	1959
Owners	976	961	769
Full owners	570	559	420
Part owners	406	402	349
Managers	12	5	3
All tenants	831	309	149
Cash	241	87	30
Share cash	78	46	42
Share tenants and croppers	461	153	63
Other and unspecified	51	23	14
Total	1, 819	1, 275	921

Land use and type of farms

In 1959, permanent pasture made up 76.2 percent of the 677,822 acres of farmland in the county. Crops were harvested from 13.5 percent of the land in farms. The use of land, as reported in the census for 1959, is shown in the list that follows:

	Acres
Cropland harvested	91, 281
Cropland used only for pasture	36, 058
Cropland not harvested and not pastured	57, 612
Woodland pastured	3, 280
Woodland not pastured	1, 427
Other pasture (not cropland and not woodland)	477, 422
Other land (house lots, roads, wasteland, etc.)	10, 742

Of the 921 farms in the county in 1959, there were 146 that were listed as miscellaneous or unclassified, and the rest were classified as follows:

	Number
Field-crop farms	281
Cash grain	88
Cotton	187
Other field crops	6
Dairy farms	79
Livestock farms other than dairy and poultry	313
General farms	102

Crops

Table 4 shows the acreage of selected crops grown in the county for stated years. Wheat and cotton are the principal cash crops. Sorghum is grown both for forage and for grain, in nearly equal proportions. Although the acreage in broomcorn is relatively small, broomcorn is an important crop in the county because of its high value per acre.

Wheat is grown throughout the county, but the heaviest concentrations are in the northern half and in bottom-land areas. The seeding dates for winter varieties usually extend from October 1 to October 15. From December 15 to March 15, about half the wheat acreage is pastured to some extent, depending on moisture conditions and fall growth. Generally, insects cause little damage to wheat, but a serious infestation of greenbug occurs about once in 10 to 15 years. Combines are used to harvest the wheat crop.

TABLE 4.—*Acreage of selected crops*

Crop	1939	1949	1959
Small grain harvested:			
Wheat	27, 364	71, 443	36, 241
Oats	5, 049	1, 234	512
Barley	3, 065	405	4, 197
Rye	9, 671	325	4, 152
Corn for all purposes	5, 704	1, 928	623
Broomcorn	6, 375	8, 909	925
Cotton	31, 210	22, 763	12, 481
Sorghum for all purposes except sirup	74, 180	36, 613	26, 554
Hay crops:			
Alfalfa and alfalfa mixtures	505	4, 428	2, 048
Native hay cut	794	572	367
Small grain cut for hay	871	359	773

Rye, oats, and barley are planted primarily for use as winter pasture, but the grain generally is harvested. Rye is also grown to a large extent as a cover crop. Oats and barley are subject to damage by the high temperatures and low humidity in the county, and barley is susceptible to greenbug damage. Rye is less readily affected by the climate and is less susceptible to insect damage.

Corn was the most important crop grown in the county in the early part of the century. Since that time, the acreage in corn has steadily decreased. Hot dry winds in June and July severely damage corn by hindering pollination. Some corn is still grown on the fertile bottom-land soils.

Broomcorn has been one of the more important cash crops in the county for many years. It is grown on the sandier soils in the western and northwestern parts of the county. The planting dates extend from May 15 to June 1. Cheyenne, the county seat, was once one of the larger markets for broomcorn.

Sorghum commonly is planted on the shallower, more eroded soils, since the better soils are used for wheat and cotton. However, it is also grown to a considerable extent on bottom lands. In places sorghum is used as a catch crop for wheat, and sometimes, if there is sufficient moisture, it is grown in fields from which winter wheat has been harvested. The sandy loams in the southern part of the county produce the best upland yields.

Cotton is grown on sandy loams, mostly in the southern part of the county and in bottom-land areas. It is the principal irrigated crop. Planting dates are from May 1 to June 1. At planting time, about half the cotton acreage is fertilized with a low-analysis fertilizer containing nitrogen and phosphate but little or no potash. Cotton is susceptible to damage by the boll weevil and pink bollworm.

Alfalfa is grown largely in the stream valleys. Some of the acreage is irrigated. The planting dates generally extend from August 25 to October 1, and the average life of a planting is about 4 years. Fertilizers are not commonly used. Alfalfa is susceptible to severe damage by aphids.

Range

In earlier years, the lands used for grazing generally consisted of shallow, eroded, sandy soils not suited to cultivation. In recent years, a considerable acreage of formerly cultivated soils has been reseeded to mixtures of native grasses. In 1959, more than three-fourths of the acreage in farms was used for range.

Livestock and livestock products

Table 5 shows the number of livestock on farms in Roger Mills County in stated years. In recent years, the trend has been from cash-crop farms to livestock farms or general crop-livestock farms. In 1959, the number of cattle in the county reached an alltime high. In that year, the sale of livestock and livestock products amounted to 62 percent of the total agricultural sales.

TABLE 5.—*Number of livestock*

Livestock	1940	1950	1959
Cattle and calves	[1]34, 703	45, 768	46, 994
Cows milked	[2] 9, 018	6, 969	5, 589
Hogs and pigs	[3] 7, 312	5, 006	3, 766
Sheep and lambs	[4] 6, 491	1, 072	989
Horses and mules	[1] 7, 111	2, 410	1, 413
Chickens	[3]94, 198	[3]72, 505	[3] 35, 868

[1] Over 3 months old.
[2] One year earlier than census year at head of column.
[3] Over 4 months old.
[4] Over 6 months old.

How Soils are Named, Mapped, and Classified

Soil scientists made this survey to learn the kinds of soils in Roger Mills 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 rocks; and many facts about the soils. They dug or bored 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 to the rock 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 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, the major horizons of all the soils of one series 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. Pratt and Woodward, for example, are the names of two soil series in Roger Mills County. All the soils in the United States having the same series name are essentially alike in natural characteristics.

Many series contain soils that differ in the texture of their surface layer. According to such differences, 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. Pratt fine sandy loam and Pratt loamy fine sand are two soil types in the Pratt series. The difference in the 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 soil phases. The name of a soil phase indicates a feature that affects management. For example, Pratt fine sandy loam, 1 to 3 percent slopes, is one of the several phases of Pratt fine sandy loam, a soil type that has a slope range of 0 to 8 percent.

After a fairly detailed guide for classifying and naming the soils had been worked out, the soil scientists drew soil boundaries on aerial photographs. These photographs show woodlands, 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 scientist has a problem of delineating areas where different kinds of soils are so intricately mixed or occur in such small individual tracts that it is not practical to show them separately on the map. Therefore, he shows this mixture of soils as one mapping unit and calls it a soil complex. Ordinarily, a soil complex is named for the major soil series in it. An example in Roger Mills County is the Mansker-Potter complex. Also, in most mapping, there are areas to be shown that are so rocky, so shallow, or so frequently worked by wind and water that the soils are too variable to be classified into soil series. These areas are shown on the soil map, but they are given descriptive names, such as Rough broken land or Eroded sandy land, and are called land types.

Occasionally, two or more recognized soils, which are not regularly associated geographically, may be mapped as a single unit, called an undifferentiated mapping unit, if the differences between them are too small to justify separate mapping. An example in Roger Mills County is Nobscot and Brownfield fine sands.

Only part of the soil survey was done when the soil scientist had named and described the soil series and mapping units and had shown the location of the mapping units on the soil map. He still had to present the mass of detailed information he had recorded in different ways for different groups of users, among them farmers, managers of woodlands and rangelands, and engineers. To do this efficiently, he had to consult with persons in other fields of work and jointly with them prepare groupings that would be of practical value to the different users. Such groupings are the capability classes, subclasses, and units, designed primarily for those interested in producing short-lived crops and tame pasture; range sites, for those using large tracts of native grass; woodland suitability groups, for those who manage wooded tracts; and the classifications used by engineers who build highways or structures to conserve soil and water.

General Soil Map

After study of the soils in a locality and the way they are arranged, it is possible to make a general map that shows several main patterns of soils, called soil associations. The nine soil associations in Roger Mills County are shown on the colored general soil map at the back of this report. Each association, as a rule, contains a few major soils and several minor soils, in a pattern that is characteristic although not strictly uniform.

The soils within any one association are likely to differ from each other in some or in many properties; for example, slope, depth, stoniness, or natural drainage. Thus, the general soil map shows, not the kind of soil at any particular place, but patterns of soils, in each of which there are several different kinds of soils.

Each soil association is named for the major soil series in it, but, as already noted, soils of other series may also be present. The major soils of one soil association may also be present in another association, but in a different pattern.

The general map showing patterns of soils is useful to people who want a general idea of the soils, who want to compare different parts of a county, or who want to know the possible location of good-sized areas suitable for a certain kind of farming or other land use.

1. Nobscot-Brownfield association

Smooth to rolling, very sandy soils on the uplands; reddish subsoil

This association covers about 25 percent of the county and is in the western part. It is composed largely of Nobscot and Brownfield fine sands. The minor soils are Miles fine sandy loams; Springer loamy fine sands; Nobscot and Brownfield soils, eroded; Eroded sandy land; and Zavala fine sandy loam (fig. 5). Eroded and severely eroded areas, characterized by blowouts and gullies, are common throughout this association.

The Nobscot soils and Brownfield soils both have a very sandy surface layer, 8 to 24 inches thick, that is susceptible to wind erosion if cultivated. The subsoil is reddish in both, but in the Brownfield soils it is more clayey.

Miles fine sandy loams have a less sandy, darker colored, and generally more shallow surface layer than the Brownfield soils and are better suited to cultivation.

Springer loamy fine sands are similar to Nobscot soils, except that the surface layer is more coherent, less sandy, and somewhat darker colored.

The Zavala soil occurs in drainageways where sandy and silty materials have accumulated. This soil is one of the most productive soils in this association for cultivated crops.

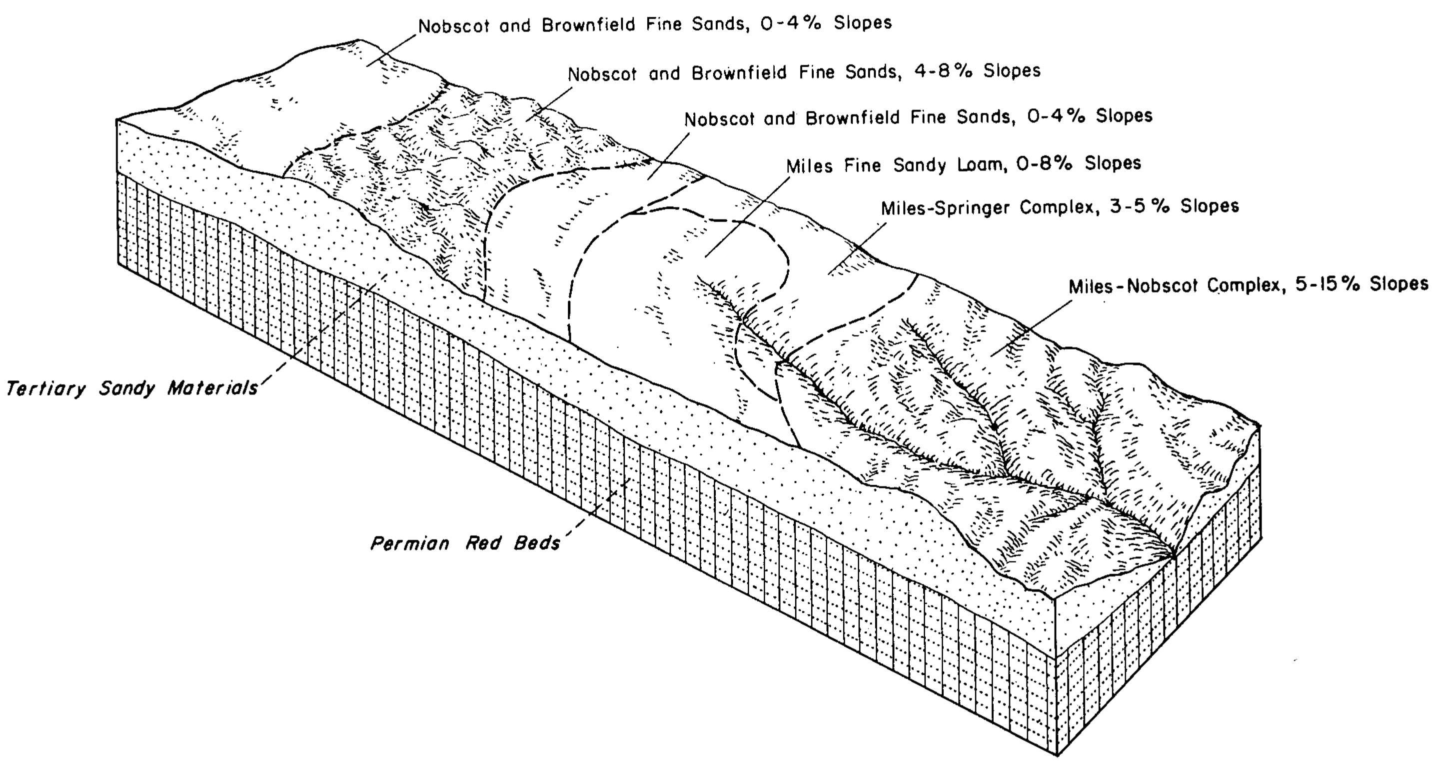

***Figure 5.*—Typical pattern of soils in associations 1 and 2.**

645305—63——2

About a third of the acreage in this association is used to grow sorghum, small grain, cotton, and broomcorn. About a fifth has been reseeded to native grasses. Much of the acreage that was formerly cultivated is now eroded or severely eroded.

The native vegetation consists of mid and tall grasses and of shin oak, which makes up one-third to one-half of the cover. The range is highly productive if properly managed.

2. *Miles-Springer association*

Steep to hilly, moderately sandy soils; reddish subsoil

This association makes up about 5 percent of the county. The two largest areas are in the southwestern part, just north of an area of the Nobscot-Brownfield association. Smaller areas are north of Crawford and east of Roll. Miles and Springer soils are dominant, but small areas of Eroded sandy land are included. Figure 5 shows a typical pattern of the dominant soils in this association and of those in the Nobscot-Brownfield association.

Miles soils are moderately sandy and have a reddish subsoil that is considerably higher in clay than the surface layer. Springer soils have less clay in the subsoil than Miles soils.

The soils in this association are susceptible to erosion and should be intensively managed if cultivated. About 25 percent of the acreage is in small grain and forage sorghum. Much of the acreage is too steep for cultivation. Beef-cattle farms predominate, and there are some dairy farms.

The native vegetation consists of tall grasses, some short and mid grasses, shin oak, and sand sagebrush. The shin oak and sand sagebrush make up about a fourth of the cover. If grazing is controlled, the production of forage is moderate.

3. *Pratt association*

Smooth to rolling, sandy to moderately sandy soils on the uplands; brownish subsoil

This association makes up about 5 percent of the county. It consists of deep, moderately dark-colored, sandy and moderately sandy Pratt soils. The sandier soils make up about three-fourths of the association (fig. 6).

Nearly 50 percent of the acreage is cultivated. The principal crops are small grain, forage sorghum, and grain sorghum. Much of the small grain is wheat, but some rye is grown for pasture and as a cover crop. The farms generally are of either the beef-cattle or the dairy type.

The soils in this association are moderately fertile, but they need intensive management, including the use of cover crops, that will control wind erosion. Sweetclover is grown to maintain fertility, and some fertilizer is applied.

The native vegetation consists of tall and mid grasses and some sand sagebrush. The range is highly productive if properly managed.

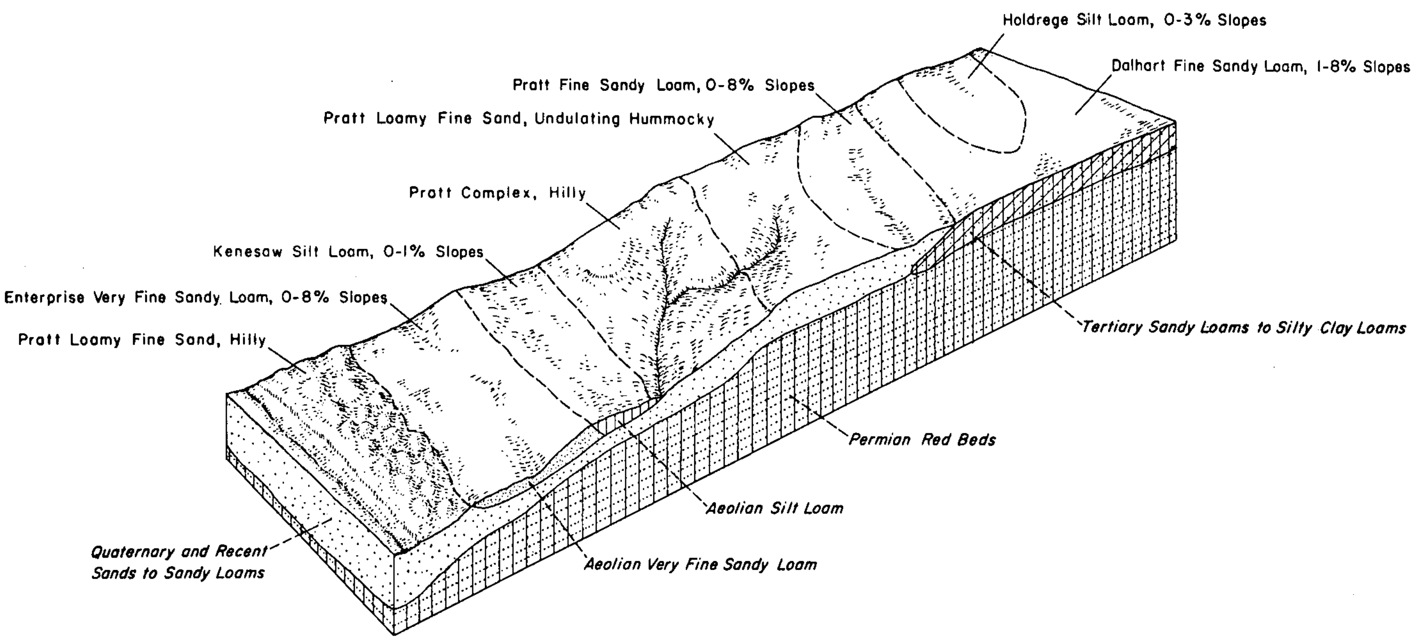

Figure 6.—**Typical pattern of soils in associations 3, 4, and 5.**

4. *Pratt-Enterprise association*

Steep to hilly or dunelike, sandy to moderately sandy soils on the uplands; brownish subsoil

This association covers about 10 percent of the county. It is in the northern part, along the South Canadian River. The largest area extends from the bend of the river north of Durham to a few miles east of Roll.

Less than a tenth of this association is suitable for cultivation. Nearly three-fourths consists of moderately dark-colored or brownish, moderately sandy Pratt and Enterprise soils. These soils are deep and moderately fertile, but in most places they are too steep for cultivation. However, soils near the base of slopes can be cultivated if intensive measures are used to control erosion. The rest of the association is made up of sandy Pratt soils. These soils are mostly in duny areas, within 1 or 2 miles of the river.

Ranches occupy much of the acreage in this association. These units are somewhat larger than those in areas used principally for farming. The vegetation consists of mid and tall grasses and some sand sagebrush. If grazing is controlled, the production of forage is moderate to high.

5. Dalhart-Holdrege association

Smooth, moderately sandy and loamy soils on the uplands; brownish subsoil

This association covers less than 3 percent of the county. It is in the northwestern part, within 4 miles of the South Canadian River. It consists mostly of deep, nearly level to gently sloping soils.

Dalhart soils have a surface layer of brownish fine sandy loam and a finer textured subsoil. Holdrege soils have a surface layer of dark-colored silt loam and a finer textured subsoil.

The soils in this association are used principally for farming, but some cattle are grazed in the rougher areas and on the borders of other associations. Most of the acreage is in wheat, a smaller acreage is in sorghum, and a little is in cotton. Farms are only average or smaller in size, but they have some of the finest equipment and best homesteads in the county.

Because the soils are naturally fertile, little fertilizer is used. Yields are higher, however, if some fertilizer is used, if crops are rotated, and if sweetclover is grown for soil improvement. Good management practices, including the use of crop residues, are needed to maintain fertility and to control erosion. The sandy soils are more susceptible to wind erosion than the loamy soils and should be more intensively managed.

6. Yahola-Port association

Alluvial soils on bottom lands and terraces

This association makes up about 4 percent of the county. It is mostly on the flood plains of the Washita River and its tributaries (fig. 7). A smaller area is in the southwestern part of the county, along tributaries of the North Fork Red River.

Yahola, Port, and Spur soils are dominant in this association. Norwood, Reinach, Lincoln, Wann, and Sweetwater are the minor soils. Norwood and Yahola soils are reddish, loamy soils on the flood plains. They are among the most productive soils in the county and are used mostly to grow alfalfa, small grain, sorghum, and cotton. Spur, Port, and Reinach soils are reddish, loamy soils on low terraces and high bottoms. They are also productive and are used mostly to grow small grain, sorghum, and cotton.

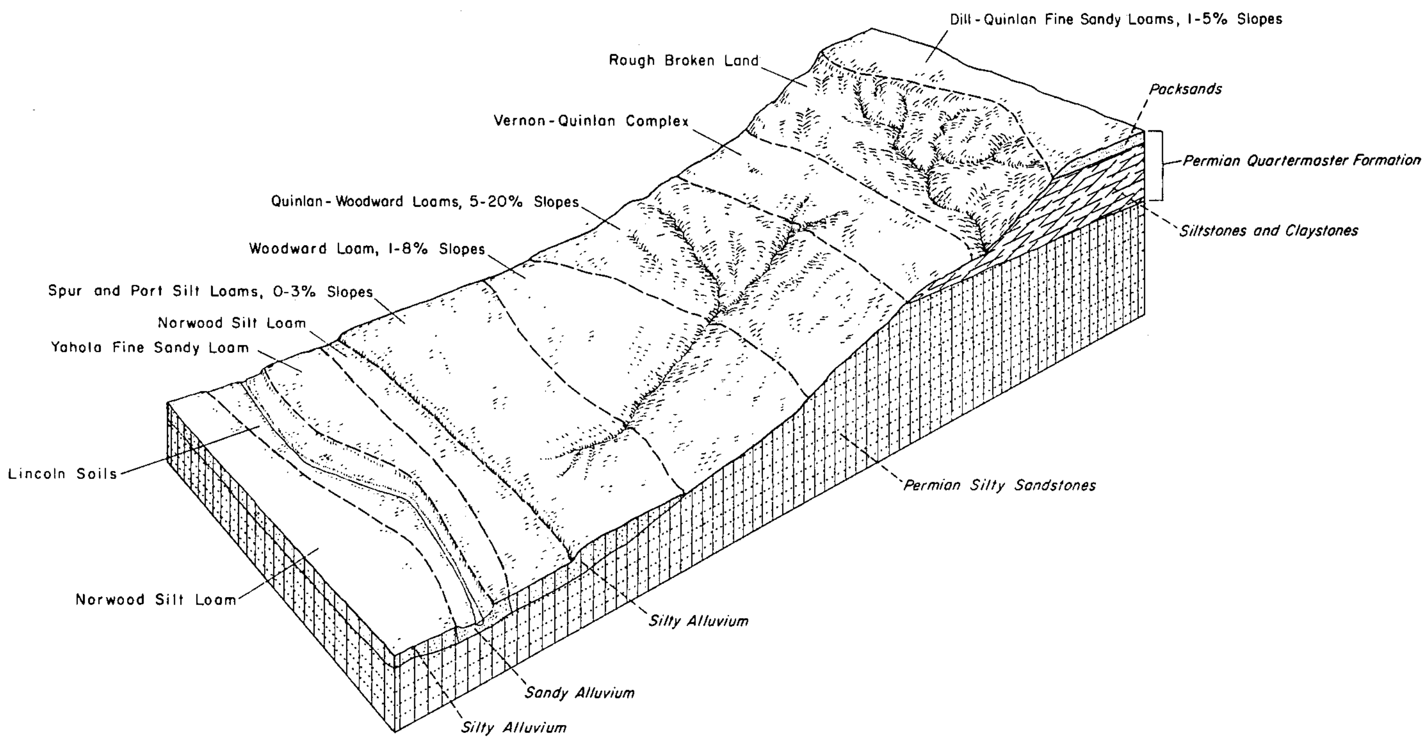

***Figure 7.*—Typical pattern of soils in associations 6, 7, and 9.**

Little alfalfa is grown on these soils. Lincoln soils are sandy and have a very sandy subsoil. They are not suited to cultivated crops but produce large amounts of forage. Wann soils have a moderately sandy subsoil and a moderately high water table and are subject to overflow. They are mostly in alfalfa or in pasture. Sweetwater soils are in sandy areas along the Washita River and small creeks. They have a high water table and are mostly in pasture or in hay. The production of forage is high.

The farms in this association generally are smaller than farms in other parts of the county. They are principally of the general type, although some beef cattle are raised. Some areas in this association are irrigated. Generally, the water is drawn from wells, but some is taken from structures built for flood prevention.

7. *Rough broken land-Vernon-Quinlan association*

Rough broken soils and very shallow, loamy or clayey soils; underlain by red beds

This association covers a little more than 12 percent of the county. The soils are mostly loamy and are shallow to very shallow over shaly red beds. In most places the depth to bedrock is 10 inches or less.

Rough broken land makes up about three-fourths of the acreage. It occurs as ragged escarpments along the Washita River in the central part of the county, and at the headwaters of some of the creeks in the eastern two-thirds of the county. It is steep to very steep, and the broken areas support sparse vegetation.

Smooth to rolling Vernon and Quinlan soils make up the rest of this association. Most of this acreage is in the southeastern part of the county, but a small acreage is in other red-bed areas.

Figure 7 shows a typical pattern of the soils in this association and those in the Yahola-Port association.

All of the acreage in this association is in range. The vegetation is principally short grasses but includes some mid grasses. Some tall grasses grow in broken or very steep areas. The production of forage is fairly low.

Fairly large ranches occupy the larger areas of this association. Small or narrow areas generally are parts of large ranches that include soils of bordering associations.

8. *Woodward-Quinlan association*

Smooth to very steep, loamy soils on the uplands; underlain by red beds

This association covers about 33 percent of the county and is mostly in the eastern part. About 80 percent is made up of steep to very steep, reddish-brown, shallow Quinlan soils and steep to very steep, reddish brown, moderately deep Woodward soils (fig. 8). These soils are not suited to cultivation. About 15 percent of the association is composed of smooth to rolling Woodward and Quinlan soils. These soils are suitable for cultivation. About 5 percent consists of smooth to rolling St. Paul and Carey soils. These soils are suited to cultivation and are the most productive soils in this association.

Only about 10 percent of the acreage in this association is cultivated. Most of the cultivated acreage is near the eastern border of the county. Generally, the farms are of the beef-cattle type. The principal crops are wheat and sorghum. Yields are moderate to good. Ranching predominates in the rest of the association. The ranches are about the largest in the county.

On these soils, particularly on the steeper ones, careful management is needed to control erosion. The native vegetation is principally mid and short grasses but includes some tall grasses. The production of forage is moderate if the pastures are well managed.

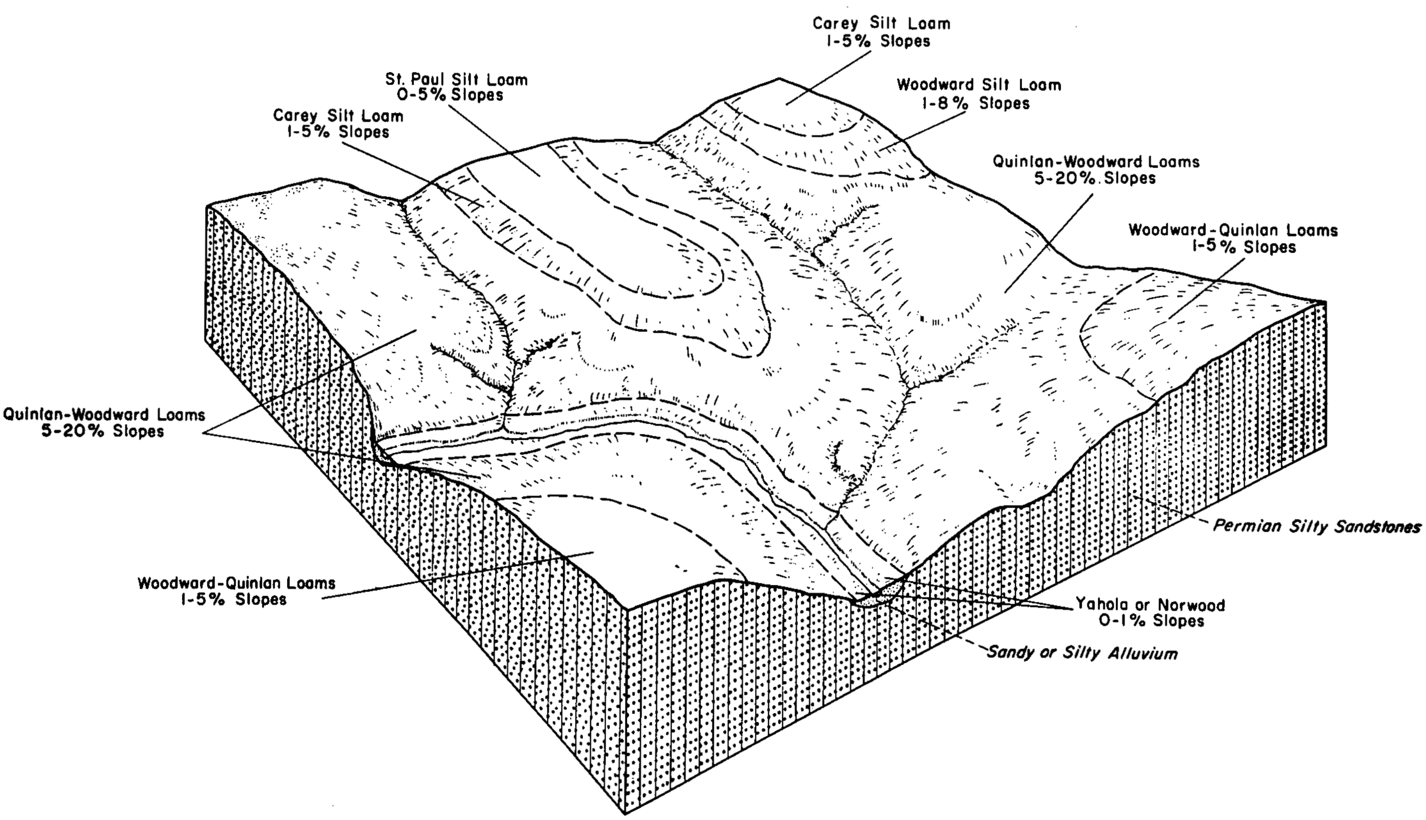

Figure 8.—**Typical pattern of soils in association 8. Woodward silt loam is a variation, which is described in the section "Descriptions of Soils."**

TABLE 6.—*Approximate acreage and proportionate extent of the soils mapped*

Soil	Acres	Percent
Brazos loamy fine sand	361	0. 1
Carey silt loam, 1 to 3 percent slopes	3, 117	. 4
Carey silt loam, 3 to 5 percent slopes	686	. 1
Dalhart fine sandy loam, 1 to 3 percent slopes	4, 359	. 6
Dalhart fine sandy loam, 3 to 5 percent slopes	2, 451	. 3
Dalhart fine sandy loam, 5 to 8 percent slopes	1, 074	. 2
Dill-Quinlan fine sandy loams, 1 to 3 percent slopes	10, 925	1. 5
Dill-Quinlan fine sandy loams, 3 to 5 percent slopes	2, 340	. 3
Enterprise very fine sandy loam, 0 to 1 percent slopes	1, 257	. 2
Enterprise very fine sandy loam, 1 to 3 percent slopes	2, 251	. 3
Enterprise very fine sandy loam, 3 to 5 percent slopes	1, 210	. 2
Enterprise very fine sandy loam, 5 to 8 percent slopes	2, 458	. 3
Eroded sandy land	20, 454	2. 8
Holdrege silt loam, 0 to 1 percent slopes	814	. 1
Holdrege silt loam, 1 to 3 percent slopes	4, 324	. 6
Kenesaw silt loam, 0 to 1 percent slopes	2, 521	. 4
Lincoln soils	5, 718	. 8
Mansker complex, severely eroded	735	. 1
Mansker loam, 2 to 5 percent slopes	820	. 1
Mansker-Potter complex	4, 647	. 6
Miles fine sandy loam, 0 to 1 percent slopes	700	. 1
Miles fine sandy loam, 1 to 3 percent slopes	7, 673	1. 1
Miles fine sandy loam, 3 to 5 percent slopes	3, 688	. 5
Miles fine sandy loam, 5 to 8 percent slopes	2, 868	. 4
Miles-Dill loamy fine sands, 1 to 4 percent slopes	3, 196	. 4
Miles-Nobscot complex, 5 to 8 percent slopes	7, 688	1. 1
Miles-Nobscot complex, 8 to 15 percent slopes	19, 919	2. 8
Miles-Springer complex, 3 to 5 percent slopes	2, 653	. 4
Nobscot fine sand, 0 to 4 percent slopes	29, 428	4. 1
Nobscot and Brownfield fine sands, 0 to 4 percent slopes	41, 888	5. 8
Nobscot and Brownfield fine sands, 4 to 8 percent slopes	42, 413	5. 9
Nobscot and Brownfield soils, eroded	2, 480	. 3
Norwood silt loam	16, 688	2. 3
Pratt complex, hilly	28, 282	3. 9
Pratt loamy fine sand, undulating	23, 634	3. 3
Pratt loamy fine sand, hummocky	9, 193	1. 3
Pratt loamy fine sand, hilly	17, 990	2. 5
Pratt fine sandy loam, 0 to 1 percent slopes	842	. 1
Pratt fine sandy loam, 1 to 3 percent slopes	5, 995	. 8
Pratt fine sandy loam, 3 to 5 percent slopes	2, 970	. 4
Pratt fine sandy loam, 5 to 8 percent slopes	4, 212	. 6
Quinlan soils, severely eroded	10, 575	1. 5
Quinlan-Woodward loams, 1 to 5 percent slopes, eroded	3, 072	. 4
Quinlan-Woodward loams, 5 to 20 percent slopes	186, 778	26. 0
Reinach fine sandy loam	3, 146	. 4
Rough broken land	57, 871	8. 0
St. Paul silt loam, 0 to 1 percent slopes	374	. 1
St. Paul silt loam, 1 to 3 percent slopes	6, 248	. 9
St. Paul silt loam, 3 to 5 percent slopes, eroded	1, 511	. 2
Springer loamy fine sand, hummocky	4, 130	. 6
Springer loamy fine sand, hilly	1, 899	. 3
Spur and Port silt loams, 0 to 1 percent slopes	4, 512	. 6
Spur and Port silt loams, 1 to 3 percent slopes	5, 223	. 7
Sweetwater soils	946	. 1
Vernon-Quinlan complex	15, 120	2. 1
Wann soils	1, 287	. 2
Woodward fine sandy loam, 1 to 3 percent slopes	1, 226	. 2
Woodward fine sandy loam, 3 to 5 percent slopes	1, 026	. 1
Woodward loam, 1 to 3 percent slopes	6, 161	. 9
Woodward loam, 3 to 5 percent slopes	11, 932	1. 7
Woodward loam, 5 to 8 percent slopes	4, 832	. 7
Woodward-Quinlan fine sandy loams, 1 to 3 percent slopes	3, 819	. 5
Woodward-Quinlan fine sandy loams, 3 to 5 percent slopes	2, 831	. 4
Woodward-Quinlan loams, 1 to 3 percent slopes	3, 547	. 5
Woodward-Quinlan loams, 3 to 5 percent slopes	9, 617	1. 3
Yahola fine sandy loam	8, 421	1. 2
Zavala fine sandy loam	4, 334	. 6
Rivers (South Canadian and Washita)	11, 360	1. 6
	718, 720	

9. Dill-Quinlan association

Smooth to rolling, reddish sandy soils on the uplands; underlain by red beds

This association covers about 3 percent of the county. It occurs in four areas near the southern border. A little less than 50 percent of this association is made up of a complex that consists mostly of Dill soils but includes Quinlan soils. A little less than 20 percent is a complex of Miles and Dill soils, in which Miles soils predominate. The rest of the association consists of moderately sandy Woodward and Quinlan soils.

Most of the acreage in this association is in cotton or sorghum. A small acreage is in small grain. The farms are about the smallest in the county.

Descriptions of Soils

In this section the soil series in Roger Mills County are described in detail. Following the general description of each series is a discussion of the soils, or mapping units, in the series. Further information on the use and management of each soil is given in the subsection "Capability Groups of Soils." Terms used to describe the soils are defined in the Glossary.

A list showing the soils mapped in the county and the capability unit and range site of each is near the back of the report. The approximate acreage and the proportionate extent of the soils are given in table 6. The location and distribution of the soils are shown on the soil map at the back of the report.

Brazos Series

The Brazos series consists of deep, well-drained, gently sloping, sandy soils. These soils are near streams but are high enough that they are not reached by overflow.

The surface layer is 18 to 24 inches of reddish-brown loamy fine sand. It is structureless, noncalcareous, and very friable. In places, it is winnowed. The reaction is neutral.

The subsoil is reddish-brown to yellowish-red loamy fine sand. It is structureless, loose, noncalcareous, and somewhat stratified. In some places it contains strata of more loamy material.

The parent material is stratified sandy and loamy outwash material derived from the Permian Red Beds.

These soils are associated with Reinach, Spur, and Port soils. Brazos soils are more sandy throughout than any of these associated soils. Lime occurs much lower in the profile than in the Spur and Port soils. Norwood, Yahola, and Lincoln soils, which are on bottom lands, are calcareous throughout. Springer and Pratt soils, which are on uplands, have some accumulation of clay in the subsoil.

Only one Brazos soil was mapped in this county. It is near the bottom lands along the Washita River. This soil is susceptible to wind erosion and needs to be protected by crop residues or by cover crops. Water erosion is not a problem, except where there is considerable runoff from higher areas. Legumes should be grown or fertilizer applied to maintain the supply of available nitrogen.

Brazos loamy fine sand (Br).—The total acreage of this soil is small. Most of it is cultivated. Included are small areas of the associated soils. *Capability unit IIIe–4; Deep Sand range site.*

Brownfield Series

The Brownfield series consists of nearly level to gently sloping soils that have a sandy surface layer and a loamy subsoil. These soils are on uplands. The entire surface shows evidence of having been modified by wind, and in places there are dunes. The native vegetation is mainly shin oak and tall grasses.

The upper part of the surface layer, to a depth of about 4 inches, is brown or dark-brown fine sand that is single grained and loose. It is slightly acid and low in organic-matter content. The lower part, extending to a depth of about 18 inches, is light yellowish-brown fine sand that is single grained and slightly acid. The boundary between this layer and the subsoil is abrupt.

The subsoil is 15 to 20 inches of yellowish-red sandy clay loam. When dry it is very hard and breaks into blocks or cubes; when wet it is slightly sticky. The reaction is slightly acid.

The parent material is yellowish-red loamy sand or fine sand and is several feet thick.

Brownfield soils are lighter colored and sandier than Springer and Miles soils. They are more clayey in the subsoil than Nobscott soils.

If Brownfield soils are cultivated, a ground cover is essential for control of wind erosion. It can be a cover crop or crop residues, but it should be dense enough to prevent the soil from blowing.

In Roger Mills County, Brownfield soils are mapped with Nobscott soils. The only mapping unit in which they occur is described under the heading "Nobscott Series."

Carey Series

The Carey series consists of deep, reddish-brown, nearly level to gently sloping soils on uplands. These soils have some accumulation of clay in the subsoil.

The surface layer is 8 to 14 inches of reddish-brown silt loam to loam. It is granular, friable, and noncalcareous.

The subsoil is 12 to 22 inches of reddish-brown silt loam to silty clay loam. It is granular, friable, noncalcareous, and porous.

The parent material weathered from sandstone of the Permian Red Beds. In most places this soft, calcareous layer of weathered rock is 4 to 20 inches thick.

These soils are associated with St. Paul and Woodward soils. St. Paul soils have a darker colored surface layer than Carey soils; they have a weak to moderate blocky subsoil that is higher in clay; and they are noncalcareous to a greater depth. Woodward soils have no clay accumulation in the subsoil, are slightly redder than Carey soils, and are calcareous to the surface.

Carey soils are fertile, easily farmed, and productive. Most of the acreage in this county is cultivated. The principal crops are small grain, sorghum, and cotton. Water control measures, good crop rotations, and use of crop residues are needed.

Carey silt loam, 1 to 3 percent slopes (CaB).—This soil generally is on high divides and on broad ridgetops in the eastern part of the county. Included are small areas of St. Paul and Woodward soils. *Capability unit IIe–1; Loamy Prairie range site.*

Carey silt loam, 3 to 5 percent slopes (CaC).—This soil is on slopes below broad ridgetops. Included are small areas of St. Paul and Woodward soils. *Capability unit IIIe–1; Loamy Prairie range site.*

Dalhart Series

The Dalhart series consists of deep, brown, loamy soils at high elevations.

The surface layer is 6 to 10 inches of brown fine sandy loam. It is granular, friable, and noncalcareous.

The subsoil is brown heavy fine sandy loam to sandy clay loam. It is granular and noncalcareous. It is slightly sticky when wet, friable when moist, and hard when dry.

The parent material generally is at a depth of 30 to 36 inches. It is lighter colored and sandier than the subsoil and normally is calcareous below a depth of 30 to 50 inches.

In places the surface layer is sandier than that described because of the action of the wind or because it developed from slightly sandier material. In some areas there are buried layers of finer textured soil.

These soils are associated with Holdrege and Pratt soils. They are lighter colored and sandier than Holdrege soils, and they have a more clayey subsoil than Pratt soils.

Dalhart soils are fertile and productive. They absorb rainfall readily and have adequate capacity to hold water that plants can use. Most of the acreage is in sorghum and small grain.

Unless protected by a growing crop or by crop residues, these soils are susceptible to wind erosion. Wind erosion is most likely to occur late in winter or early in spring. Growing small grain is an effective means of controlling wind erosion during periods of adequate rainfall. Measures to control water erosion are needed on much of the acreage.

Dalhart fine sandy loam, 1 to 3 percent slopes (DaB).—This soil generally is on broad ridges or high divides at some of the highest altitudes in the northwestern part of the county. It is commonly associated with Holdrege soils. Most of the acreage is within a few miles of the

South Canadian River. *Capability unit IIIe-3; Sandy Prairie range site.*

Dalhart fine sandy loam, 3 to 5 percent slopes (DaC).—This soil is on gentle slopes or narrow ridges. It has a thinner surface layer and a less clayey subsoil than Dalhart fine sandy loam, 1 to 3 percent slopes. *Capability unit IVe-3; Sandy Prairie range site.*

Dalhart fine sandy loam, 5 to 8 percent slopes (DaD).—This soil is on side slopes where deep drainageways have developed. The subsoil is less clayey than that of the other Dalhart soils. Some areas are adjacent to Pratt complex, hilly. Included are areas of calcareous sandy soils. *Capability unit IVe-3; Sandy Prairie range site.*

Dill Series

The Dill series consists of reddish, moderately sandy to sandy soils that developed under a cover of tall grasses, in material weathered from red sandstone of the Elk City formation.

The surface layer is 6 to 10 inches of red loamy fine sand or fine sandy loam that is granular, friable, and alkaline but not calcareous. The boundary between this layer and the subsoil is gradual.

The subsoil contains more clay than the surface layer. Generally it is fine sandy loam. It is porous, granular, friable, and alkaline but not calcareous.

The parent material is at a depth of 30 to 36 inches. It is more sandy than the subsoil and contains fragments of sandstone. In some places it is calcareous. In places the subsoil is directly over sandstone.

Dill soils are associated with Vernon, Quinlan, and Woodward soils. They are deeper than Quinlan soils and both sandier and deeper than Vernon soils. Woodward soils are calcareous and have no accumulation of clay in the subsoil.

The soil and the underlying porous sandstone both absorb rainfall readily; consequently, Dill soils are well suited to summer crops. Most of the acreage in this county is cultivated. Yields of cotton and sorghum are good, even in years of low rainfall. Yields of small grain and sweetclover are good, also. Most crops respond to nitrogen and phosphate. Growing clean-tilled crops depletes the supply of organic matter rapidly. The supply can be replenished by growing crops that leave large amounts of residue.

These soils are susceptible to erosion by wind and by water. They need the protection provided by growing cover crops and by controlling runoff.

Maintaining the structure of these soils is difficult. Seeding must be done as soon as possible after a rain so that a stand can become established before the surface soil is so dry that the seed will not germinate. Using farm machinery while the soils are still wet is apt to cause puddling and deterioration of the soil structure. After hard rains the surface soil dries rapidly, but water stands in depressions. If a strong wind starts to blow, emergency tillage is necessary to control wind erosion. This tillage causes puddling and damages the structure in the wet spots.

Dill soils occur at the higher elevations in the southern part of Roger Mills County. They have been mapped in a complex with Quinlan soils. The proportion of each soil varies from one area to another, but generally between 40 and 60 percent of a given area is Dill soil. The Quinlan soils are described under the heading "Quinlan Series."

Dill-Quinlan fine sandy loams, 1 to 3 percent slopes (DfB).—These nearly level soils show some evidence of wind erosion, and there are a few rills or small gullies. *Capability unit IIIe-3; Sandy Prairie range site.*

Dill-Quinlan fine sandy loams, 3 to 5 percent slopes (DfC).—These gently sloping soils are adjacent to broad areas of the nearly level Dill-Quinlan soils but are lower. They have a thinner surface layer because erosion has been more active. The proportion of Quinlan soil is greater than that of Dill soil. Vernon-Quinlan soils and Woodward soils generally are adjacent to these soils but are at lower altitudes. *Capability unit IIIe-3; Sandy Prairie range site.*

Enterprise Series

The Enterprise series consists of brown, well-drained, moderately sandy soils that developed under a cover of tall grasses and some sand sagebrush.

The surface layer is 12 to 20 inches of brown very fine sandy loam that is friable, granular, and calcareous.

The subsoil contains more lime than the surface layer and is slightly lighter brown in color. It is friable and porous and generally is several feet thick.

The parent material is very fine sand that was blown from dry river channels. At a depth of several feet, there is stratified Tertiary outwash consisting of gravel, sand, or silty material.

In some places the plow layer is not calcareous, but in all places the soils are calcareous below a depth of about 20 inches. In texture, the surface layer ranges from fine sandy loam to silt loam.

Enterprise soils are associated with Pratt soils and in some ways resemble Kenesaw soils. Pratt soils are more sandy and are noncalcareous. Kenesaw soils are darker colored than Enterprise soils and are noncalcareous to a greater depth.

Enterprise soils are fertile and absorb moisture readily. Most of the more nearly level areas are cultivated. The principal crops are small grain, cotton, and sorghum. Sweetclover and alfalfa supply nitrogen and improve soil structure.

Water erosion is not a serious problem, except where runoff from higher areas concentrates and causes gullies.

Wind erosion is a hazard late in winter and early in spring. It can be controlled by growing cover crops and by leaving crop residues on the surface.

Enterprise very fine sandy loam, 0 to 1 percent slopes (EnA).—This soil occurs on low benches near the South Canadian River and also in higher positions. It generally is noncalcareous to a depth of about 14 inches. It is associated with and includes small areas of Kenesaw soils. *Capability unit IIe-3; Loamy Prairie range site.*

Enterprise very fine sandy loam, 1 to 3 percent slopes (EnB).—This soil is adjacent to Enterprise very fine sandy loam, 0 to 1 percent slopes, and in many places is on foot slopes below Enterprise very fine sandy loam, 3 to 5 percent slopes. The surface layer is thinner and the depth to the calcareous material is less than in Enterprise very fine sandy loam, 0 to 1 percent slopes. *Capability unit IIe-3; Loamy Prairie range site.*

Enterprise very fine sandy loam, 3 to 5 percent slopes (EnC).—This soil occurs on three levels, or benches, along the South Canadian River. It is on the breaks, or slopes, from one level to another, generally adjacent to Pratt loamy fine sand, hilly, or to Enterprise very fine sandy loam, 5 to 8 percent slopes. It has a thinner surface layer than Enterprise very fine sandy loam, 1 to 3 percent slopes, and it is calcareous to the surface. *Capability unit IIIe-1; Loamy Prairie range site.*

Enterprise very fine sandy loam, 5 to 8 percent slopes (EnD).—This soil is mostly on slopes between areas of other Enterprise soils. It is calcareous throughout. The surface layer is 4 to 10 inches thick and is lighter colored than that of other Enterprise soils. *Capability unit IVe-1; Loamy Prairie range site.*

Eroded Sandy Land

This land type is made up of severely eroded Nobscot, Brownfield, Miles, and Springer soils. Blown-out areas and gullies are common. In some areas the gullies are several feet deep and from 50 to 100 feet apart. Much of the original surface layer has been removed by erosion, and the present surface layer consists mostly of the former subsoil.

The texture ranges from fine sand to sandy clay loam. Some blown-out areas have highly calcareous material in the lower part.

Eroded sandy land is similar to Nobscot and Brownfield soils, eroded, but is much more eroded. It is easily distinguished by the large blown-out areas and deep gullies.

This land type occurs throughout the western third of the county. It is suited only to permanent grass. If not stabilized, it will spread. Soil material blown from unprotected areas can cover soils that have a good grass cover. Those areas that do not already have a good cover of grass should be seeded and carefully managed.

Eroded sandy land (Er).—This land type is in the "sandy land" area in the western and northern parts of the county. In some places, erosion is still active; in other places, the land has been reseeded and erosion has been controlled. All of this land has been cultivated at some time. *Capability unit VIe-3; Eroded Sandy Land range site.*

Holdrege Series

The Holdrege series consists of deep, loamy soils that formed under a cover of tall grasses.

The surface layer is 8 to 14 inches of very dark brown silt loam that is granular and friable. It is alkaline but not calcareous.

The subsoil is 24 to 30 inches of dark-brown silt loam to silty clay loam that has granular to weak blocky structure and is friable, porous, and noncalcareous.

The parent material is brown, wind-laid silt. It is calcareous and is several feet thick. In many places buried soils occur at a depth of about 4 feet. These soils are darker colored and contain more clay than the material above.

Holdrege soils are associated with Dalhart soils but are darker colored and less sandy. Pratt soils are more sandy than Holdrege soils and have less clay in the subsoil. Enterprise and Kenesaw soils are calcareous near the surface and have no accumulation of clay in the subsoil.

Holdrege soils occur on high divides in the northwestern part of Roger Mills County. They are most extensive near Durham and on the divide between the South Canadian and the Washita Rivers.

Most of the acreage is cultivated. The principal crops are small grain and sorghum. Fertility is high. There is some likelihood of erosion. The principal management need is a good crop rotation. Growing cover crops helps to control wind erosion and to increase the intake of water. Control of water erosion is needed in sloping areas.

Holdrege silt loam, 0 to 1 percent slopes (HoA).—This soil is in slightly concave areas at the head of shallow drainageways on gently undulating uplands. In a few areas, water ponds for short periods after rains, but these areas are not considered poorly drained. *Capability unit IIc-1; Loamy Prairie range site.*

Holdrege silt loam, 1 to 3 percent slopes (HoB).—This soil generally is adjacent to Holdrege silt loam, 0 to 1 percent slopes, or near Dalhart soils. The surface layer is thinner and lighter colored than that of the less sloping soil, and rills are common. *Capability unit IIe-1; Loamy Prairie range site.*

Kenesaw Series

The Kenesaw series consists of deep, nearly level, loamy soils.

The surface layer is 20 to 24 inches of brown to grayish-brown silt loam. It is granular, friable, and noncalcareous.

The subsoil is brown or dark-brown silt loam that is granular, friable, and calcareous. It extends to a depth of several feet and is nearly uniform, except that it becomes slightly lighter colored and more calcareous with depth.

The parent material is windblown silt that probably originated on the high plains. It is several feet thick.

The depth to the calcareous material ranges from 20 to 40 inches.

Kenesaw soils have less clay in the subsoil than Holdrege or Dalhart soils. They are darker colored and less sandy than Pratt and Enterprise soils.

There is only one Kenesaw soil in this county. It is fertile and produces good yields of small grain, sorghum, and cotton. Leaving stubble from small grain or residues from other crops on the surface helps to increase the intake of water and to control erosion.

Kenesaw silt loam, 0 to 1 percent slopes (KeA).—This soil is in the northern part of the county, within a few miles of the South Canadian River. Included are small areas of Enterprise and Pratt soils. *Capability unit IIc-1; Loamy Prairie range site.*

Lincoln Series

The Lincoln series consists of dark-brown to reddish-brown, calcareous, sandy soils.

The surface layer is dark brown to reddish brown in color and sandy to moderately sandy in texture. It is about 12 inches thick and is weak, granular, very friable or loose, and calcareous.

The subsoil is brown to yellowish-brown, calcareous, sandy material that contains strata of loam or sandy loam.

These soils developed in sediments that washed from Dalhart, Miles, Springer, Nobscot, and Brownfield soils, which are in areas that have a sandy mantle.

There are extreme variations in these soils because frequent overflow adds new deposits and reworks much of the surface layer.

Lincoln soils occur near Wann soils, which are less frequently flooded and have a fluctuating, moderately high water table. Yahola soils are damaged less by overflow than Lincoln soils and are less sandy, more uniform in texture, and reddish in color. Norwood soils are silty, reddish, more stable, and more uniform in texture.

Only one unit of Lincoln soils is mapped in this county. It is not suited to cultivated crops because of the hazard of overflow. It is best suited to permanent grass.

Lincoln soils (Ln).—These soils are mostly on the flood plains of the Washita River, but they occur to a minor extent on the flood plains of the South Canadian River and other streams in the county. They are used mostly for range. If well managed, the range has good carrying capacity. *Capability unit VIw–1; Sandy Bottom Land range site.*

Mansker Series

The Mansker series consists of brown to grayish-brown, loamy soils on uplands. The original vegetation was mid and tall grasses.

The surface layer is 6 to 10 inches thick. It ranges from clay loam to sandy loam in texture and from brown to grayish brown in color. It is friable when moist and slightly hard when dry. It is calcareous and contains a few lime pebbles or concretions.

The subsoil is about the same texture as the surface layer but generally is yellowish brown in color. It is granular, porous, and strongly calcareous. It extends to a depth of 24 to 48 inches.

The parent material generally is pale-brown sandy loam or loamy sand. It is outwash material and is high in lime. It has been deposited on the Permian Red Beds or, in some places, on grayish to brownish soft sandstone. The depth to the underlying material ranges from 2 feet to many feet.

Mansker soils are the only brownish or grayish, calcareous soils in the county. Their parent material was the dominant factor in their formation. It is unlike the parent material of any of the other soils in the county, except that of the Potter soils.

About 85 to 90 percent of the acreage is in range. The rest is in small grain or sorghum. Including sweetclover in the rotation and leaving all residues on the surface will help to increase the intake of moisture.

Small areas of Mansker soils are scattered throughout the county, but the total acreage is small. The larger areas are in the vicinity of Antelope Hills and where the sandy parent material is shallow over the red beds. Some of the areas of Mansker soils in Roger Mills County were mapped in a complex with Potter soils.

Mansker complex, severely eroded (Ma3).—These soils are at the top of slopes or on side slopes where runoff from higher areas has caused gullies. Most of the original surface layer has been lost through erosion, and the present surface layer is light-gray loam or clay loam. Much of the acreage was cultivated but is now in permanent grass and is used as range. Only a few small areas are still cultivated. *Capability unit VIe–1; Eroded Prairie range site.*

Mansker loam, 2 to 5 percent slopes (MbC).—This soil generally occurs as small areas at the top of slopes. It is subject to water erosion. Between 30 and 40 percent of the acreage is cultivated. Measures have been taken to control erosion in most cultivated areas. *Capability unit IVe–5; Loamy Prairie range site.*

Mansker-Potter complex (Mc).—These soils are rolling to very steep. They occur mostly in the vicinity of the Antelope Hills, in the northwestern part of the county.

Potter soils, which are underlain by limestone or a partly cemented limy layer at a depth of 6 to 10 inches, occur mostly in the Antelope Hills and the Twin Hills. Areas of this complex in other parts of the county consist mostly of Mansker soils.

Most of the acreage is used as range. *Capability unit VIe–6; Shallow Prairie range site.*

Miles Series

The Miles series consists of reddish-brown fine sandy loams and loamy sands. These soils have more clay in the subsoil than in the surface layer. They generally occur in areas that have a deep, sandy mantle near the transition to the red beds.

The surface layer is brown to reddish-brown fine sandy loam or loamy fine sand that is granular and friable. Most commonly, this layer is from 5 to 12 inches thick, but in places it is as much as 15 inches thick. The reaction is slightly acid. The boundary between this layer and the subsoil is clear.

The subsoil is 16 to 22 inches of red to reddish-brown sandy clay loam or fine sandy loam. It is very hard when dry and is slightly sticky when wet. The reaction is slightly acid. The boundary between this layer and the parent material is gradual.

The parent material is yellowish-red fine sandy loam that becomes sandier with depth. It generally is neutral in reaction.

The Miles soils are associated with Springer soils. They have more clay in the subsoil than Springer soils and are slightly more acid. Dalhart soils had more sand sagebrush in their original vegetation than Miles soils, and they are mildly alkaline. Nobscot and Brownfield soils are sandier than Miles soils and have considerably more and larger shin oak in the vegetative cover.

Miles soils are only moderately fertile. Nevertheless, crop yields are good if the soils are well managed. The water-absorbing capacity and water-supplying capacity are good. Cultivated areas are subject to severe wind erosion. They need the protection of cover crops and crop residues.

Some Miles soils in Roger Mills County were mapped in a complex with Dill soils, some in a complex with Nobscot soils, and some with Springer soils. Dill, Nobscot, and Springer soils are described under their respective series headings.

Miles fine sandy loam, 0 to 1 percent slopes (MfA).—This soil is on broad ridgetops. The surface layer is darker colored than that of most Miles soils, and the subsoil is more clayey. This soil is subject to wind erosion. *Capability unit IIe–5; Sandy Prairie range site.*

Miles fine sandy loam, 1 to 3 percent slopes (MfB).—This soil is in depressions or on narrow ridgetops. It has the largest acreage of any of the Miles soils in the county. The surface generally is undulating rather than smooth. This soil is subject to both wind and water erosion. *Capability unit IIIe-3; Sandy Prairie range site.*

Miles fine sandy loam, 3 to 5 percent slopes (MfC).—This soil generally is on slopes that break from the more nearly level Miles soils. In many places, part of the original surface layer has been removed by erosion, and there are some gullies or rills. *Capability unit IIIe-3; Sandy Prairie range site.*

Miles fine sandy loam, 5 to 8 percent slopes (MfD).—This soil is commonly adjacent to Miles fine sandy loam, 3 to 5 percent slopes. The areas are not deeply cut by drainageways. The surface layer is lighter colored than that of the more nearly level soil, and the subsoil contains less clay. The hazard of erosion is severe. *Capability unit IVe-3; Sandy Prairie range site.*

Miles-Dill loamy fine sands, 1 to 4 percent slopes (MmB).—Most of this complex is near Sweetwater. About 50 percent of the acreage consists of the Miles soil, and about 15 percent of the Dill soil. The rest consists of soils that have some characteristics of Miles soils and some characteristics of Dill soils. The Miles soil formed in outwash, and the Dill soil formed in material weathered from the red beds. The other soils formed from a mixture of these two kinds of parent material. The Miles soils in this complex are redder than the Miles fine sandy loams. Dill soils are described in more detail under the heading "Dill Series." *Capability unit IIIe-4; Deep Sand range site.*

Miles-Nobscot complex, 5 to 8 percent slopes (MnD).—This complex is 70 to 80 percent Miles soils and 20 to 30 percent Nobscot soils. It generally is adjacent to Miles-Nobscot complex, 8 to 15 percent slopes. The Miles soils in this complex have less clay in the subsoil than other Miles soils, and there are more inclusions of calcareous soils. Most of the acreage is southwest of Reydon. *Capability unit IVe-2; Sandy Prairie range site.*

Miles-Nobscot complex, 8 to 15 percent slopes (MnE).—This complex is about 50 to 60 percent Miles soils and about 40 to 50 percent Nobscot soils. It also includes small amounts of Springer and Mansker soils. It occurs mostly in areas that have a sandy mantle but are near red-bed areas. Drainageways have cut deeply into the areas. These hilly to moderately steep soils are sandy to moderately sandy. They are used for range. *Capability unit VIe-2; Sandy Prairie range site.*

Miles-Springer complex, 3 to 5 percent slopes (MxC).—Miles soils make up 50 to 60 percent of this complex. The rest consists of Springer soils and soils that are intermediate between Miles and Springer soils. Most of the acreage is in the vicinity of Reydon and near the Washita River. Smaller areas are in other parts of the county near Miles fine sandy loams. The Miles soils in this complex are sandier than other Miles soils, and they have less clay in the subsoil. *Capability unit IIIe-2; Sandy Prairie range site.*

Nobscot Series

The Nobscot series consists of nearly level to sloping, loose, sandy soils on uplands. The subsoil contains slightly more clay than the surface layer. These soils show evidence of having been modified by wind. Dunes are common. Shin oak makes up a large part of the native vegetation.

The surface layer is brown to dark grayish-brown fine sand that is very friable or loose and is medium acid. Most commonly, this layer is 14 to 22 inches thick, but it ranges in thickness from as little as 10 inches to as much as 30 inches. The color becomes lighter at a depth of about 5 inches in uncultivated areas.

The subsoil generally extends to a depth of about 5 feet. It is yellowish red and ranges in texture from fine sandy loam to a very sandy material that contains only slightly more clay than the surface layer. In many places there are thin bands of finer textured material at intervals of about 5 inches. The reaction is medium acid.

The parent material is yellowish-red, slightly acid fine sand. It is several feet thick.

Nobscot soils have a less clayey subsoil than Brownfield soils. Springer soils have a shallower, less sandy surface layer than Nobscot soils, and Miles soils have a less sandy surface layer and a more clayey subsoil. Pratt soils have a brown, alkaline subsoil, and the vegetative cover is mostly sand sage instead of shin oak.

If Nobscot soils are cultivated, an adequate ground cover is essential for the control of erosion. Cover crops can be grown or crop residues can be left on the surface.

In Roger Mills County, some Nobscot soils were mapped with Brownfield soils in undifferentiated units. Brownfield soils are described under the heading "Brownfield Series."

Nobscot fine sand, 0 to 4 percent slopes (NaB).—This nearly level soil occurs at the relatively higher altitudes in the county. Nearly 50 percent of the acreage is cultivated. About 20 percent has been reseeded to native grasses. Included soils occupy only small areas. *Capability unit IVe-4; Deep Sand Savannah range site.*

Nobscot and Brownfield fine sands, 0 to 4 percent slopes (NbB).—These soils are associated with Nobscot and Brownfield fine sands, 4 to 8 percent slopes, but they are smoother. Brownfield soils make up between 15 and 75 percent of any given unit, but most commonly between 35 and 40 percent. About 10 percent of the acreage consists of included Miles and Springer soils. *Capability unit IVe-4; Deep Sand Savannah range site.*

Nobscot and Brownfield fine sands, 4 to 8 percent slopes (NbC).—These soils occur in the western and southwestern parts of the county. They are near Nobscot and Brownfield fine sands, 0 to 4 percent slopes. Brownfield soils make up about 15 to 20 percent of the acreage. The topography is dunelike. *Capability unit VIe-5; Deep Sand Savannah range site.*

Nobscot and Brownfield soils, eroded (Nc2).—These soils are very sandy. They have been eroded both by wind and by water. Some areas are blown out, and others are gullied by runoff from higher areas, some of which are the blown-out areas. The gullies generally are narrow and V-shaped. They are from 1 to 3 feet deep and in places are no more than 200 feet apart. The soil between the gullies is similar to the uneroded Nobscot and Brownfield soils. In most blown-out areas, the original surface layer and part of the subsoil have been removed by erosion. *Capability unit VIe-3; Eroded Sandy Land range site.*

Norwood Series

The Norwood series consists of red, loamy soils on bottom lands. These soils receive new silty deposits during floods. They are very productive.

The surface layer is 18 to 24 inches of red silt loam. It is friable, calcareous, granular, and porous.

The subsoil is silt loam that is granular, porous, and calcareous. It is several feet thick and contains strata that are more sandy or more clayey.

The parent material consists of silty deposits derived from the Permian Red Beds.

Included are small areas that have a surface layer and subsoil of silty clay loam to fine sandy loam. Small areas of the associated soils are also included. In some of the included areas, the surface layer is not calcareous.

Norwood soils are associated with Yahola soils, which are on bottom lands and are sandier throughout. Lincoln soils are very sandy. They have a subsoil of fine sand. Spur and Port soils are at higher altitudes and normally are not subject to overflow. They are darker colored than Norwood soils, and they generally have a noncalcareous layer. Reinach soils are sandier, are noncalcareous, and normally are not subject to overflow.

There is only one Norwood soil in this county. It is one of the most productive soils in the county and is well suited to all crops commonly grown in the area. The principal crops are alfalfa, small grain, sorghum, and cotton (fig. 9). The productivity will remain high if good crop rotations are used and the soil is not cultivated or grazed when wet.

Norwood silt loam (No).—This soil is on bottom lands along the Washita River and its main tributaries. *Capability unit I–1; Loamy Bottom Land range site.*

Figure 9.—**Cotton growing on Norwood silt loam.**

Port Series

The Port series consists of deep, fertile, silty soils that formed under native grasses.

The surface layer is 9 to 15 inches of dark reddish-brown to brown silt loam that is granular, porous, friable, and noncalcareous.

The subsoil is reddish-brown silt loam that is granular, porous, and friable. It becomes calcareous at a depth of 15 to 24 inches.

The parent material consists of reddish, silty red-bed sediments.

Port soils are similar to Spur soils, but they have a noncalcareous surface layer. They are darker colored than Norwood soils, which have a calcareous surface layer.

Port soils are fertile. They are productive if they receive enough moisture. At times runoff from adjacent higher areas causes gullying. This generally can be controlled by means of terraces or diversions. Rotating crops and utilizing crop residues will help to maintain fertility and to increase the intake of water. The surface will crust after heavy rains unless it is protected by crop residues.

In Roger Mills County, Port soils are mapped only in undifferentiated units with Spur soils. They occur in the eastern two-thirds of the county, along the Washita River but above the normal flood plain. All of the mapping units are described under the heading "Spur Series."

Potter Series

All of the Potter soils in Roger Mills County are mapped in a complex with Mansker soils. The mapping unit is described under the heading "Mansker Series."

Pratt Series

This series consists of brownish, sandy or moderately sandy, nearly level to steep soils on uplands. These soils developed in sandy wind-laid material under tall grasses and sagebrush.

The surface layer is 8 to 14 inches of grayish-brown or dark-brown loamy fine sand or fine sandy loam. It is very friable, noncalcareous, and about neutral.

The subsoil is only slightly lighter colored than the surface layer. In texture, it ranges from loamy sand, where the surface layer is loamy fine sand, to loam, where the surface texture is fine sandy loam. It normally contains more clay than the surface layer but in some places only a little more. It is friable, granular, and noncalcareous. Generally, it is 16 to 24 inches thick.

The parent material is a little more sandy than the subsoil and normally is slightly lighter colored. It is friable and noncalcareous, and it extends to a depth of several feet.

Pratt soils are associated with Dalhart soils but have less clay in the subsoil. Holdrege and Kenesaw soils are darker colored than Pratt soils and are more silty throughout. Enterprise soils are finer textured and are calcareous near the surface. Nobscott and Brownfield soils are sandier and have a reddish, more clayey subsoil. Springer soils are similar in texture to Pratt soils but have a reddish subsoil.

Pratt soils absorb moisture readily, but the sandier types are somewhat limited in their capacity to store moisture. Wind erosion and the consequent loss of fertility are the major management problems. Growing cover crops and leaving all crop residues on the soil help to control erosion. Suitable crop rotations and fertilization are essential for continued high production.

Pratt complex, hilly (PcE).—This complex consists of steeply sloping fine sandy loams. It occurs in the northern part of the county, along the South Canadian River and near many of its tributaries. It includes some areas of Enterprise, Dalhart, and Springer soils. All of the acreage is in range. *Capability unit VIe–2; Sandy Prairie range site.*

Pratt loamy fine sand, undulating (PfB).—This soil is on broad ridges at the top of divides and on the more gentle side slopes. The largest areas are near Roll and Crawford. Other large areas are in the northern part of the county. The undulating surface is evidence of deposition of material by wind. If cultivated, this soil is susceptible to wind erosion. *Capability unit IIIe–4; Deep Sand range site.*

Pratt loamy fine sand, hummocky (PfD).—This soil is on ridgetops or on slopes adjacent to Pratt loamy fine sand, hilly. Sand dunes and long, low hills are common. Pratt loamy fine sand, undulating, and the Pratt fine sandy loams occur in depressions within areas of this soil. *Capability unit IVe–6; Deep Sand range site.*

Pratt loamy fine sand, hilly (PfE).—This steeply sloping, sandy soil generally is on breaks from the high divides to the benchlike areas near the South Canadian River. It is commonly adjacent to Pratt loamy fine sand, hummocky. It is more sandy than Pratt complex, hilly. Most of the acreage is in range. *Capability unit VIe–4; Deep Sand range site.*

Pratt fine sandy loam, 0 to 1 percent slopes (PsA).—This soil generally is on flats or benches, between Enterprise or Kenesaw soils and the steeper soils on the uplands. There are also small areas on the high divides. The surface layer is darker colored than that of any of the other Pratt fine sandy loams. *Capability unit IIe–2; Sandy Prairie range site.*

Pratt fine sandy loam, 1 to 3 percent slopes (PsB).—This soil is mostly on the high divides. It has the greatest acreage of any of the Pratt fine sandy loams. Some of it is in depressions or swales within areas of Pratt loamy fine sand. *Capability unit IIIe–2; Sandy Prairie range site.*

Pratt fine sandy loam, 3 to 5 percent slopes (PsC).—This soil generally is in the more undulating areas on the high divides. It commonly is adjacent to Pratt fine sandy loam, 1 to 3 percent slopes. It has a thinner surface layer than the more nearly level soil and is more likely to erode if cultivated. *Capability unit IVe–2; Sandy Prairie range site.*

Pratt fine sandy loam, 5 to 8 percent slopes (PsD).—This soil is adjacent to Pratt fine sandy loam, 3 to 5 percent slopes, and to Pratt complex, hilly. The surface layer is shallower and lighter colored than that of the more nearly level Pratt fine sandy loams, and the subsoil is more sandy. *Capability unit IVe–2; Sandy Prairie range site.*

Quinlan Series

The Quinlan series consists of shallow, reddish soils that developed under a cover of mid and tall grasses. The parent material was derived from the Permian Red Beds.

The surface layer is 4 to 8 inches of reddish-brown silt loam to fine sandy loam. It is friable, granular, and calcareous.

The subsoil is about the same as the surface layer. It is 6 to 10 inches thick. Lime concretions occur in the lower part.

The parent rock generally is soft, red, calcareous sandstone or siltstone but includes some claystone.

The Quinlan soils are associated with Woodward, Vernon, Dill, and Carey soils. Woodward soils are deeper to bedrock than Quinlan soils and have a thicker, better developed surface layer. Vernon soils are more clayey and generally are shallower to bedrock. Dill soils are not calcareous. They are deeper and generally sandier than Quinlan soils; their subsoil contains more clay than the surface layer. Carey soils are deeper, are noncalcareous in the surface layer, and have an accumulation of clay in the subsoil.

Quinlan soils are not suited to cultivation because they are too shallow. Generally, they are not farmed unless they occur as complexes with more productive soils. Much of the acreage that was cultivated became severely eroded and has been seeded to native grasses (fig. 10).

These soils occur throughout Roger Mills County, wherever the red beds have been exposed to weathering and soil-forming processes. Small inclusions have a surface layer of coarse sand and gravel and are shallower than the typical Quinlan soils.

Quinlan soils, severely eroded (Qu3).—These are shallow or moderately deep soils that have lost most or all of the original surface layer through erosion. Gullies are

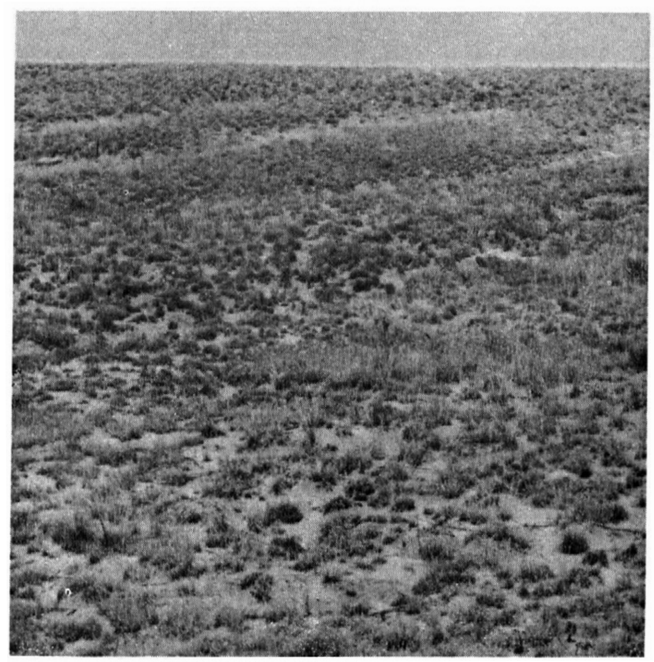

***Figure 10.*—Quinlan soils, severely eroded, seeded to native grasses.**

common, and in places the underlying red beds are exposed. Consequently, little moisture is absorbed and stored, and these soils are not productive until a vegetative mulch is established or the soil structure is improved. *Capability unit VIe-1; Eroded Prairie range site.*

Quinlan-Woodward loams; 1 to 5 percent slopes, eroded (QwC2).—Most of this complex is in the northeastern part of the county, but areas of it occur wherever the red beds are exposed. The surface layer is lighter colored than that of Quinlan-Woodward loams, 5 to 20 percent slopes, because part of the original surface layer has been removed by erosion and some of the subsoil has been mixed into the plow layer. *Capability unit IVe-5; Loamy Prairie range site.*

Quinlan-Woodward loams, 5 to 20 percent slopes (QwE).—This complex is 60 to 65 percent shallow Quinlan soils and 35 to 40 percent moderately deep Woodward soils. Quinlan soils are dominant on the relatively smooth slopes. Woodward soils are dominant in canyonlike areas. This is the largest mapping unit in the county. Most of it is north and east of Cheyenne. Most of the acreage is in range. If the pastures are well managed, forage production is high. *Capability unit VIe-6; Shallow Prairie range site.*

Reinach Series

The Reinach series consists of reddish, moderately sandy soils that are near the bottom lands but are higher and are not subject to overflow. These soils formed in alluvium derived from red beds. The native vegetation consisted of tall grasses and some trees of kinds that normally grow on bottom lands.

The surface layer is dark reddish-brown fine sandy loam that is granular, friable, and noncalcareous. It is 12 to 18 inches thick.

The subsoil is reddish-brown fine sandy loam that is granular, friable, porous, and noncalcareous. It is 18 to 24 inches thick.

The parent material is reddish-brown to yellowish-red, somewhat stratified fine sandy loam that normally is calcareous.

Locally, these soils are calcareous in the surface layer. In places the subsoil is darker colored than that described. The parent material varies in texture. In some small areas it is loamy sand or loam.

Reinach soils are similar to Yahola soils, but Yahola soils are calcareous and are on flood plains. Port and Spur soils are more silty throughout than Reinach soils, and Spur soils are calcareous at the surface. Brazos soils are more sandy.

Reinach soils are subject to wind erosion and, in places, to gullying by runoff from higher areas. Growing cover crops and leaving crop residues on the surface will help to control wind erosion. Structures may be necessary to intercept runoff.

Only one Reinach soil was mapped in this county.

Reinach fine sandy loam (Ra).—This soil is only a few feet above the flood plains of the larger streams and is generally adjacent to the uplands. Most of the acreage is cultivated. The principal crops are alfalfa, small grain, sorghum, and cotton. *Capability unit IIe-2; Sandy Prairie range site.*

Rough Broken Land

This land type occurs where drainageways have cut deeply into the higher parts of the county. In about 40 to 60 percent of the acreage, the red sandstone or siltstone is exposed. Many areas start near the smoother watershed divides and continue along the drainageways to the place where the gradient decreases. Most of the acreage is several miles from the Washita and South Canadian Rivers and is about parallel to these rivers.

This land type occurs mostly with Vernon-Quinlan complex, and to a lesser extent with Quinlan-Woodward loams. Generally, it has only a sparse vegetative cover, whereas Quinlan-Woodward loams, 5 to 20 percent slopes, has a good vegetative cover.

Rough broken land (Rb).—In much of this unit, the red sandstone is exposed. Vegetation is sparse, except where there are inclusions of deeper soils. Included are fairly large areas of Vernon-Quinlan complex. All of the acreage is in range. *Capability unit VIIs-1; Red Shale range site.*

St. Paul Series

The St. Paul series consists of deep, loamy, reddish-brown, nearly level to strongly sloping soils on the uplands. These soils developed under a cover of mid and tall grasses.

The surface layer is 8 to 14 inches of dark reddish-brown silt loam or silty clay loam. It is friable, granular, and noncalcareous. The boundary between this layer and the subsoil is gradual.

The subsoil is reddish-brown, noncalcareous silty clay loam or clay loam. When moist it is firm; when dry it is hard and blocky. This layer is 16 to 22 inches thick.

The parent material weathered from sandstone and shale of the Permian Red Beds. It is red to reddish brown and is calcareous.

In places the surface layer and the subsoil are browner in color.

St. Paul soils are most commonly associated with Carey soils. Carey soils have a redder surface layer and a less clayey subsoil. Woodward soils are redder, are calcareous in the surface layer, and have no accumulation of clay in the subsoil.

St. Paul soils are fertile, and most of the acreage is cultivated. Yields of small grain and sorghum are good on uneroded soils that are well managed. Cultivating or pasturing these soils when they are wet decreases their ability to absorb moisture. Leaving crop residues on the surface and including deep-rooted legumes in the rotation will increase the intake of moisture.

St. Paul silt loam, 0 to 1 percent slopes (SaA).—This soil is mostly on ridgetops. It includes a few slightly depressed areas. The surface layer is deep, and there is little evidence of erosion. This soil is productive in years of adequate rainfall. *Capability unit IIc-1; Loamy Prairie range site.*

St. Paul silt loam, 1 to 3 percent slopes (SaB).—This soil has the largest acreage of any of the St. Paul soils in the county. It is on broad divides, along gently sloping drainageways, and on foot slopes. In many places, it is adjacent to Carey silt loams. There is little evidence of accelerated erosion, but there are a few shallow gullies and rills. *Capability unit IIe-1; Loamy Prairie range site.*

St. Paul silt loam, 3 to 5 percent slopes, eroded (SaC2).—This soil is on gently sloping divides, adjacent to St. Paul silt loam, 1 to 3 percent slopes. Part of the original surface layer has been removed by erosion, and the present surface layer is only 4 to 8 inches thick. In places gullies and rills have cut into the subsoil. A few gullies are 2 to 3 feet deep. *Capibility unit IIIe-1; Loamy Prairie range site.*

Springer Series

The Springer series consists of reddish-brown sandy or moderately sandy soils on uplands. These soils developed in sandy outwash material. They formed under a cover of tall grasses and scattered shin oak and sand sagebrush.

The surface layer is 6 to 12 inches of reddish-brown or brown loamy sand that is friable and noncalcareous. The reaction is slightly acid.

The subsoil is 10 to 25 inches of reddish-brown fine sandy loam or loamy fine sand. It contains more clay than the surface layer. It is friable or slightly hard and is noncalcareous.

The parent material normally is reddish brown. It is more sandy than the subsoil and is noncalcareous.

In places these soils have inclusions of calcareous material in the surface layer, in the subsoil, or in the parent material. There is considerable gravel in some areas, and especially in eroded areas. The texture of the surface layer varies from sandy loam to sand.

These soils are similar to Pratt soils, but Pratt soils are browner, have less clay in the subsoil, are more alkaline in reaction, and have more sand sagebrush and less shin oak in the vegetation. Miles and Dalhart soils have much more clay in the subsoil than Springer soils. Nobscot and Brownfield soils have more sand in the surface layer and more clay in the subsoil.

About half the acreage of Springer soils is in sorghum and small grain. Rye grows well and affords protection from wind erosion. During the time of the year when winds are strongest, a growing crop or crop residues are needed to protect the soil.

Springer loamy fine sand, hummocky (SfC).—Most of this soil is near large streams on the higher spots in hummocky areas. One area is 2 miles northwest of Hammon. Other areas are farther west. This soil has little runoff or stream development. *Capability unit IVe-6; Deep Sand range site.*

Springer loamy fine sand, hilly (SfE).—This soil is in the steeper or dunelike areas near Springer loamy fine sand, hummocky. It shows evidence of having been modified by wind before it was stabilized. The subsoil contains less clay than that of smoother Springer soils. *Capability unit VIe-4; Deep Sand range site.*

Spur Series

The Spur series consists of deep, reddish-brown, silty soils that developed under a cover of native grasses.

The surface layer is 8 to 14 inches of reddish-brown silt loam. It is calcareous and friable.

The subsoil is 18 to 30 inches of reddish-brown silt loam. It is calcareous, granular, and porous. In places the upper part is darker colored and noncalcareous, which indicates that the surface material was deposited on an older soil.

The parent material is reddish, silty, red-bed sediments.

These soils are similar to Port soils but are calcareous in the surface layer. They are darker colored than Norwood soils and less likely to be flooded.

Spur soils are highly fertile. They are productive when adequate moisture is available. However, they are considered droughty by some farmers. Droughtiness probably is caused by breakdown of soil structure and the consequent decrease in the intake of moisture. Rapid early growth of crops on these highly fertile soils results in a need for large amounts of moisture. Rotating crops and the use of crop residues will help to maintain fertility and to increase the water intake. Runoff from adjacent higher areas causes gullying in some places. This runoff can be controlled by the use of terraces and diversions.

Spur soils in Roger Mills County are mapped in undifferentiated units with Port soils. They occur in the eastern two-thirds of the county, above the flood plains of the Washita River and its larger tributaries.

Spur and Port silt loams, 0 to 1 percent slopes (SpA).—These soils are only a few feet above the flood plains. About 50 to 60 percent of the acreage is Spur soils, and 40 to 50 percent is Port soils. Erosion is not a serious hazard. *Capability unit I-1; Loamy Bottom Land range site.*

Spur and Port silt loams, 1 to 3 percent slopes (SpB).—These soils occur generally between Spur and Port silt loams, 0 to 1 percent slopes, and the sloping uplands. About 75 percent of the acreage consists of Spur soils, which have a lighter colored surface layer than Port soils. The Port soil in this unit has a thinner surface layer than the Port soil in Spur and Port silt loams, 0 to 1 percent slopes.

These soils show evidence of erosion. There are some rills and small gullies. *Capability unit IIe-6; Loamy Bottom Land range site.*

Sweetwater Series

The Sweetwater series consists of soils on bottom lands where drainage is restricted by clogging of the stream channels. The soils are permanently wet below a depth of 2 or 3 feet. The water table fluctuates to such extent that free water is often at the surface.

The texture of the surface layer is sand to silty clay loam, but within the 12-inch surface layer there are strata of almost every texture. The surface layer is calcareous and generally is dark brown.

The subsoil is calcareous fine sand stratified with yellowish-brown loam or clay loam on which there are rust-colored splotches. In places the subsoil extends to a depth of several feet, and it commonly has very dark colored strata at a depth of 3 feet or more.

The parent material consists of stratified sandy deposits derived from the sandy lands in the western part of the county.

Sweetwater soils are somewhat similar to Wann soils, which have a fluctuating water table but are not permanently wet and are suitable for cultivation. Lincoln soils are more sandy than Sweetwater soils, and they do not have a high water table. Zavala soils are more uniform in texture, and they do not have a high water table.

Sweetwater soils are suited only to range. They are productive if well managed. In places there are concentrations of salts that restrict vegetation largely to salt-tolerant plants.

Only one unit of Sweetwater soils is mapped in Roger Mills County.

Sweetwater soils (Sw).—These soils are mostly on the flood plains of small creeks in the sandy land area, but there is a small acreage on the flood plain of the Washita River where drainage is restricted by the clogging of stream channels. *Capability unit Vw-1; Subirrigated range site.*

Vernon Series

The Vernon series consists of reddish-brown to red, very shallow, loamy to clayey soils that overlie fine-grained sandstone or siltstone of the Permian Red Beds.

The surface layer is reddish brown, granular, friable, and calcareous. It is predominantly silt loam, but it ranges from very fine sandy loam to silty clay loam, depending on the texture of the underlying sandstone or siltstone. This surface layer is directly over the parent rock. Ordinarily it is from 4 to 10 inches thick, but where weathered parent material has accumulated in depressions it is as much as 20 inches thick.

Vernon soils are the shallowest red-bed soils in the county. Quinlan soils generally are somewhat deeper, as well as sandier, and their parent material was derived from coarser grained, softer sandstone. Woodward soils are deeper.

Most of the acreage of Vernon soils is in range. The native vegetation is mostly mid and short grasses. Careful management is needed to keep a dense cover of vigorous plants on these soils. Some areas that were formerly farmed do not have an adequate cover and should be reseeded.

In Roger Mills County, Vernon soils are mapped in a complex with Quinlan soils.

Vernon-Quinlan complex (Vc).—The soils in this complex are mostly on gentle to moderate slopes at the higher altitudes in the southeastern and southern parts of the county, but a discontinuous band extends several miles northwest of Cheyenne. Locally, these soils are called red shale. About 60 to 70 percent of this complex is Vernon soils, and 30 to 40 percent is Quinlan soils. *Capability unit VIIs-1; Red Shale range site.*

Wann Series

The Wann series consists of brownish, sandy to moderately sandy soils on flood plains. These soils are subject to flooding during periods of high water. They have a fluctuating, moderately high water table.

The surface layer commonly is 18 to 24 inches of brown to dark-brown fine sandy loam but ranges in texture from loamy sand to silty clay loam. It is friable, granular, and calcareous.

The subsoil is 30 to 36 inches of brown loamy sand that contains strata of silt or clay. It is friable and calcareous.

The parent material is yellowish-brown, stratified fine sand that has rust-colored mottles. Most of the year, the water table is in this layer.

The texture of the surface layer and subsoil varies, but generally is fine sandy loam. The depth to the water table varies from season to season and ranges from 3 to 6 feet.

Wann soils are similar to Sweetwater soils but are better drained and are suited to cultivation. Lincoln soils are more sandy than Wann soils and are well drained, but they are not suited to cultivation because they are so frequently flooded. Zavala soils are more uniform in texture than Wann soils, and they do not have a high water table. Norwood and Yahola soils are reddish in color, are more uniform in texture, and are more silty.

Most of the acreage of Wann soils is cultivated. The principal crops are alfalfa, small grain, sorghum, and cotton. Wind erosion is a hazard on the sandier areas. It can be controlled by growing cover crops or by leaving crop residues on the surface. Generally, fertility can be maintained by good crop rotations and fertilization, but the sandier areas need special care.

Wann soils (Wa).—These soils occur mostly on the flood plains along the Washita River, but there are some small areas along the South Canadian River. *Capability unit IIIw-1; Loamy Bottom Land range site.*

Woodward Series

The Woodward series consists of reddish, silty or moderately sandy soils on uplands underlain by red beds. These soils developed under a cover of tall grasses. They do not have an accumulation of clay in the subsoil.

The surface layer is 8 to 14 inches of reddish-brown to dark reddish-brown silt loam to fine sandy loam. It is granular, friable, and calcareous.

The subsoil is 16 to 30 inches of red to reddish-brown silt loam to fine sandy loam. It is granular, porous, friable, and calcareous. The parent rock is soft, calcareous sandstone of the red beds.

In places these soils are not calcareous in the surface layer, but they are alkaline in reaction. In many places there are lime concretions in the surface layer. The depth to the parent material ranges from 24 inches to several feet. The deeper areas generally are on footslopes.

These soils are similar to Carey soils, but Carey soils are noncalcareous in the surface layer and have more clay in the subsoil than in the surface layer. Dill soils are noncalcareous and have an accumulation of clay in the subsoil. In many places, Woodward soils are adjacent to the shallower Quinlan soils.

About 40 to 50 percent of the acreage of Woodward soils is cultivated. The principal crops are small grain, sorghum, and cotton. These soils are fertile and productive but are subject to both wind and water erosion. They can be kept fertile and productive by the use of good crop rotations, by erosion control practices, and by fertilization. Mechanical measures are needed to help control erosion, and cover crops should be grown or crop residues should be left on the surface during the windy season.

Woodward fine sandy loam, 1 to 3 percent slopes (WdB).—This soil is in areas where the Permian Red Beds have a thin mantle of sandy material. It generally is near the top of slopes and in many places is adjacent to Dill-

Quinlan soils, which are on broad divides. Most of the acreage is in the southern and southwestern parts of the county. The largest acreage is northwest of Sweetwater. *Capability unit IIe-3; Loamy Prairie range site.*

Woodward fine sandy loam, 3 to 5 percent slopes (WdC).—This soil generally is adjacent to Woodward fine sandy loam, 1 to 3 percent slopes. In some places it is on slopes adjacent to Dill-Quinlan fine sandy loams. It has a thinner surface layer than the more gently sloping Woodward soil, and it is shallower. *Capability unit IIIe-5; Loamy Prairie range site.*

Woodward loam, 1 to 3 percent slopes (WoB).—This soil is on broad ridgetops, on foot slopes, and along drainageways, mostly north and northeast of Cheyenne. It generally is adjacent to Carey silt loams or to Woodward-Quinlan loams. The surface layer is deeper and darker colored than that of other Woodward loams, and there are fewer inclusions of Quinlan soil. *Capability unit IIe-1; Loamy Prairie range site.*

Woodward loam, 3 to 5 percent slopes (WoC).—This soil generally is adjacent to other Woodward loams, and it has the largest acreage of any of the Woodward loams. It has a thinner surface layer than Woodward loam, 1 to 3 percent slopes, is more eroded, and has more inclusions of Quinlan soil. *Capability unit IIIe-1; Loamy Prairie range site.*

Woodward loam, 5 to 8 percent slopes (WoD).—This soil generally is on foot slopes and lower than either Quinlan-Woodward loams or other Woodward loams. In places it is deep because of the accumulation of soil material from higher areas. In some places inclusions of Quinlan soils make up from 5 to 10 percent of the acreage. *Capability unit IVe-1; Loamy Prairie range site.*

Woodward-Quinlan fine sandy loams, 1 to 3 percent slopes (WsB).—This complex is mostly in the southwestern part of the county. It is 70 to 75 percent Woodward soils and 25 to 30 percent Quinlan soils. These soils are on gentle slopes, generally adjacent to but lower than Dill-Quinlan fine sandy loams. *Capability unit IIIe-5; Loamy Prairie range site.*

Woodward-Quinlan fine sandy loams, 3 to 5 percent slopes (WsC).—The percentage of Quinlan soil in this complex generally is greater than in the more nearly level Woodward-Quinlan fine sandy loams, and the soils are more eroded. Consequently, the surface layer is thinner and lighter colored, and gullies and rills are more common. *Capability unit IVe-5; Loamy Prairie range site.*

Woodward-Quinlan loams, 1 to 3 percent slopes (WwB).—This complex generally is 60 to 70 percent Woodward soils and 30 to 40 percent Quinlan soils, but the percentage varies considerably. Included are some Vernon soils. These soils occur mostly on divides and commonly are adjacent to Vernon-Quinlan complex, Woodward loams, or Quinlan-Woodward loams. *Capability unit IIIe-1; Loamy Prairie range site.*

Woodward-Quinlan loams, 3 to 5 percent slopes (WwC).—This complex is 50 to 60 percent Woodward soils and 40 to 50 percent Quinlan soils. These soils are associated with Quinlan-Woodward loams and Woodward loams. They are more extensive than Woodward-Quinlan loams, 1 to 3 percent slopes, and are more eroded. Outcrops of gypsum occur in places. *Capability unit IVe-5; Loamy Prairie range site.*

Yahola Series

The Yahola series consists of reddish, moderately sandy, calcareous soils on flood plains. These soils are subject to flooding. They formed under a cover of tall grasses.

The surface layer is 12 to 20 inches of reddish-brown to dark reddish-brown fine sandy loam. It is granular, friable, and calcareous.

The subsoil is 24 to 36 inches of red to reddish-brown fine sandy loam. It is slightly granular, friable, and calcareous. It is stratified and has lenses of sandy and loamy material.

The parent material consists of calcareous, sandy, alluvial sediments washed from areas underlain by red beds. It is commonly stratified.

Included are small areas of loamy sands. In some places the subsoil contains strata of material that varies in texture but is predominantly sandy loam.

Norwood soils are more silty and less sandy throughout than Yahola soils. Reinach soils are not subject to overflow and are not calcareous in the surface layer. Lincoln soils are more sandy, less uniform in texture and topography, and more subject to damage by flooding than Yahola soils. Sweetwater and Wann soils are more poorly drained. Zavala soils are brown, noncalcareous sandy loams.

Yahola soils are susceptible to wind erosion and need to be protected by crop residues or by cover crops. Good crop rotations are needed to keep the soil fertile.

Only one Yahola soil is mapped in Roger Mills County.

Yahola fine sandy loam (Ya).—This reddish, moderately sandy soil is on the flood plains of the Washita River and other large streams in the county. *Capability unit IIe-4; Loamy Bottom Land range site.*

Zavala Series

The Zavala series consists of brown fine sandy loams on flood plains of small drainageways in the sandy land areas in the western part of the county. These soils are somewhat stratified and have a dark-colored surface layer. They developed under a cover of tall grasses and some shin oak and bottom land trees.

The surface layer is 18 to 24 inches of dark-brown fine sandy loam that is friable, slightly granular, and noncalcareous.

The subsoil is 24 to 30 inches of grayish-brown fine sandy loam or loamy fine sand that is stratified with loamier or sandier material. This layer is very friable to loose and is noncalcareous.

The parent material is sand or loamy sand that washed from areas covered by a sandy mantle.

The surface layer ranges from fine sandy loam to loamy fine sand, and the subsoil from fine sandy loam to fine sand. In places the uppermost 2 inches of the surface layer is slightly calcareous.

These soils are somewhat similar to Yahola soils, but Yahola soils are reddish in color and are calcareous throughout. Sweetwater and Wann soils are poorly drained. Lincoln soils are less uniform in texture and are calcareous.

Zavala soils can be protected against wind erosion by leaving crop residues on the surface and keeping a growing crop on the soil as much of the year as possible. Fer-

Figure 11.—**Grain sorghum stubble protects the soil from erosion.**

tility can be maintained by rotating crops and applying fertilizer.

Only one Zavala soil was mapped in this county. About half the acreage is cultivated. The principal crops are alfalfa, small grain, sorghum, and cotton.

Zavala fine sandy loam (Za).—This soil is along small streams in the western part of the county. *Capability unit IIe–4; Loamy Bottom Land range site.*

Use and Management of Soils

This section offers suggestions on the use of soils for crops, pasture, range, trees, wildlife, and engineering structures, and on the suitability of the soils for irrigation. It includes an explanation of the system of classification used to show the relative suitability of the soils for various uses. Table 7 gives the estimated yields of the principal crops, under prevailing management and under improved management; table 8 shows the suitability of the soils for windbreaks and post lots; and tables 9, 10, and 11, the soil characteristics significant in engineering.

Management of Soils for Cultivated Crops[3]

The successful farmer is conservation minded. He knows how much his soils will produce and the limitations of the different soils on his farm. He applies conservation methods suited to the climate and the soils so that he can obtain profitable yields.

The continuous profitable use of cultivated soils in Roger Mills County depends to a great extent on control of erosion and maintenance of good tilth. Following are discussions of practices that help to protect the soils from erosion and to maintain good tilth.

Minimum tillage.—Tillage should be kept to the minimum necessary to prepare a seedbed and to control weeds. Excessive tillage breaks down the soil structure and and destroys the protective residues. When the soil structure is damaged, the circulation of air is obstructed, the intake of water is impeded, and the soil is more likely to puddle when wet and crust when dry. Destruction of the residues leaves the soil more susceptible to damage by wind erosion.

Frequent tillage at the same depth tends to pack the soil just below plow depth and to create a compacted layer, called a plowpan, which obstructs the movement of air and moisture and restricts the development of roots. Loamy and clayey soils are most likely to be affected.

Soil-improving crops.—Legumes and grasses are soil-improving crops. The principal legumes grown in Roger Mills County are alfalfa, sweetclover, cowpeas, mungbeans, Austrian winter peas, and hairy vetch. Alfalfa is the best suited, and sweetclover and cowpeas are next. Mungbeans, Austrian winter peas, and vetch do well if rainfall is adequate. Legumes can be grown throughout the county, except on the tight, clayey, shallow soils.

Either native grasses or introduced grasses, such as blue panic and weeping lovegrass, can be grown for pasture and then turned under for soil improvement. Native grasses should be grown in a long rotation, because they require from 2 to 4 years to become established.

Residues from small grain and other crops can also be utilized for soil improvement.

Use of crop residues.—Residues of sorghum, small grain, and other crops can be left on the surface to protect the soil against erosion (fig. 11), or they can be turned under to provide organic matter. If the residues are used for these purposes, grazing and other uses should be restricted. If the amount of residue is large, nitrogen can be applied to speed decomposition.

Stubble mulching.—Stubble mulching is designed to keep a protective cover of crop residues on the surface until the next crop is seeded. This practice requires the use of sweeps, rod weeders, and blades that undercut the soil and leave residues on the surface. The seeding equipment used must be capable of drilling through the trashy cover.

Stubble mulching protects the soil against wind erosion, reduces water erosion, improves tilth, reduces surface crusting, and reduces extremes in temperature in the surface soil (fig. 12).

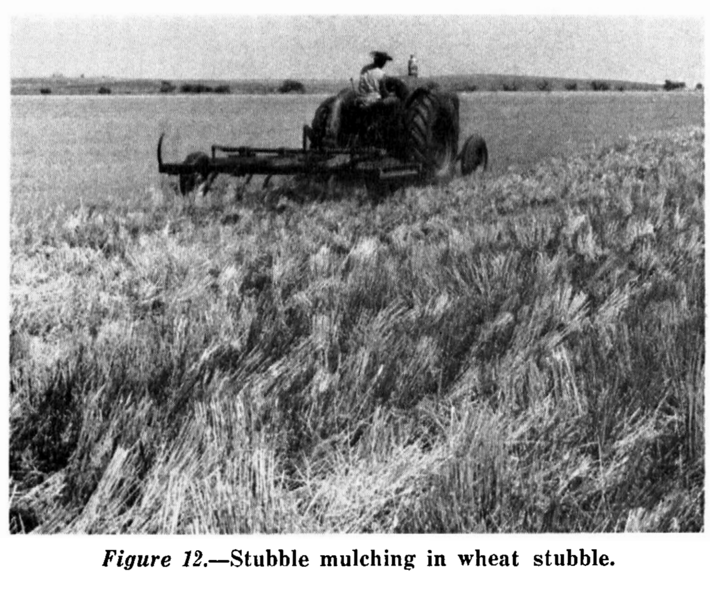

Figure 12.—**Stubble mulching in wheat stubble.**

[3] By M. D. GAMBLE, conservation agronomist, Soil Conservation Service.

Emergency tillage.—This practice is used to make the surface soil rough and cloddy so that it can resist the wind. It helps to control wind erosion for a limited time, but it is detrimental to tilth and it reduces the supply of moisture. It should be resorted to only if there is not enough vegetation to protect the soils. Whole areas have to be treated; tilling in strips is not effective.

In Roger Mills County, chisels are used for emergency tillage. The effectiveness of the tillage depends on the speed of the equipment, the depth of tillage, the spacing between chisels, and the size of the chisel points.

Chiseling is rarely successful on sandy soils. On soils that are low in organic matter, its effectiveness is short lived because the soils rapidly fuse, or run together, when wet.

Contour farming.—In contour farming, all tillage, planting, and other operations are done across the slope instead of up and down the slope. This is a normal practice on terraced land (fig. 13). Contour farming helps to control erosion and to reduce runoff.

Deep plowing.—Deep plowing helps in controlling wind erosion on soils that have a moderately coarse textured or coarse textured surface layer and sandy clay subsoil not more than 24 inches below the surface. The depth of plowing ranges from 16 to 24 inches. The purpose is to bring the heavier subsoil material up into the surface layer.

If deep plowing is properly done, crop yields increase and wind erosion is controlled. For good results, one-fourth to one-third of the furrow slice must be in the heavier subsoil material. After deep plowing, a well-fertilized high-residue crop should be grown.

Deep plowing can be useless or even harmful on certain kinds of soils. A local representative of the Soil Conservation Service can advise whether specific soils are suitable for deep plowing.

Stripcropping.—This practice consists of growing a close-growing or erosion-resistant crop and a clean-tilled crop in alternate strips of equal width. The close-growing crop provides a barrier that breaks the force of the wind and protects the other crop. The width of the strips is determined by the erodibility of the surface soil. On sandy soils, narrow strips are needed. The strips should be at right angles to the prevailing wind.

Cover crops.—A cover crop consists of close-growing grasses, legumes, or small grains that are grown in a crop rotation and are kept on the soil for 1 year or less.

Cover crops are now grown extensively on the sandy soils in the county as a means of controlling wind and water erosion in winter and early in spring. Rye is the principal cover crop grown, but other small grains are used. They can be seeded in cotton or grain sorghum early in September with drills designed especially for this purpose.

One objection to the use of cover crops on medium-textured and fine-textured soils is that they use much of the moisture needed for the growth of the following crop. The benefit of the cover crop, however, more than compensates for the moisture used.

Fertilization.—The use of fertilizer in an area having an average annual rainfall of about 25 inches is of questionable value, except for a few soils. The soils most likely to benefit are those that are moderately sandy to sandy. Soil tests now being made show that the tight, or clayey, soils do not need fertilizer, though crops grown on them will respond during years when rainfall is high. Use of fertilizer should be based on recommendations of the Oklahoma Agricultural Experiment Station.

***Figure 13.*—Terraced field on which contour farming is practiced.**

Most soils in the county are neutral or alkaline in reaction and do not require lime.

Grassed waterways.—Grassed waterways are broad, flat-bottomed, sodded channels. Either bermudagrass or native grass is commonly used for the vegetative cover. The waterways may have a retaining dike on each side if such is needed to increase their capacity. Their purpose is to dispose of excess water without causing erosion of fields. They are used to supplement natural drains where terrace systems, diversion terraces, or drainage or irrigation systems have been installed or are planned. They are not designed to control floodwaters from creeks, rivers, or very large drainage areas.

Each waterway needs to be especially designed. The size of the area drained and the slope, erodibility, and permeability of the soil are important.

Assistance on proper design, layout, construction, and maintenance of grassed waterways can be obtained from a local representative of the Soil Conservation Service.

Weed control.—Johnsongrass is prevalent in all cultivated sections of the country. Roadsides, railroad rights-of-way, and creek banks are covered with it. The seed is spread to cultivated fields by wind, birds, overflow water, and tillage equipment. Continuous pasturing through the growing season is the most economical and effective way of controlling johnsongrass. Spot treatment of infested patches may be practical, and control can be achieved by tillage or use of chemical sprays.

Bindweed is found throughout the county, normally in small areas within fields. It is probably the most difficult weed in the county to control without making the soils unfit for crops. A combination of chemical spraying and tillage can be used with limited success. Sterilizing the soil is practical only if the areas infested are so small that a hazard of wind erosion will not be created.

Field dodder, another noxious weed, is difficult to control. Clean cultivation is the only practice now successful.

Many other weeds grow in the county, but they can be controlled by proper cultivation and by the use of weed-free seed.

Capability Groups of Soils

The capability classification is a grouping of soils that shows, in a general way, how suitable they 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, the subclass, and the 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 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 have little or no erosion hazard but have other limitations that limit 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 Roger Mills County, are described in the list that follows.

Class I. Soils that have few limitations that restrict their use.
- Unit I–1. Deep, well-drained, loamy soils on bottom lands and low terraces.

Class II. Soils that have some limitations that reduce the choice of plants or require moderate conservation practices.
- Subclass IIe. Soils that have a moderate risk of erosion if they are not protected.
  - Unit IIe–1. Deep, nearly level to gently sloping, loamy soils.
  - Unit IIe–2. Deep, nearly level to gently sloping fine sandy loams that have moderately rapid permeability.
  - Unit IIe–3. Deep, nearly level to gently sloping, silty or moderately sandy soils on uplands.
  - Unit IIe–4. Deep, well-drained, moderately sandy soils on flood plains.
  - Unit IIe–5. Deep, nearly level, moderately permeable fine sandy loams.
  - Unit IIe–6. Deep, gently sloping, moderately permeable, silty soils on low stream terraces.
- Subclass IIc. Soils that have moderate limitations because of climate.
  - Unit IIc–1. Deep, slowly or moderately permeable, loamy soils on nearly level uplands.

Class III. Soils that have severe limitations that reduce the choice of plants, or require special conservation practices, or both.
- Subclass IIIe. Soils that have a severe risk of erosion if they are cultivated and not protected.
  - Unit IIIe–1. Shallow to deep, loamy soils on gently sloping to sloping uplands.
  - Unit IIIe–2. Deep, gently sloping to sloping, moderately sandy soils that have moderately rapid permeability.
  - Unit IIIe–3. Shallow to deep, gently sloping to sloping fine sandy loams that are moderately permeable.
  - Unit IIIe–4. Deep, gently sloping to sloping loamy fine sands.
  - Unit IIIe–5. Shallow to moderately deep, gently sloping to sloping fine sandy loams.
- Subclass IIIw. Soils that have severe limitations because of excess water.
  - Unit IIIw–1. Deep soils that are severely limited in their use for crops because of a moderately high water table.

Class IV. Soils that have very severe limitations that restrict the choice of plants, require very careful management, or both.
- Subclass IVe. Soils that have a very severe risk of erosion if they are cultivated and not protected.
  - Unit IVe–1. Deep, strongly sloping, loamy or moderately sandy soils.
  - Unit IVe–2. Deep, strongly sloping fine sandy loams that have moderately rapid permeability.
  - Unit IV–3. Deep, strongly sloping fine sandy loams that are moderately permeable.
  - Unit IVe–4. Deep, gently sloping fine sands.
  - Unit IVe–5. Shallow to moderately deep, gently sloping to strongly sloping, loamy soils.
  - Unit IVe–6. Deep, strongly sloping loamy fine sands.

Class V. Soils that have little or no erosion hazard but have other limitations that are impractical to remove without major reclamation and that limit their use largely to pasture, range, woodland, or wildlife food and cover.

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

Unit Vw-1. Soils that have a high water table and are on flood plains.

Class VI. Soils that have severe limitations that make them generally unsuitable for cultivation and that limit their use largely to pasture, 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. Shallow to moderately deep, loamy soils that are severely eroded.

Unit VIe-2. Deep, steep to very steep, moderately sandy soils.

Unit VIe-3. Deep, sandy soils that are moderately to severely eroded.

Unit VIe-4. Deep, steep loamy fine sands.

Unit VIe-5. Deep, sloping to strongly sloping fine sands.

Unit VIe-6. Shallow to deep, steep to very steep, loamy soils.

Subclass VIw. Soils severely limited by excess water and generally unsuitable for cultivation.

Unit VIw-1. Deep, sandy to loamy soils on bottom lands.

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 VIIs. Soils very severely limited by low moisture capacity, stones, or other soil features.

Unit VIIs-1. Very shallow soils on gentle to very steep or broken slopes.

Class VIII. Soils and landforms that have limitations that preclude their use, without major reclamation, for commercial production of plants and restrict their use to recreation, wildlife, water supply, or esthetic purposes.

There are no class VIII soils in Roger Mills County.

Management by Capability Units

All the soils in one capability unit have about the same limitations and similar risks of damage. Therefore, all soils in a unit need about the same kind of management, though they may have formed from different kinds of parent material and in different ways. In the following pages the soils in each unit are listed and management for each unit is suggested.

Capability unit I-1

This unit consists of deep, well-drained, reddish, loamy soils on bottom lands and low terraces. They are—

Norwood silt loam.
Spur and Port silt loams, 0 to 1 percent slopes.

These soils are fertile and are readily permeated by both roots and moisture. They are easily farmed and are well suited to all crops commonly grown in the county. However, some losses from flooding can be expected on the Norwood soil.

Most irrigation undertaken in the county is on these soils. In years when these soils are not irrigated, water that runs or seeps from higher areas generally is beneficial.

The principal crops are small grain, alfalfa, cotton, and sorghum for grain or forage. A suitable rotation consists of 3 or 4 years of alfalfa, 1 year of forage sorghum, and 2 years of small grain. This rotation can be used on a livestock farm. A rotation of 2 years of small grain and 4 years of cotton is suitable if all residues are returned to the soil and a winter cover crop of Austrian winter peas, vetch, or other legumes is grown after each cotton crop.

Natural fertility generally is high, but where the soils have been depleted by intensive cropping, fertilizers are needed, especially if the soils are irrigated. The soils should be tested periodically, and fertilizer applied if needed.

Soil compaction can be kept to a minimum by working or pasturing these soils only when they are dry. Varying the depth of tillage helps to prevent the development of a plowpan.

Keeping crop residues on or near the surface as much of the time as possible helps to increase the capacity of the soils to absorb moisture and helps to prevent sealing of their surface by the impact of rain.

Capability unit IIe-1

This unit consists of deep soils on nearly level to gently sloping uplands. These soils are slowly to moderately permeable. They are—

Carey silt loam, 1 to 3 percent slopes.
Holdrege silt loam, 1 to 3 percent slopes.
St. Paul silt loam, 1 to 3 percent slopes.
Woodward loam, 1 to 3 percent slopes.

These soils are fertile but are subject to erosion. They should be terraced and farmed on the contour, particularly if row crops are grown. Terracing is not necessary if only close-growing crops are used, stubble-mulch tillage is practiced, and drainageways are sodded or seeded to permanent grass.

The principal crops are small grain, cotton, and sorghum. A soil-improving crop, such as sweetclover, should be grown at least 1 year in each 5- or 6-year rotation. Suitable rotations are (1) 2 years of sweetclover and 4 years of wheat that is stubble mulched; or (2) 2 years of wheat and 4 years of cotton, with a legume or a legume-grain mixture grown as a winter cover crop and plowed under before cotton is seeded in spring.

Small grain and sweetclover can be grown together when rainfall is adequate, but in most years the summers are too dry.

The suggestions given for unit I-1 concerning maintenance of soil structure, fertilization, and use of crop residues apply to this unit also.

Capability unit IIe-2

The soils in this unit are deep, nearly level to gently sloping fine sandy loams on uplands and stream terraces. Their subsoil contains only slightly more clay, and in places no more clay, than the surface layer. The soils in this unit are—

Pratt fine sandy loam, 0 to 1 percent slopes.
Reinach fine sandy loam.

These soils absorb water readily but are low in water-holding capacity. Wind erosion is a hazard. Careful management is needed to maintain fertility and preserve soil structure. Rotations should include soil-improving crops, such as alfalfa or sweetclover. During the windy season the soils should be protected by a close-growing crop or a cover crop. If summer crops are grown, tillage should be delayed in spring until near the end of the windy season. Drainageways should be kept in sod.

The principal crops are small grain, cotton, sorghum, and alfalfa. Broomcorn is also well suited. Alfalfa yields are good in years of adequate rainfall, but in dry years they are satisfactory only where runoff from higher areas collects or where there is a relatively high water table.

Suitable rotations are (1) 3 years of alfalfa and 3 years of small grain, stubble mulched; or (2) 2 years of cotton or grain sorghum, followed by a winter cover crop, 2 years of small grain, stubble mulched, and 2 years of sweetclover.

The suggestions given for unit I–1 concerning maintenance of soil structure, fertilization, and use of crop residues apply to this unit also.

Capability unit IIe–3

This unit consists of deep, fertile, silty or moderately sandy soils on the uplands. The texture of the subsoil is about the same as that of the surface layer. The soils in this unit are—

Enterprise very fine sandy loam, 0 to 1 percent slopes.
Enterprise very fine sandy loam, 1 to 3 percent slopes.
Woodward fine sandy loam, 1 to 3 percent slopes.

These soils are similar to the soils in unit IIe–2, except that they are suited to terracing. Terraces can be of the conventional type or the water-impounding type. If terraces are not used, drains should be established and kept in permanent sod.

The management practices and crop rotations suggested for the soils of unit IIe–2 are suitable for these soils.

Capability unit IIe–4

In this unit are deep, well-drained, moderately sandy soils that have a moderately sandy subsoil. These soils are on flood plains. They are—

Yahola fine sandy loam.
Zavala fine sandy loam.

Some damage to crops because of flooding can be expected on these soils, but for many years there has been little damage.

Maintaining fertility is a greater problem in the more sandy areas than in the more silty areas, and some commercial fertilizer may be needed in the more sandy areas. The suggestions given in unit I–1 for fertilization are applicable.

Small grain, cotton, sorghum, and alfalfa are the principal crops. The crop rotations given for unit IIe–2 are suitable for these soils also. On some fields, windbreaks are needed to control wind erosion.

Capability unit IIe–5

The only soil in this unit is Miles fine sandy loam, 0 to 1 percent slopes. This deep, moderately sandy soil is on the uplands. It has more clay in the subsoil than in the surface layer.

This soil is subject to both wind and water erosion. If cultivated it should be terraced and tilled on the contour. Stubble-mulch tillage will provide protection if crop residues are adequate. Cover crops are needed if clean-tilled crops are grown. Where terraces are not used, drainageways should be kept in permanent sod. Stripcropping and field windbreaks also help to control wind erosion.

Maintaining fertility and preserving soil structure are problems if this soil is cultivated. Soil-improving crops should be included in the rotations to supply organic matter, add nitrogen, and improve soil structure. The suggestions given in unit I–1 are applicable.

Small grain, sorghum, and cotton are important crops. Broomcorn has been grown extensively. Suitable rotations are (1) 4 years of small grain, stubble mulched, and 2 years of sweetclover; or (2) 2 years of cotton or sorghum, followed by a winter cover crop, 2 years of small grain, stubble mulched, and 2 years of sweetclover.

Capability unit IIe–6

This unit consists of Spur and Port silt loams, 1 to 3 percent slopes. These deep, moderately permeable soils are on low stream terraces. The principal crops are small grain, sorghum, and alfalfa. Yields are good if adequate moisture is available.

Erosion is not a serious problem on these soils. Crop rotations should include soil-improving crops, such as legumes, and crops that provide ample residues, such as small grain. A suitable rotation consists of 2 years of sweetclover and 4 years of wheat, and in this rotation as much of the residue as possible should be left on or near the surface. A good rotation for soils on which cotton and sorghum are grown consists of 4 years of cotton followed by a winter legume or by a legume and small-grain mixture, and then 2 years of wheat that is stubble mulched.

The suggestions given for unit I–1 concerning maintenance of soil structure, fertilization, and the use of crop residues apply to this unit also.

Capability unit IIc–1

This unit consists of deep, dark-colored, moderately permeable or slowly permeable soils on nearly level uplands. The soils in this unit are—

Holdrege silt loam, 0 to 1 percent slopes.
Kenesaw silt loam, 0 to 1 percent slopes.
St. Paul silt loam, 0 to 1 percent slopes.

These soils are fertile. Crop yields are good if adequate moisture is available. The principal crops are small grain, sorghum, and cotton. Some alfalfa is grown in areas where runoff or seepage from higher areas collects. Water-impounding terraces can be used to advantage on these soils.

Erosion is not a serious problem. Crop rotations should include soil-improving crops, such as legumes, and crops that produce ample residues, such as small grain. A suitable rotation consists of 2 years of sweetclover and 4 years of wheat, and as much of the residue as possible should be left on or near the surface. A good rotation for soils on which cotton and sorghum are grown consists of 4 years of cotton followed by a winter legume or by a legume and small-grain mixture, and then 2 years of wheat that is stubble mulched.

The suggestions given for unit I–1 concerning maintenance of soil structure, fertilization, and the use of crop residues apply to this unit also.

Capability unit IIIe-1

This unit consists of shallow to deep, well-drained, fertile soils on gently sloping to sloping uplands. The soils in this unit are—

Carey silt loam, 3 to 5 percent slopes.
Enterprise very fine sandy loam, 3 to 5 percent slopes.
St. Paul silt loam, 3 to 5 percent slopes, eroded.
Woodward loam, 3 to 5 percent slopes.
Woodward-Quinlan loams, 1 to 3 percent slopes.

These soils lose considerable moisture through runoff; consequently, they are slightly eroded. Terraces and adequate water-disposal systems are needed, and also measures to increase the intake of moisture. About a fifth of the acreage should be in soil-improving crops, such as grasses and legumes, and about a fourth should be in crops that leave large amounts of residue. As much of this residue as possible should be left on or near the surface.

Suitable crop rotations are (1) 2 years of sweetclover and 4 years of small grain; or (2) 2 years of cotton or sorghum, 2 years of small grain, and 2 years of sweetclover.

Capability unit IIIe-2

In this unit are deep, moderately sandy soils that have only slightly more clay in the subsoil than in the surface layer. These soils are on the uplands. They are—

Miles-Springer complex, 3 to 5 percent slopes.
Pratt fine sandy loam, 1 to 3 percent slopes.

If these soils are cultivated, they should be protected as much of the year as possible by a growing crop or by crop residues. Crops that produce large amounts of residue and that can be stubble mulched should be grown at least half the time. Winter cover crops are needed if clean-tilled crops are grown. If summer crops are planted, tillage should be delayed in spring until the windy season is about over. Stripcropping and field windbreaks will also help to control erosion.

These soils are mostly in small grain and sorghum. In recent years much of the sorghum grown has been broomcorn. Suitable crop rotations are (1) 3 years of wheat and 2 years of sweetclover; or (2) 2 years of sorghum or cotton, 2 years of small grain, and 2 years of sweetclover. The soils are better protected if sorghum is planted in rows only 20 inches apart than if the rows are more widely spaced.

The suggestions given for unit I–1 for fertilization and for maintenance of soil structure apply to this unit also.

Capability unit IIIe-3

In this unit are shallow to deep, moderately sandy soils that have more clay in the subsoil than in the surface layer. These soils are on uplands. They are—

Dalhart fine sandy loam, 1 to 3 percent slopes.
Dill-Quinlan fine sandy loams, 1 to 3 percent slopes.
Dill-Quinlan fine sandy loams, 3 to 5 percent slopes.
Miles fine sandy loam, 1 to 3 percent slopes.
Miles fine sandy loam, 3 to 5 percent slopes.

These soils are subject to both wind and water erosion. If cultivated, they need careful management that will maintain their fertility and preserve their structure. Terraces should be established in cultivated areas. About a fifth of the acreage should be kept in soil-improving crops, and about half in crops that produce large amounts of residue. Terraces are not necessary in areas where only close-growing crops that produce large amounts of residue are grown and drainageways are kept in permanent sod. Stripcropping and field windbreaks also help to control erosion.

The principal crops are small grain, cotton, and sorghum. Suitable rotations are (1) 4 years of wheat and 2 years of sweetclover; or (2) 1 year of cotton or sorghum followed by a winter cover crop, 2 years of small grain, 1 year of cotton or sorghum followed by a winter cover crop, and 2 years of sweetclover.

The suggestions given for unit I–1 concerning fertilization and maintenance of soil structure apply to this unit also.

Capability unit IIIe-4

This unit consists of deep, sandy soils that have a sandy or moderately sandy subsoil. The soils in this unit are—

Brazos loamy fine sand.
Miles-Dill loamy fine sands, 1 to 4 percent slopes.
Pratt loamy fine sand, undulating.

These soils absorb water readily but are low in water-holding capacity. Wind erosion is a serious hazard. If possible, a vegetative cover should be kept on these soils throughout the year. A fourth of the acreage should be in soil-improving crops, and half the acreage in crops that produce large amounts of residue. If practical, tillage should be delayed in spring until near the end of the windy season. Stripcropping or field windbreaks can be used to help control erosion. Drainageways should be kept in permanent sod.

Most of the acreage is in sorghum, but some is in small grain and cotton. A suitable crop rotation is 1 year of cotton or sorghum followed by a winter cover crop, 2 years of small grain that is stubble mulched, and 2 years of sweetclover. A rotation of 3 years of sorghum and 2 years of sweetclover is suitable if the sorghum is planted in rows 20 inches apart and enough residue is left.

The suggestions given for unit I–1 concerning fertilization and maintenance of soil structure apply to this unit also.

Capability unit IIIe-5

In this unit are reddish, shallow to moderately deep, moderately sandy soils that do not have an accumulation of clay in the subsoil. The soils in this unit are—

Woodward-Quinlan fine sandy loams, 1 to 3 percent slopes.
Woodward fine sandy loam, 3 to 5 percent slopes.

These soils are subject to both wind and water erosion. They should be terraced and cultivated on the contour. Stubble-mulch tillage will provide protection if crop residues are adequate. Cover crops are needed if clean-tilled crops are grown. If terraces are not used, drainageways should be kept in permanent sod, close-growing crops that produce large amounts of residue should be grown continuously, and a fourth of the acreage should be in soil-improving crops. Stripcropping and field windbreaks also help to control erosion.

Maintaining fertility and preserving soil structure are problems if these soils are cultivated. Soil-improving crops should be included in the rotations; they supply organic matter, add nitrogen, and improve the soil structure.

The suggestions given for unit I–1 concerning fertilization and maintenance of soil structure apply to this unit also.

Most of the acreage is in cotton, sorghum, and small grain. Suitable crop rotations are (1) 4 years of small grain, stubble mulched, and 2 years of sweetclover; or (2) 1 year of cotton or sorghum followed by a winter cover crop, 2 years of small grain that is stubble mulched, and 2 years of sweetclover.

Capability unit IIIw–1

This unit consists only of Wann soils. These deep, sandy to loamy soils are on bottom lands and are subject to overflow at intervals of 1 to 3 years. They have a moderately high water table that is ordinarily 3 to 6 feet below the surface.

Excess water in the root zone severely limits the use of these soils. In some areas, wind erosion is a hazard. About a sixth of the acreage should be in soil-improving crops, and a fifth should be in crops that produce large amounts of residue. Diversion terraces are needed in some adjacent areas to divert water from these soils.

The principal crops are alfalfa, cotton, and small grain. Suitable rotations are (1) 4 years of small grain that is stubble mulched, and 2 years of alfalfa; or (2) 3 years of cotton followed by a winter cover crop, 2 years of small grain that is stubble mulched, and 2 years of alfalfa.

Capability unit IVe–1

This unit consists of deep, loamy or moderately sandy soils on the uplands. The subsoil is about the same texture as the surface layer. The soils in this unit are—

Enterprise very fine sandy loam, 5 to 8 percent slopes.
Woodward loam, 5 to 8 percent slopes.

These soils have been slightly eroded by runoff. To control this erosion, use terraces and farm on the contour. About a fourth of the acreage should be in soil-improving crops, and the rest should be in close-growing crops. Where terraces are not established, drainageways should be kept in permanent sod.

The principal crops are small grain and sown sorghum. A suitable rotation consists of 3 years of wheat or sorghum, and 2 years of sweetclover. All cultivated areas should be stubble mulched.

The suggestions given for unit I–1 concerning fertilization and maintenance of soil structure apply to these soils also.

Capability unit IVe–2

This unit consists of deep, moderately sandy soils that have slightly more clay in the subsoil than in the surface layer. These soils are on the uplands. They are—

Miles-Nobscot complex, 5 to 8 percent slopes.
Pratt fine sandy loam, 3 to 5 percent slopes.
Pratt fine sandy loam, 5 to 8 percent slopes.

Wind erosion is a hazard on these soils. A fourth of the acreage should be in soil-improving crops, and the rest should be in crops that produce large amounts of residue. Tillage should be delayed in spring until near the end of the windy season. Field windbreaks also help to control erosion.

The principal crops are small grain and sown sorghum. A suitable rotation consists of 3 years of wheat that is stubble mulched, and 2 years of sweetclover. Either some other small grain or sown sorghum can be grown instead of wheat.

The suggestions for unit I–1 concerning fertilization and maintenance of soil structure apply to this unit also.

Capability unit IVe–3

In this unit are deep, moderately sandy soils that have more clay in the subsoil than in the surface layer. These soils are on the uplands. They are—

Dalhart fine sandy loam, 3 to 5 percent slopes.
Dalhart fine sandy loam, 5 to 8 percent slopes.
Miles fine sandy loam, 5 to 8 percent slopes.

These soils are subject to both wind and water erosion. They should be terraced and farmed on the contour. The rotation should be one that keeps soil-improving crops on about a fourth of the acreage. On the rest, crops that produce large amounts of residue should be grown, and stubble-mulch tillage should be used. Terraces are not needed if drainageways are kept in permanent sod. Field windbreaks help to control erosion.

The principal crops are small grain and sorghum. A suitable rotation consists of 3 years of wheat, stubble mulched, and 2 years of sweetclover. Either some other small grain or sown sorghum can be grown instead of wheat.

Capability unit IVe–4

This unit consists of deep, sandy soils that have a moderately sandy or moderately clayey subsoil. These soils are on the uplands. They are—

Nobscot and Brownfield fine sands, 0 to 4 percent slopes.
Nobscot fine sand, 0 to 4 percent slopes.

Careful management is needed to maintain fertility and to control wind erosion. A careful check of the fertility level should be made periodically, and fertilizer should be applied as needed. A vegetative cover should be kept on these soils as much of the time as possible. Soil-improving crops should be grown on a third of the cultivated acreage. On the rest, crops that produce large amounts of residue should be grown, and stubble-mulch tillage should be used. Tillage should be delayed in spring until near the end of the windy season. Field windbreaks also help to control erosion.

The principal crops are rye and sown sorghum. A suitable rotation consists of 3 years of small grain or sown sorghum that is stubble mulched, and 2 years of sweetclover. Winter legumes and small grain can be grown together. Broomcorn is a suitable crop if its residue is left on the soils.

Capability unit IVe–5

In this unit are shallow and moderately deep, loamy soils that are slightly to moderately eroded. These soils are on the uplands. They are—

Mansker loam, 2 to 5 percent slopes.
Quinlan-Woodward loams, 1 to 5 percent slopes, eroded.
Woodward-Quinlan fine sandy loams, 3 to 5 percent slopes.
Woodward-Quinlan loams, 3 to 5 percent slopes.

These soils have considerable runoff; consequently, erosion is a serious hazard. Since these soils are shallow in spots, further erosion could do considerable damage. To control erosion, terraces should be established, stubble-mulch tillage should be used, and fertilizer should be applied as needed. About a fourth of the acreage should be in soil-improving crops, and the rest in crops that produce large amounts of residue.

Terraces are not necessary if drainageways are kept in permanent sod and a third of the acreage is in soil-improving crops.

The principal crops are small grain and sown sorghum. A suitable rotation consists of 3 years of wheat, stubble mulched, and 2 years of sweetclover. Some other small grain or sown sorghum can be grown instead of wheat.

The suggestions made for unit I-1 concerning fertilization and maintenance of soil structure apply to this unit also.

Capability unit IVe-6

This unit consists of deep, sandy soils that have only slightly more clay in the subsoil than in the surface layer. These soils are on uplands. They are—

Pratt loamy fine sand, hummocky.
Springer loamy fine sand, hummocky.

Careful management is needed to control wind erosion and to maintain fertility. If possible, a vegetative cover should be kept on the soils for much of the year. The fertility level should be checked periodically, and fertilizer applied as needed. Soil-improving crops should be grown on a third of the cultivated acreage. Crops that produce large amounts of residue should be grown on the rest of the acreage, and stubble-mulch tillage should be used. If possible, tillage should be delayed in spring until near the end of the windy season. Field windbreaks also help to control erosion.

The principal crops are small grain and sorghum. Much of the sorghum acreage has been used for growing broomcorn. A suitable crop rotation consists of 3 years of small grain or sown sorghum that is stubble mulched, and 2 years of sweetclover. Winter legumes and small grain can be grown together. Broomcorn is a suitable crop if the residue is left on the soils.

Capability unit Vw-1

This unit consists of Sweetwater soils. These soils are on flood plains, mostly along small creeks. They range in texture from sand to clay loam. The subsoil is stratified with sandy, loamy, and clayey sediments. The depth to the water table fluctuates. It may be at or near the surface or at any depth down to about 30 inches, depending on the season of the year. These wet soils are not suited to cultivation. They are in the Subirrigated range site.

Capability unit VIe-1

The soils in this unit are shallow to moderately deep loams and clay loams that are on gently sloping to steep uplands. These soils have lost most, and in places all, of their original surface layer through erosion. They are—

Mansker complex, severely eroded.
Quinlan soils, severely eroded.

These soils have been so severely eroded that they are not suited to cultivation. They are in the Eroded Prairie range site.

Capability unit VIe-2

This unit consists of deep, moderately sandy soils on the steep to very steep uplands. The soils in this unit are—

Miles-Nobscot complex, 8 to 15 percent slopes.
Pratt complex, hilly.

These soils are not suited to cultivation, because of the severe hazard of erosion. They are in the Sandy Prairie range site.

Capability unit VIe-3

In this unit are deep, sandy soils on the gently sloping to steep uplands. These soils have been eroded or severely eroded by wind. In places erosion is still active. They are—

Eroded sandy land.
Nobscot and Brownfield soils, eroded.

These soils are no longer suitable for cultivation. They are in the Eroded Sandy Land range site.

Capability unit VIe-4

This unit consists of deep, sandy soils on the steep uplands. These soils are not eroded or are only slightly eroded. They are—

Pratt loamy fine sand, hilly.
Springer loamy fine sand, hilly.

These soils are not suited to cultivation because of the severe hazard of erosion. They are in the Deep Sand range site.

Capability unit VIe-5

This unit consists of Nobscot and Brownfield fine sands, 4 to 8 percent slopes. These deep, sandy soils are on the sloping to strongly sloping uplands. They are not suited to cultivation, because of the severe hazard of wind erosion. They are in the Deep Sand Savannah range site.

Capability unit VIe-6

This unit consists of shallow to deep, loamy soils on the steep to very steep uplands. The soils in this unit are—

Mansker-Potter complex.
Quinlan-Woodward loams, 5 to 20 percent slopes.

Because of the severe hazard of erosion, these soils are not suited to cultivation. They are in the Shallow Prairie range site.

Capability unit VIw-1

The only soils in this unit are Lincoln soils. These deep, sandy to loamy soils are on bottom lands. They vary in texture, both in the surface layer and in the stratified subsoil. They do not have a high water table but are so frequently flooded that they are not suited to cultivation. They are in the Sandy Bottom Land range site.

Capability unit VIIs-1

This unit consists of very shallow soils on gentle to very steep or broken slopes on the uplands. Sandstone is exposed in many places. In this unit are—

Rough broken land.
Vernon-Quinlan complex.

These soils are not suited to cultivation, because they are very shallow. Regular grass-seeding equipment cannot be used for reseeding the steep, broken slopes.

Use of Cropland as Supplemental Pasture [4]

In an agricultural economy dominated by livestock raising and dairying, the growing of supplemental pasture on cropland is an important part of the cropping system.

Many crops used successfully as supplemental pasture in Roger Mills County also serve as cover crops that protect the soils from wind and water erosion and help to maintain fertility. Only the most durable plants can be depended on to provide reasonably reliable cropland pasture and, at the same time, to protect the soils from the ravages of high winds and intense rainfall.

Winter pasture.—Small grain is the only reliable crop for winter pasture. Rye and wheat are the most durable and will provide the most forage. Rye will withstand wind better than any of the other small grains and, consequently, is best suited to the sandy soils in the Nobscot-Brownfield soil association, which is in the western part of the county. Either rye or wheat is suitable for the less sandy soils, but rye is best for soils that are low in fertility. There will be years when neither crop will provide pasture before early in spring.

Vetch can be grown with rye or wheat as a winter legume but will not supply much forage before spring. It is of more value for its soil-improving qualities than as a pasture crop.

Summer pasture.—Sudangrass, sweet sorghum, and grain sorghum are the annual plants grown in the county for summer cropland pasture. Blue panicgrass, weeping lovegrass, and johnsongrass are the perennials. The only commonly grown legumes are biennial sweetclover and alfalfa. Sudangrass and sweetclover are the most commonly grown of the summer pasture plants.

Sweetclover is the best legume for pasture on the sandy soils. It is reliable on these soils if it is drilled in a good stubble mulch in spring. Although sweetclover has been grown successfully on other soils in the county, it is best suited to sandy soils.

Alfalfa is grown extensively on bottom lands but generally is cut and baled for winter forage. Ordinarily, it is not grazed until after frost.

Sudangrass is well suited to all soils in the county except those in the Rough broken land-Vernon-Quinlan soil association and those on bottom lands where soil material from the Vernon-Quinlan area has recently been deposited. The growth of any of the sorghum-type plants on these soils is severely restricted by lime-induced chlorosis. Sudangrass probably tolerates this condition better than other sorghums.

Sweet sorghum and grain sorghum, drilled early in summer and grazed after frost, are particularly well suited to Dalhart and Pratt soils. Hegari is one of the best varieties for this purpose.

Blue panicgrass, weeping lovegrass, johnsongrass, and switchgrass have only limited use as pasture. Except for weeping lovegrass, which is suited to sandy soils, all of these plants need fertile soils.

Soil erosion is a serious hazard in establishing summer pasture. Consequently, seed for summer pasture should be broadcast or drilled, even though yields may be reduced because of drought. Irrigation will benefit any of these crops.

Estimated Yields [5]

In table 7 are estimated long-term average acre yields for the principal crops grown in the county. Yields are given for soils in classes I, II, III, and IV, under two levels of management. In columns A are listed yields to be expected under the management now prevailing in the county. In columns B are those to be expected under improved management. Alfalfa is an important crop in the county, but it is not included in the table because it can be grown on only a few soils.

The figures in columns A are based largely on observations made by members of the soil survey party, on information obtained by interviews with farmers and ranchers who have had experience with the soils and crops of the area, on comparisons with yield tables for other counties in Oklahoma that have similar soils, and on actual yields where records were available. Crop failures were considered in estimating the average yields.

The management commonly practiced by most farmers in the county includes (1) use of recommended crop varieties, (2) use of proper seeding rates, planting dates, and efficient harvesting methods; (3) control of weeds, insects, and plant diseases, (4) use of cover crops on sandy soils, (5) fertilization and deep plowing on Nobscot, Brownfield, Miles, and Dill soils, (6) establishment of terraces where needed, and (7) use of the one-way moldboard plow.

Requirements of good management vary from one soil to another, but the following practices are considered requisite to obtain the yields in columns B: (1) Proper choice and rotation of crops, (2) correct use of commercial fertilizers and green-manure crops, (3) use of crop residues to control erosion, increase water infiltration, and improve soil structure, (4) contour tillage where needed, (5) minimum tillage to control erosion, and (6) conservation of soil material, plant nutrients, and soil moisture.

[4] By Bob Wright, soil conservationist, Soil Conservation Service.

[5] Roy Smith, soil scientist, Oklahoma Agricultural Experiment Station, prepared this subsection.

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TABLE 7.—*Estimated average acre yields of principal crops under two levels of management*

[Yields in columns A are those obtained under prevailing management; those in columns B are yields to be expected under improved management. Absence of a yield figure indicates the crop is not commonly grown]

Capability unit	Map symbol	Soil	Wheat		Grain sorghum		Forage sorghum		Cotton (lint)		Broomcorn (brush)	
			A	B	A	B	A	B	A	B	A	B
			Bu.	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
IIIe-4	Br	Brazos loamy fine sand	9	13	12	16	1.5	1.9	130	170	------	------
IIe-1	CaB	Carey silt loam, 1 to 3 percent slopes	13	21	17	23	2.1	2.6	160	265	------	------
IIIe-1	CaC	Carey silt loam, 3 to 5 percent slopes	11	18	14	20	1.7	2.2	140	230	------	------
IIIe-3	DaB	Dalhart fine sandy loam, 1 to 3 percent slopes	14	20	17	23	2.0	2.6	170	280	330	410
IVe-3	DaC	Dalhart fine sandy loam, 3 to 5 percent slopes	11	15	14	19	1.5	2.0	135	200	280	340
IVe-3	DaD	Dalhart fine sandy loam, 5 to 8 percent slopes	8	11	10	13	1.2	1.5	------	------	------	------
IIIe-3	DfB	Dill-Quinlan fine sandy loams, 1 to 3 percent slopes	14	19	18	24	2.0	2.5	200	280	340	425
IIIe-3	DfC	Dill-Quinlan fine sandy loams, 3 to 5 percent slopes	12	16	15	20	1.7	2.2	170	240	290	335
IIe-3	EnA	Enterprise very fine sandy loam, 0 to 1 percent slopes	15	20	19	25	2.2	2.8	190	300	310	400
IIe-3	EnB	Enterprise very fine sandy loam, 1 to 3 percent slopes	14	19	17	23	2.0	2.6	170	280	300	390
IIIe-1	EnC	Enterprise very fine sandy loam, 3 to 5 percent slopes	12	16	15	20	1.5	2.0	145	220	280	340
IVe-1	EnD	Enterprise very fine sandy loam, 5 to 8 percent slopes	10	13	11	14	1.2	1.6	------	------	------	------
IIc-1	HoA	Holdrege silt loam, 0 to 1 percent slopes	15	21	14	20	2.0	2.6	180	285	------	------
IIe-1	HoB	Holdrege silt loam, 1 to 3 percent slopes	14	19	12	17	1.8	2.3	165	260	------	------
IIc-1	KeA	Kenesaw silt loam, 0 to 1 percent slopes	16	22	18	24	2.3	3.0	200	310	------	------
IVe-5	MbC	Mansker loam, 2 to 5 percent slopes	9	13	10	14	.8	1.2	110	160	------	------
IIe-5	MfA	Miles fine sandy loam, 0 to 1 percent slopes	14	20	19	26	2.1	2.8	190	290	350	425
IIIe-3	MfB	Miles fine sandy loam, 1 to 3 percent slopes	13	18	17	24	2.0	2.6	170	260	325	400
IIIe-3	MfC	Miles fine sandy loam, 3 to 5 percent slopes	10	14	15	20	1.7	2.2	155	210	275	335
IVe-3	MfD	Miles fine sandy loam, 5 to 8 percent slopes	7	10	11	15	1.3	1.7	------	------	------	------
IIIe-4	MmB	Miles-Dill loamy fine sands, 1 to 4 percent slopes	12	17	18	24	2.0	2.5	185	270	310	390
IVe-2	MnD	Miles-Nobscot complex, 5 to 8 percent slopes	------	------	9	12	1.0	1.3	------	------	------	------
IIIe-2	MxC	Miles-Springer complex, 3 to 5 percent slopes	10	13	11	15	1.5	1.8	110	180	260	320
IVe-4	NaB	Nobscot fine sand, 0 to 4 percent slopes	8	11	11	18	1.4	1.8	------	------	210	280
IVe-4	NbB	Nobscot and Brownfield fine sands, 0 to 4 percent slopes	8	12	14	22	1.6	2.1	115	260	200	280
I-1	No	Norwood silt loam	18	26	22	28	2.5	3.1	230	350	------	------
IIIe-4	PfB	Pratt loamy fine sand, undulating	8	13	12	19	1.4	2.1	125	230	220	320
IVe-6	PfD	Pratt loamy fine sand, hummocky	------	------	7	10	1.0	1.3	------	------	190	250
IIe-2	PsA	Pratt fine sandy loam, 0 to 1 percent slopes	14	19	18	24	2.0	2.6	175	270	335	415
IIIe-2	PsB	Pratt fine sandy loam, 1 to 3 percent slopes	13	18	17	22	2.0	2.5	170	260	320	400
IVe-2	PsC	Pratt fine sandy loam, 3 to 5 percent slopes	10	14	15	19	1.7	2.1	150	210	270	330
IVe-2	PsD	Pratt fine sandy loam, 5 to 8 percent slopes	7	10	10	13	1.2	1.5	------	------	240	300
IVe-5	QwC2	Quinlan-Woodward loams, 1 to 5 percent slopes, eroded	8	12	10	14	.8	1.2	------	------	------	------
IIe-2	Ra	Reinach fine sandy loam	15	21	17	22	1.9	2.3	210	330	------	------
IIc-1	SaA	St. Paul silt loam, 0 to 1 percent slopes	14	20	16	22	2.0	2.5	175	280	------	------
IIe-1	SaB	St. Paul silt loam, 1 to 3 percent slopes	13	18	15	20	1.8	2.2	165	270	------	------
IIIe-1	SaC2	St. Paul silt loam, 3 to 5 percent slopes, eroded	8	12	12	16	1.4	1.7	100	160	------	------
IVe-6	SfC	Springer loamy fine sand, hummocky	8	11	13	17	1.4	1.8	125	175	255	320
I-1	SpA	Spur and Port silt loams, 0 to 1 percent slopes	16	22	18	22	2.0	2.4	210	320	------	------
IIe-6	SpB	Spur and Port silt loams, 1 to 3 percent slopes	14	19	16	20	1.8	2.2	190	285	------	------

TABLE 7.—*Estimated average acre yields of principal crops under two levels of management*—Continued

[Yields in columns A are those obtained under prevailing management; those in columns B are yields to be expected under improved management. Absence of a yield figure indicates the crop is not commonly grown]

Capability unit	Map symbol		Wheat		Grain sorghum		Forage sorghum		Cotton (lint)		Broomcorn (brush)	
			A	B	A	B	A	B	A	B	A	B
			Bu.	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
IIIw-1	Wa	Wann soils	12	16	16	20	1.8	2.2				
IIe-3	WdB	Woodward fine sandy loam, 1 to 3 percent slopes	11	15	14	19	1.9	2.4	150	240		
IIIe-5	WdC	Woodward fine sandy loam, 3 to 5 percent slopes	8	12	11	15	1.5	1.8	110	180		
IIe-1	WoB	Woodward loam, 1 to 3 percent slopes	11	16	14	18	1.9	2.3	150	240		
IIIe-1	WoC	Woodward loam, 3 to 5 percent slopes	9	13	11	14	1.5	1.8	110	180		
IVe-1	WoD	Woodward loam, 5 to 8 percent slopes	7	10	8	11	1.0	1.3				
IIIe-5	WsB	Woodward-Quinlan fine sandy loams, 1 to 3 percent slopes	7	10	12	16	1.3	1.7	120	200		
IVe-5	WsC	Woodward-Quinlan fine sandy loams, 3 to 5 percent slopes	6	10	9	13	.7	1.1				
IIIe-1	WwB	Woodward-Quinlan loams, 1 to 3 percent slopes	8	12	12	15	1.3	1.7	110	180		
IVe-5	WwC	Woodward-Quinlan loams, 3 to 5 percent slopes	7	10	9	12	.8	1.1				
IIe-4	Ya	Yahola fine sandy loam	14	20	18	24	2.0	2.5	200	305		
IIe-4	Za	Zavala fine sandy loam	10	14	12	16	1.7	2.0	150	190		

Management of Rangeland [6]

Cattle raising is the major enterprise of Roger Mills County. A little more than two-thirds of the land area is in range.

The main objective of good range management is to keep rangelands in excellent or good condition so they will produce good yields of forage. If this is done, water is conserved and the soils are protected. The problem is to recognize significant changes in the kind of cover on a range site. These changes take place gradually and can be misunderstood or overlooked. Growth encouraged by heavy rainfall may lead to the conclusion that the range is in good condition, when actually the cover is weedy and the long-time trend is toward lower production. On the other hand, some rangeland that has been closely grazed for relatively short periods under careful management may have a degraded appearance that temporarily conceals its quality and ability to recover.

Different kinds and amounts of grass are produced on different kinds of soils. To manage the range properly, an operator should know the different kinds of soil in his holdings and the plants that will grow on each kind of soil. He is then able to manage the range to favor the best forage plants on each kind of soil.

Livestock graze selectively, constantly seeking out the more palatable and nutritious plants. If grazing is not carefully regulated, the better plants are eventually eliminated and less desirable plants increase. If grazing is continued, even the second-choice plants can be thinned out or eliminated, and undesirable plants take their place.

[6] By F. L. WHITTINGTON, range conservationist, Soil Conservation Service.

Experience has shown that when only about half the yearly volume of grass produced is grazed, damage to the better plants is kept to a minimum and the range will improve. The growth left on the ground does the following things:

1. Serves as a mulch that encourages the intake and storage of water. The more water stored in the ground, the better the growth of grasses for grazing.
2. Allows roots to reach moisture deep in the soils. Overgrazed grass cannot do this because not enough green shoots are left to provide food for good root growth.
3. Protects the soil from wind and water erosion. Grass is the best cover for controlling erosion.
4. Allows the better grasses to crowd out weeds. When this happens the range improves.
5. Enables grasses to store in their roots the food they need for quick, vigorous growth in spring and after droughts.
6. Provides a reserve of feed for dry spells that otherwise might force sale of livestock at a loss.

Range sites and condition classes

Different kinds of soil vary in their capacity to produce grass and other plants for grazing. Soils that produce about the same kind and amount of forage, if the range is in similar condition, make up what is called a range site.

Range sites differ from each other in their capacity to produce vegetation. The soils of any one range site produce about the same kind of climax vegetation. *Climax vegetation* is the stabilized plant community on a particular site; it reproduces itself and does not change so long as the environment remains unchanged. Throughout most of the prairie and the plains, the climax vegetation is the combination of plants that was growing there when the region was first settled. The most productive combination of forage plants on a range site generally is the climax type of vegetation.

In the descriptions of range sites, the plants growing on them are referred to as *decreasers*, *increasers*, and *invaders*. Decreasers are species in the climax vegetation that tend to decrease in relative amount under close grazing. They generally are the tallest and most productive perennial grasses and forbs and are the most palatable to livestock. Increasers are species in the climax that increase in relative amount as the more desirable plants are reduced by close grazing. They are commonly shorter, and some are less palatable to livestock than the decreasers. Invaders are plants that cannot withstand the competition for moisture, nutrients, and light in the climax vegetation. Hence, they come in and grow along with increasers after the climax vegetation has been reduced by grazing. Many are annual weeds, and some are shrubs that have some grazing value, but others have little value for grazing.

Range condition expresses the present kind and amount of vegetation in relation to the climax vegetation for a given site. Four classes are used to indicate the degree of departure from the native, or climax, vegetation brought about by grazing or other use. These classes show the present condition of the native vegetation on a range site in relation to the native vegetation that could grow there.

A range is in *excellent condition* if 76 to 100 percent of the vegetation is of the same kind as the original stand. It is in *good condition* if the percentage is between 51 and 75, in *fair condition* if the percentage is between 26 and 50, and in *poor condition* if the percentage is less than 25.

Range sites

The 11 range sites in Roger Mills County are placed in 4 general groups.

Sandy range sites occupy most of soil associations 1, 2, 3, 4, 5, and 9 (see general soil map). In this group are the Deep Sand, Deep Sand Savannah, Sandy Prairie, and Eroded Sandy Land range sites. These sites cover about 48 percent of the land area of the county.

Loamy range sites are chiefly in soil association 8. In this group are the Loamy Prairie, Shallow Prairie, and Eroded Prairie range sites. These sites cover about 35 percent of the land area of the county and consist of medium-textured, moderately rolling to steep soils. Included are some shallow soils.

The shale range site is chiefly in soil association 7. The only site in this group is the Red Shale range site. It makes up about 9 percent of the land area of the county and consists of gently sloping to steep soils.

Bottom land range sites occupy most of association 6. In this group are the Loamy Bottom Land, Sandy Bottom Land, and Subirrigated range sites. These sites cover about 8 percent of the land area of the county and consist of deep, nearly level soils along streams and drainageways.

DEEP SAND RANGE SITE

This site consists of deep loamy fine sands on undulating to hilly uplands. These soils absorb water rapidly, but they are somewhat droughty because they have a permeable subsoil. They are—

Brazos loamy fine sand.
Miles-Dill loamy fine sands, 1 to 4 percent slopes.
Pratt loamy fine sand, undulating.
Pratt loamy fine sand, hummocky.
Pratt loamy fine sand, hilly.
Springer loamy fine sand, hummocky.
Springer loamy fine sand, hilly.

The dominant climax grasses are sand bluestem (*Andropogon halli*), Indiangrass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*), little bluestem (*A. scoparius*), and sand lovegrass (*Eragrostis trichodes*). The principal forage-producing legumes are leadplant (*Amorpha canescens*), roundhead lespedeza (*Lespedeza capitata*), and Stuves lespedeza (*L. stuvei*). Decreaser forbs common on this site are fringeleaf ruellia (*Ruellia ciliosa*), spiderwort (*Tradescantia bracteata*), and dayflower (*Commelina*). Woody plants common on this site are sandsage (*Artemisia filifolia*), skunkbush (*Rhus trilobata*) (commonly known as skunkbrush), and sandplum (*Prunus watsoni*).

The first grasses to increase if the climax vegetation is reduced are blue grama (*Bouteloua gracilis*) and sideoats grama (*B. curtipendula*). Some of the less productive and undesirable plants are mat sandbur (*Cenchrus panciflorus*), purple three-awn (*Aristida purpurea*), fall witchgrass (*P. dichotomiflorum*), and western ragweed (*Ambrosia psilostachya*).

If this site is in excellent condition, the estimated forage production is 3,800 pounds per acre in years of adequate rainfall and 1,700 pounds per acre in years of inadequate rainfall.

DEEP SAND SAVANNAH RANGE SITE

This site consists of deep, sandy soils on the uplands. The surface layer is fine sand and absorbs water rapidly. The subsoil ranges from fine sandy loam to sandy clay loam. It has good moisture-supplying capacity. Consequently, this site is highly productive. The soils in this site are—

Nobscot and Brownfield fine sands, 0 to 4 percent slopes.
Nobscott and Brownfield fine sands, 4 to 8 percent slopes.
Nobscot fine sand, 0 to 4 percent slopes.

Tall and mid grasses make up the climax vegetation. The dominant grasses are sand bluestem, Indiangrass, switchgrass, little bluestem, and sand lovegrass. The desirable legumes and forbs are leadplant, roundhead lespedeza, Stuves lespedeza, and fringeleaf ruellia.

Undesirable grasses common on this site are mat sandbur, common witchgrass (*P. capillare*), and gummy lovegrass (*E. curtipedicellata*). Shin oak (*Quercus harvardi*) is common. It increases rapidly and may become dominant if the more desirable plants are destroyed. Shin oak can be controlled by the use of chemical sprays and by other good management practices.

If this site is in excellent condition, the estimated forage production is 3,500 pounds per acre in years of adequate rainfall and 1,700 pounds per acre in years of inadequate rainfall.

SANDY PRAIRIE RANGE SITE

In this site are moderately deep and deep, permeable soils on the gently rolling uplands. These soils have a fine sandy loam surface layer and a somewhat finer textured subsoil. This site is highly productive. The soils in this site are—

Dalhart fine sandy loam, 1 to 3 percent slopes.
Dalhart fine sandy loam, 3 to 5 percent slopes.
Dalhart fine sandy loam, 5 to 8 percent slopes.
Dill-Quinlan fine sandy loams, 1 to 3 percent slopes.
Dill-Quinlan fine sandy loams, 3 to 5 percent slopes.
Miles fine sandy loam, 0 to 1 percent slopes.
Miles fine sandy loam, 1 to 3 percent slopes.
Miles fine sandy loam, 3 to 5 percent slopes.
Miles fine sandy loam, 5 to 8 percent slopes.
Miles-Nobscot complex, 5 to 8 percent slopes.
Miles-Nobscot complex, 8 to 15 percent slopes.
Miles-Springer complex, 3 to 5 percent slopes.
Pratt complex, hilly.
Pratt fine sandy loam, 0 to 1 percent slopes.
Pratt fine sandy loam, 1 to 3 percent slopes.
Pratt fine sandy loam, 3 to 5 percent slopes.
Pratt fine sandy loam, 5 to 8 percent slopes.
Reinach fine sandy loam.

The climax vegetation consists mostly of tall and mid grasses. Sand bluestem is the dominant tall grass, and little bluestem is the dominant mid grass. Blue grama is the principal increaser. Some woody plants, such as sandsage and shin oak, are common. The woody species should not be permitted to exceed 5 percent of the vegetation.

If this site is in excellent condition, the estimated forage production is 3,300 pounds per acre in years of adequate rainfall and 1,500 pounds per acre in years of inadequate rainfall.

ERODED SANDY LAND RANGE SITE

This site consists of deep, sandy soils that are moderately steep. These soils were formerly cultivated, and they have been eroded by both wind and water. Consequently, productivity has been lowered. The soils in this site are—

Eroded sandy land.
Nobscot and Brownfield soils, eroded.

The original vegetation consisted principally of tall and mid grasses but included some legumes, forbs, and woody plants. If this site is permitted to revegetate without artificial reseeding, silver bluestem (*A. saccharoides*), sand dropseed (*Sporobolus cryptandrus*), and other undesirable grasses and weeds will become dominant.

If this site were in excellent condition, the estimated forage production would be 2,000 pounds per acre in years of adequate rainfall and 1,200 pounds per acre in years of inadequate rainfall.

LOAMY PRAIRIE RANGE SITE

The soils in this range site are on gently sloping to steep uplands (fig. 14). They are moderately permeable to slowly permeable and generally have an adequate root zone. There are some steep, hilly areas in this site and some ravines. The soils in this site are—

Carey silt loam, 1 to 3 percent slopes.
Carey silt loam, 3 to 5 percent slopes.
Enterprise very fine sandy loam, 0 to 1 percent slopes.
Enterprise very fine sandy loam, 1 to 3 percent slopes.
Enterprise very fine sandy loam, 3 to 5 percent slopes.
Enterprise very fine sandy loam, 5 to 8 percent slopes.
Holdrege silt loam, 0 to 1 percent slopes.
Holdrege silt loam, 1 to 3 percent slopes.
Kenesaw silt loam, 0 to 1 percent slopes.
Mansker loam, 2 to 5 percent slopes.
Quinlan-Woodward loams, 1 to 5 percent slopes, eroded.
St. Paul silt loam, 0 to 1 percent slopes.
St. Paul silt loam, 1 to 3 percent slopes.
St. Paul silt loam, 3 to 5 percent slopes, eroded.
Woodward fine sandy loam, 1 to 3 percent slopes.
Woodward fine sandy loam, 3 to 5 percent slopes.
Woodward loam, 1 to 3 percent slopes.
Woodward loam, 3 to 5 percent slopes.
Woodward loam, 5 to 8 percent slopes.
Woodward-Quinlan fine sandy loams, 1 to 3 percent slopes.
Woodward-Quinlan fine sandy loams, 3 to 5 percent slopes.
Woodward-Quinlan loams, 1 to 3 percent slopes.
Woodward-Quinlan loams, 3 to 5 percent slopes.

The vegetation consists mainly of tall and mid grasses but includes some short grasses. The dominant tall grass is sand bluestem. The dominant mid grasses are little bluestem and side-oats grama. Blue grama is the principal short grass. In areas that are heavily grazed, blue grama and buffalograss (*Buchloe dactyloides*) increase rapidly and may become dominant.

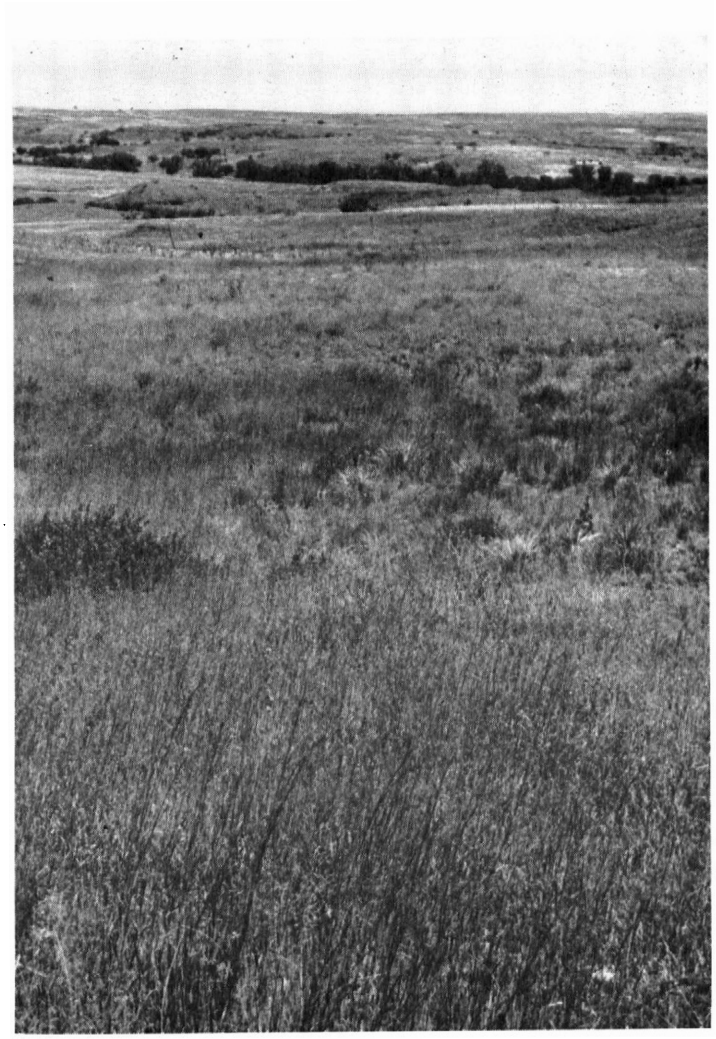

Figure 14.—Typical view of Loamy Prairie range site. The dominant tall grass is sand bluestem.

If this site is in excellent condition, the estimated forage production is 3,000 pounds per acre in years of adequate rainfall and 1,700 pounds per acre in years of inadequate rainfall.

SHALLOW PRAIRIE RANGE SITE

This site consists mostly of loamy, steep soils. There are some deep ravines, which may make it difficult to distribute grazing evenly. The soils in this site are—

Mansker-Potter complex.
Quinlan-Woodward loams, 5 to 20 percent slopes.

About 97 percent of the acreage consists of Quinlan-Woodward loams, 5 to 20 percent slopes. The climax vegetation is mid and tall grasses. There is a larger percentage of short grasses on this site than on the Loamy Prairie range site. The dominant grasses are little bluestem, side-oats grama, and blue grama. The principal increasers are blue grama and buffalograss.

If this site is in excellent condition, the estimated forage production is 2,000 pounds per acre in years of adequate rainfall and 1,000 pounds per acre in years of inadequate rainfall.

ERODED PRAIRIE RANGE SITE

This site is made up of steep, loamy soils that were formerly cultivated and that are now severely eroded. Erosion has greatly reduced productivity. The soils in this site are—

Mansker complex, severely eroded.
Quinlan soils, severely eroded.

The vegetation on this site is variable. The principal grasses are side-oats grama and little bluestem. Silver bluestem and sand dropseed are common in most places.

If this site were in excellent condition, the estimated forage production would be 1,800 pounds per acre in years of adequate rainfall and 800 pounds in years of inadequate rainfall.

RED SHALE RANGE SITE

This site is made up of gently sloping to steep, moderately fine textured and medium-textured soils that are underlain by shaly red beds (fig. 15). The moisture-holding capacity is low, and runoff is high. There is some geologic erosion. Red shale hills and canyons are common. The soils in this site are—

Rough broken land.
Vernon-Quinlan complex.

The climax vegetation consists principally of mid and short grasses. Side-oats grama, blue grama, and buffalograss are dominant. A small percentage of the climax vegetation consists of sand bluestem and little bluestem. Fragrant mimosa (*Mimosa borealis*) is common. Hairy tridens (*Triodia albescens*) is dominant in areas that have been overgrazed. Intensive management is needed to keep this site in a high condition class.

If this site is in excellent condition, the estimated forage production is 1,400 pounds per acre in years of adequate rainfall and 700 pounds per acre in years of inadequate rainfall.

LOAMY BOTTOM LAND RANGE SITE

The site consists of deep, loamy soils that are on bottom lands but are not subject to frequent overflow. This is the most productive site in the county. The soils in this site are—

Norwood silt loam.
Spur and Port silt loams, 0 to 1 percent slopes.
Spur and Port silt loams, 1 to 3 percent slopes.
Wann soils.
Yahola fine sandy loam.
Zavala fine sandy loam.

The dominant grasses are sand bluestem, switchgrass, Indiangrass, and western wheatgrass (*Agropyron smithii*). There are some woody plants, including American elm (*Ulmus americana*), hackberry (*Celtis occidentalis*), and cottonwood (*Populus* spp.). As the climax grasses are killed, the woody plants increase and in time they may dominate on the site.

If this site is in excellent condition, the estimated forage production is 4,000 pounds per acre in years of adequate rainfall and 2,500 pounds per acre in years of inadequate rainfall.

SANDY BOTTOM LAND RANGE SITE

The only soils in this site are Lincoln soils, which are deep, nearly level, and subject to frequent flooding. The deposition of new material reduces the productivity of this site. The water table is sometimes within reach of the roots of some plants.

The principal climax plants are switchgrass, sand bluestem, little bluestem, and Indiangrass. The common woody species are tamarisk (*Tamarix* spp.), sand sage, skunkbush, cottonwood, and willow (*Salix* spp.).

If this site is in excellent condition, the estimated forage production is 4,000 pounds per acre in years of ade-

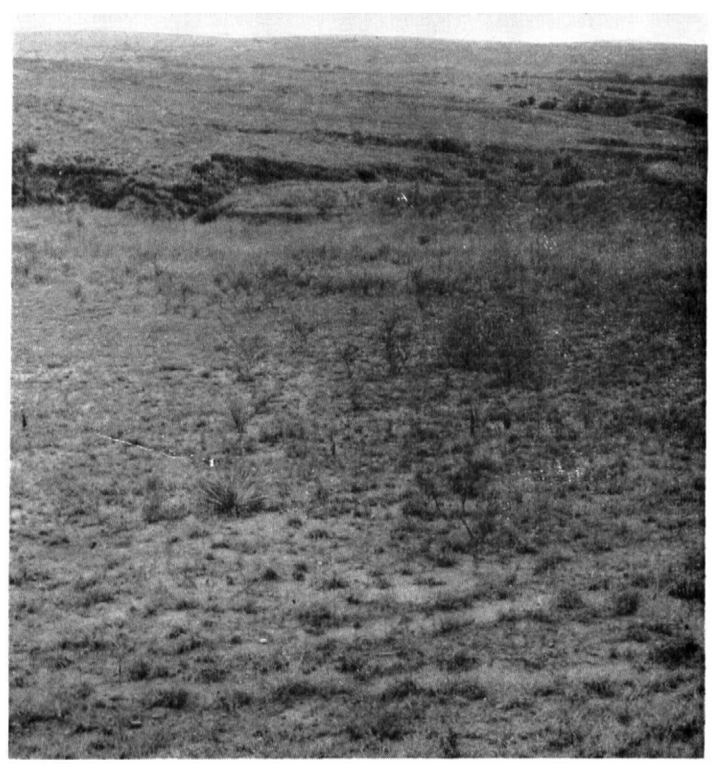

Figure 15.—Typical view of Red Shale range site.

quate rainfall and 3,000 pounds per acre in years of inadequate rainfall.

SUBIRRIGATED RANGE SITE

The only soils in this site are Sweetwater soils. These are sandy and loamy soils along creeks and drainageways. They have a high water table and generally are moist at the surface. They seldom are dry below a depth of 3 feet. Consequently, the production of forage is high.

Tall grasses make up the climax vegetation. The principal grasses are switchgrass, sand bluestem, prairie cordgrass (*Spartina pectinata*), and eastern gamagrass (*Tripsacum dactyloides*).

Most of the site is fenced in with other sites. It is commonly overgrazed and is seldom in good or excellent condition.

If this site were in excellent condition, the estimated forage production would be 6,000 pounds per acre in years of adequate rainfall and 4,000 pounds per acre in years of inadequate rainfall.

Range management practices

The main practices needed to encourage the growth of the best native forage plants are the following:

Control of grazing.—Without control of grazing, all other practices will fail. In their green leaves, grasses manufacture the food they need to grow, flower, and reproduce. If too much of this green foliage is removed by grazing or mowing, the plant is weakened and stunted.

The control of grazing in Roger Mills County is complicated because forage production is high in wet years and low in dry years. To control grazing, it may be necessary to maintain surplus forage or to stock a class of livestock that can be disposed of during periods of low forage production. This can be done by holding the breeding herd in balance with forage production during dry periods. If surplus forage is available, stockers can be added in fall. They can be sold in spring if it appears that the supply of moisture available for summer forage is inadequate.

Ranchers can provide reserve pastures for use during droughts or other periods when forage production is low. The subsection "Use of Cropland as Supplemental Pasture" gives additional information on reserve pastures.

Deferred grazing.—Rest in spring and in summer is an excellent way to hasten recovery of range that is in poor or fair condition. This practice is not advisable if it necessitates the overgrazing of other pastures. Cropland can be used for temporary pasture to permit deferred grazing.

Distribution of grazing.—To obtain an even distribution of grazing is a problem in some pastures, especially if the pasture includes soils of two or more range sites. Fencing each site as a separate pasture is desirable, but the cost and the returns expected must be considered. Placing salt or water in selected spots may help to distribute grazing.

Controlling brush.—Brush can be controlled by the use of chemicals, by mechanical means, or through natural succession. The use of herbicides to control shin oak, sand sagebrush, or other woody species is becoming more common and is an excellent practice to increase forage production. To permit recovery of the better grasses, pastures that have been treated for removal or control of brush should not be grazed during the next growing season. Light grazing in winter may help to distribute seed. Generally, woody plants should not be removed from sand dunes, where any kind of cover helps to prevent soil from drifting.

Figure 16.—**Seeding native grass with an especially designed grass-seed drill, in noncompetitive sorghum cover.**

Detailed instructions on the control of brush can be obtained from the county agent or a local representative of the Soil Conservation Service.

Range seeding.—Seeding native grasses in areas not suited to cultivation has been highly successful in this county. The seed mixture should be determined by the range site. Generally, climax grasses should make up most of the mixture. A noncompetitive sorghum should be used as a cover crop.

Seeding should be undertaken with an especially designed grass-seed drill (fig. 16). The seeded fields should be enclosed with fences until a good stand is established. This usually requires 3 years deferment of summer grazing and only light or moderate grazing in winter and in spring. Suggestions on seed mixtures can be obtained from the Soil Conservation Service or from the county agent. The Upper Washita Soil Conservation District has drills available.

Woodland and Windbreaks [7]

Native woodland occurs along the South Canadian and Washita Rivers and in diminishing amounts along their tributaries. There is also some woodland in the southern part of the county along tributaries of the North Fork Red River.

The many miles of windbreaks planted 20 to 25 years ago have not provided the hoped for control of soil blowing. Many of these plantings failed, either because the soils were not suitable and rainfall was limited and irregular, or because the trees were not given sufficient care. Plantings on the more favorable soils were not in protective patterns, and the trees were not properly spaced. The experience gained from these plantings, however, has been utilized to make windbreaks successful on a number of soils in the county. Table 8 shows the suitability of the soils for field and farmstead windbreaks and for post-lot plantings.

[7] By H. R. WELLS, soil conservationist, Soil Conservation Service.

TABLE 8.—*Suitability of soils for field and farmstead windbreaks and post-lot plantings*

Map symbol	Soil	Field windbreak	Farmstead windbreak	Post lot
Br	Brazos loamy fine sand	Fair	Good	Fair.
CaB	Carey silt loam, 1 to 3 percent slopes	Not suitable	Fair	Not suitable.
CaC	Carey silt loam, 3 to 5 percent slopes	Not suitable	Fair	Not suitable.
DaB	Dalhart fine sandy loam, 1 to 3 percent slopes	Good	Excellent	Fair.
DaC	Dalhart fine sandy loam, 3 to 5 percent slopes	Good	Excellent	Fair.
DaD	Dalhart fine sandy loam, 5 to 8 percent slopes	Fair	Good	Fair.
DfB	Dill-Quinlan fine sandy loams, 1 to 3 percent slopes	Fair to good	Good	Fair to good.
DfC	Dill-Quinlan fine sandy loams, 3 to 5 percent slopes	Fair	Fair to good	Fair.
EnA	Enterprise very fine sandy loam, 0 to 1 percent slopes	Good	Good to excellent	Fair.
EnB	Enterprise very fine sandy loam, 1 to 3 percent slopes	Good	Good to excellent	Fair.
EnC	Enterprise very fine sandy loam, 3 to 5 percent slopes	Fair to good	Fair to good	Not suitable to fair.
EnD	Enterprise very fine sandy loam, 5 to 8 percent slopes	Not suitable	Fair to good	Not suitable.
Er	Eroded sandy land	Not suitable	Not suitable	Not suitable.
HoA	Holdrege silt loam, 0 to 1 percent slopes	Not suitable	Fair	Not suitable.
HoB	Holdrege silt loam, 1 to 3 percent slopes	Not suitable	Fair	Not suitable.
KeA	Kenesaw silt loam, 0 to 1 percent slopes	Fair	Good	Fair.
Ln	Lincoln soils	Good	Not applicable	Good.
Ma3	Mansker complex, severely eroded	Not suitable	Not suitable	Not suitable.
MbC	Mansker loam, 2 to 5 percent slopes	Not suitable	Not suitable	Not suitable.
Mc	Mansker-Potter complex	Not suitable	Not suitable	Not suitable.
MfA	Miles fine sandy loam, 0 to 1 percent slopes	Fair	Good	Fair.
MfB	Miles fine sandy loam, 1 to 3 percent slopes	Fair	Good	Fair.
MfC	Miles fine sandy loam, 3 to 5 percent slopes	Fair	Good	Fair.
MfD	Miles fine sandy loam, 5 to 8 percent slopes	Not suitable to fair.	Fair	Fair.
MmB	Miles-Dill loamy fine sands, 1 to 4 percent slopes	Good to excellent	Excellent	Good.
MnD	Miles-Nobscot complex, 5 to 8 percent slopes	Not suitable to fair.	Fair	Not suitable.
MnE	Miles-Nobscot complex, 8 to 15 percent slopes	Not suitable	Not suitable to fair.	Not suitable.
MxC	Miles-Springer complex, 3 to 5 percent slopes	Fair to good	Good	Fair to good.
NaB	Nobscot fine sand, 0 to 4 percent slopes	Fair	Fair to good	Fair to good.
NbB	Nobscot and Brownfield fine sands, 0 to 4 percent slopes	Fair	Good	Fair to good.
NbC	Nobscot and Brownfield fine sands, 4 to 8 percent slopes	Fair	Good	Fair to good.
Nc2	Nobscot and Brownfield soils, eroded	Not suitable	Not suitable	Not suitable.
No	Norwood silt loam	Good	Not applicable	Excellent.
PcE	Pratt complex, hilly	Fair	Good	Fair.
PfB	Pratt loamy fine sand, undulating	Good	Good to excellent	Good.
PfD	Pratt loamy fine sand, hummocky	Fair	Fair to good	Fair.
PfE	Pratt loamy fine sand, hilly	Not suitable	Fair	Not suitable.
PsA	Pratt fine sandy loam, 0 to 1 percent slopes	Good	Excellent	Good.
PsB	Pratt fine sandy loam, 1 to 3 percent slopes	Good	Good to excellent	Good.
PsC	Pratt fine sandy loam, 3 to 5 percent slopes	Fair	Good	Fair to good.
PsD	Pratt fine sandy loam, 5 to 8 percent slopes	Fair	Fair to good	Fair.
Qu3	Quinlan soils, severely eroded	Not suitable	Not suitable	Not suitable.
QwC2	Quinlan-Woodward loams, 1 to 5 percent slopes, eroded	Not suitable	Not suitable	Not suitable.
QwE	Quinlan-Woodward loams, 5 to 20 percent slopes	Not suitable	Not suitable	Not suitable.
Ra	Reinach fine sandy loam	Good	Excellent	Good.
Rb	Rough broken land	Not suitable	Not suitable	Not suitable.
SaA	St. Paul silt loam, 0 to 1 percent slopes	Not suitable	Fair	Not suitable.
SaB	St. Paul silt loam, 1 to 3 percent slopes	Not suitable	Fair	Not suitable.
SaC2	St. Paul silt loam, 3 to 5 percent slopes, eroded	Not suitable	Not suitable	Not suitable.
SfC	Springer loamy fine sand, hummocky	Fair to good	Good	Fair.
SfE	Springer loamy fine sand, hilly	Not suitable	Not suitable	Not suitable.
SpA	Spur and Port silt loams, 0 to 1 percent slopes	Fair	Good	Good.
SpB	Spur and Port silt loams, 1 to 3 percent slopes	Fair	Good	Fair.
Sw	Sweetwater soils	Not suitable	Not suitable	Not suitable.
Vc	Vernon-Quinlan complex	Not suitable	Not suitable	Not suitable.
Wa	Wann soils	Fair	Not applicable	Good.
WdB	Woodward fine sandy loam, 1 to 3 percent slopes	Not suitable	Fair	Not suitable.
WdC	Woodward fine sandy loam, 3 to 5 percent slopes	Not suitable	Fair	Not suitable.
WoB	Woodward loam, 1 to 3 percent slopes	Not suitable	Fair	Not suitable.
WoC	Woodward loam, 3 to 5 percent slopes	Not suitable	Fair	Not suitable.
WoD	Woodward loam, 5 to 8 percent slopes	Not suitable	Fair	Not suitable.
WsB	Woodward-Quinlan fine sandy loams, 1 to 3 percent slopes	Not suitable	Fair	Not suitable.
WsC	Woodward-Quinlan fine sandy loams, 3 to 5 percent slopes	Not suitable	Fair	Not suitable.
WwB	Woodward-Quinlan loams, 1 to 3 percent slopes	Not suitable	Fair	Not suitable.
WwC	Woodward-Quinlan loams, 3 to 5 percent slopes	Not suitable	Fair	Not suitable.
Ya	Yahola fine sandy loam	Excellent	Excellent	Excellent.
Za	Zavala fine sandy loam	Good to excellent	Excellent	Excellent.

In many places, three-row windbreaks will give satisfactory protection to soils and crops if correctly planted and given good care. In a three-row windbreak, two rows should consist of tall species that have dense growth near the top. The third row, or windward side row, should be of a short species that produces foilage close to the ground. Suitable tall trees are cottonwood, Siberian elm, Chinese elm, and sycamore. Redcedar, Austrian pine, or ponderosa pine are suitable for the windward side row. Russian mulberry, planted 4 feet apart in the row, also makes a dense shrublike barrier.

On a dryland site that is without a reliable water table and receives no extra moisture through drainage, the rows should be spaced from 14 to 20 feet apart. The distance between trees in the rows should range from 6 to 8 feet for the tall species and from 4 to 6 feet for the short species or shrubs. The exact spacing depends on the characteristics of the soil and the depth to which moisture penetrates. Plantings should not be made on very coarse sandy soils unless there is a moisture-holding layer within 10 feet of the surface. Unless the plantings are on the contour, trees should not be planted on slopes of more than 5 percent.

Farmstead windbreaks receive more water and are better cared for than field windbreaks, and generally tall trees are not needed for protection. Consequently, these plantings can be on shallower, finer textured soils. Frequently, five or more rows of trees are used. The species suggested for field windbreaks are suitable, as are also the species recommended by local nurseries. The most popular types of plantings are those that combine hardwood and evergreen species. The spacing suggested for field windbreaks normally can be followed.

The species most commonly used for posts are black locust, catalpa, and osage-orange. Under good management, the trees are cut before they are large enough to compete for space. Therefore, 12 feet between rows and 6 feet within the row provides adequate growing space. Sprouts that develop after the trees are cut are managed for successive harvests.

All plantings need some cultivation. As trees in closely spaced rows develop, their branches interlock between rows. Consequently, cultivation generally is not necessary or possible after the trees are 3 to 5 years old. However, if trees are planted on soils that are not suitable or if narrow-crowned species are planted in rows spaced 20 feet apart, closure may never occur and cultivation may be necessary during the entire life of the planting.

Wildlife [8]

The principal game species in the county are bobwhite quail, mourning dove, cottontail rabbit, and squirrel. There are some prairie chickens and wild turkeys and a few coveys of scaled quail in the limited suitable habitats. Ring-necked pheasants have been stocked sporadically but have failed to become well established. There are white-tailed deer in a few areas. Generally there is a short open season for deer, but the take is very small.

Quail are present throughout the county but are most abundant along the southern and western borders and along the South Canadian River. Favorable habitats are spots where the native vegetation borders fields of grain sorghum or small grain. The weather and variations in the intensity of grazing have caused the quail population to fluctuate, but, even after several consecutive years of drought, the number increases rapidly under favorable conditions.

Generally, little management is needed to improve quail habitats in this county, except to protect these areas from fire and overgrazing and to reduce to a minimum the burning and mowing of weeds and brush along roadsides. Some improvement can be made at little cost by disking around trees and shrubs to promote the growth of weeds and by protecting the vegetation in fence rows. Fencing and planting will help to restore badly eroded tracts that are potentially good as quail habitats.

Although a considerable number of coyote skins are marketed, furbearing animals are not numerous in the county and are of little economic importance. There is little or no professional trapping, but a certain amount of trapping is done by boys and small-farm operators. Some raccoons, minks, and opossums inhabit areas along drainage systems and river basins. Coyotes, skunks, and a few badgers are found throughout the county, and cottontail rabbits and jackrabbits are plentiful.

The construction of almost 2,000 farm ponds, averaging more than an acre in size, and the inception of the Washita Flood Control Program have made fishing important in the county. Under the flood control program, 8 watersheds have been established along the Washita River and 48 control structures, averaging 30 surface acres at permanent pool level, have been constructed. The principal sport fish of the ponds and lakes are largemouth bass, channel catfish, and bluegill and other sunfish (fig. 17). The Washita and South Canadian Rivers contain a few fish of these species, as well as some carp and other species of catfish.

Figure 17.—**Flood control structures provide good fishing.**

[8] By H. R. Wells, soil conservationist, Soil Conservation Service.

Wildfowl are being attracted to the ponds and control structures in the county. Marshy areas below some structures also can be managed to attract wildfowl. Upland birds and animals, including some furbearing animals, are also attracted to the vicinity of the watershed developments.

Irrigation

There are about 75,000 acres suitable for irrigation in the county. Prior to the construction of detention structures for flood control, irrigation was confined to the bottom lands along the Washita River and its tributaries. Now, detention structures provide a supply of water that can be readily used for irrigation, and the importance of irrigation agriculture in the county is greatly increasing. The potential water supply should be adequate to irrigate from 5,000 to 8,000 acres.

The quality of water for irrigation is generally good if surface water is used and is variable if underground supplies are used. Of 11 samples of underground water tested, 7 were found to be suitable, 3 were questionable, and 1 was unsuitable. On a State-wide basis, 38 percent of the water samples tested was found to be unsuitable.

Of the 1,520 acres irrigated in 1958, 770 acres were supplied by surface water and 750 acres by underground water. Water was applied by gravity systems on 640 acres, and by overhead or sprinkler systems on 880 acres.

Engineering Properties of the Soils [9]

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, shear strength, compaction characteristics, drainage, shrink-swell characteristics, grain size, plasticity, and pH. Depth to water table, depth to bedrock, and topography also are important.

The information in this report can be used by engineers to—

1. Make soil and land use studies that will aid in selecting and developing industrial, business, residential, and recreational sites.
2. Make preliminary estimates of the engineering properties of soils that affect the planning of agricultural drainage and irrigation systems, farm ponds, and terraces.
3. Make preliminary evaluations of soils and ground conditions that will aid in selecting highway, airport, pipeline, and cable locations, and in planning detailed investigations of the selected locations.
4. Locate probable sources of road and highway construction materials.
5. Correlate performance of engineering structures with soils, and thus gain information that will be useful in designing and maintaining the structures.
6. Determine the suitability of soil units for cross-country movement of vehicles and construction equipment.
7. Supplement information obtained from other published maps and reports and aerial photographs for the purpose of making maps and reports that can be readily used by engineers.

This report, however, does not eliminate the need for sampling and testing soils at the site chosen for construction. The mapping and the descriptions of the soils are somewhat generalized and, therefore, are not a substitute for detailed engineering surveys at a particular site.

Presented in tables 9 and 10 are data based on engineering properties of several soil types that together cover about 70 percent of Roger Mills County. In table 9 are the results of tests made on these soils by the Materials Testing Laboratory, Oklahoma Department of Highways. Table 10 provides ratings that indicate the suitability of the soil type for highway construction, as well as appraisals of its hardness when dry, permeability, moisture-holding capacity, and shrink-swell potential. Table 11 lists all the soils in the county, and gives the properties of these soils that affect their use for ponds, reservoirs, irrigation systems, terraces, and waterways. The terms and classifications used in these tables are explained for farmers and others who are not engineers but are interested in engineering uses of soils.

TABLE 9. The samples tested were taken at sites where the soil was considered typical. The thickness of each horizon sampled is shown in the column headed "Depth." In this column the progression downward is not consecutive, because not all layers of each profile were sampled. Samples of Holdrege silt loam, for example, were taken at 0 to 9 inches, at 18 to 38 inches, and at 38 to 48 inches. The layer not sampled (9 to 18 inches) is transitional; that is, it has engineering properties partly like the layer above and partly like the one below.

Engineering classifications: Two engineering classifications are shown: the AASHO (American Association of State Highway Officials), which is used widely by highway engineers (*1*)[10]; and the Unified, which is used mainly by the U.S. Bureau of Reclamation, U.S. Army Corps of Engineers, and the Soil Conservation Service (*9*).

In the AASHO classification system, soils are placed in seven principal groups. The groups range from A–1, consisting of gravelly soils of high bearing capacity, to A–7, consisting of clay soils that have low strength when wet. Within each group, the relative engineering value of the soil material is indicated by a group index number. These range from 0 for the best materials to 20 for the poorest. The group index number is shown in parentheses following the soil group symbol.

In the Unified classification, soils are grouped on the basis of their texture and plasticity and their performance as materials for engineering structures. Soil materials are identified as coarse grained (8 classes), fine grained (6 classes), or highly organic.

[9] By GRANT WOODWARD and ROBERT G. DAY, civil engineers, Soil Conservation Service.

[10] Italicized numbers in parentheses refer to Literature Cited, p. 66.

Shrinkage limit: The moisture content at which shrinkage stops. As moisture leaves the soil, the soil shrinks and decreases in volume in direct proportion to the loss in moisture until a condition of equilibrium is reached where shrinkage stops even if additional moisture is removed.

Shrinkage ratio: The volume change resulting from drying of a soil material, divided by the amount of water lost in drying above the shrinkage limit. This ratio is expressed numerically.

Volumetric change: The change in volume that will take place in a soil material when it dries from a given moisture content to the point where no further shrinkage takes place.

Field moisture equivalent (FME): The minimum moisture content at which a smooth soil surface will absorb no more water within 30 seconds when the water is added in individual drops.

Mechanical analysis: Tests to determine the percentage of soil particles that will pass through sieves of specified sizes. The very small particles, those that pass through a No. 200 sieve, are analyzed in engineering tests by the hydrometer method, rather than by the pipette method commonly used by soil scientists.

Liquid limit: The moisture content at which a soil passes from a plastic to a liquid state.

Plastic limit: The moisture content at which a soil passes from a semisolid to a plastic state.

Plasticity index: The numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil is in plastic condition. Nonplastic, indicated by NP, applies to soils that are granular or without cohesion and for which a liquid or plastic limit cannot be determined.

TABLE 10. The ratings for the various uses of soils in highway construction are primarily based on plasticity and gradation. Other characteristics shown, such as hardness when dry, permeability, moisture-holding capacity, and shrink-swell potential, are based on data in table 9 and on field experience.

The shrink-swell potential is the volume change of a soil; that is, the shrinkage of a soil when it dries and the swelling as it takes up moisture. Soils with a high shrink-swell potential are normally undesirable sites for concrete structures.

TABLE 11. The data in table 11 are interpretations based on data in tables 9 and 10.

How the Soils Formed and are Classified

In this section are discussed the five factors of soil formation and the classification of soil series by orders and great soil groups. Included is a table that shows the classification of the soil series by soil orders and great soil groups and gives some of the factors that have influenced soil formation.

Factors of Soil Formation

Soil results from the interaction of five major factors of soil formation. The characteristics of the soil at any given place are determined by (1) the type of parent material; (2) the climate under which the soil material has accumulated and has existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time the forces of soil development have acted on the soil material.

Although in an area as small as Roger Mills County, the range of these factors is relatively narrow, there is enough variation to produce different kinds of soil.

The individual factors of soil formation are discussed separately in the paragraphs that follow. However, it is the interaction of all of these factors that determines the nature of the soil profile.

Parent material

In Roger Mills County, the soils developed from material deposited during three geological ages—the Permian, the Tertiary, and the Quaternary.

The parent material of about two-thirds of the soils in the county was influenced by formations of the Permian age. The oldest exposed formation of this age in the county is the Rush Springs sandstone. It is exposed along Quartermaster Creek. The next oldest member is the Cloud Chief formation, which is in the east-central part of the county. Most recent is the Quartermaster formation, which is primarily on the south side and extends northward and westward, past the central part of the county. The Doxey and Elk City are members of the Quartermaster formation, and the Doxey is the older member.

The Permian formations in the county are mostly silty sandstones. The Doxey is the finest textured. It is composed of stratified fine-grained sandstone and siltstone or coarse-grained shale. The finer textured Vernon and Quinlan soils developed in material derived from this formation, and Woodward soils were influenced by this material.

The Elk City member consists of medium-grained and fine-grained sandstone. The coarser textured Dill and Quinlan soils developed in material derived from this formation, and Woodward soils were influenced by it.

The silty St. Paul, Carey, Woodward, and Quinlan soils developed in material derived mostly from the Rush Springs and Cloud Chief formations.

About a third of the soils in the county are influenced by formations of the Pliocene, Pleistocene, and Recent epochs of the Tertiary and Quaternary ages. Some soils that developed in material derived from these formations are much sandier and are more brown or less red than those that developed in Permian parent material. The more sandy Nobscot, Brownfield, and Pratt soils are examples. Most other soils on the uplands were influenced by Tertiary or Quaternary material. Soils along the South Canadian River were influenced by material blown from the channel of the river, which is dry most of the year.

TABLE 9.—*Engineering test data for*

[Tests performed by Oklahoma Department of Highways in accordance with standard procedures of the American Association

Soil type and location of samples	Parent material	Oklahoma report number	Depth	Horizon	Shrinkage	
					Limit	Ratio
Carey silt loam (samples taken in Beaver Co., Okla.):			*Inches*			
50 ft. S. and 1,050 ft. W. of the NW. cor. of the NW¼ sec. 27, T. 4 N., R. 23 E. (Modal.)	Permian red-bed shale and sandstone.	SO-220	0-7	A_{1p}	19	1. 81
		SO-221	7-14	B_1	16	1. 83
		SO-222	30-49+	C_{ca}	15	1. 90
75 ft. S. and 1,150 ft. W. of the NE. cor. of the NE¼ sec. 36, T. 4 N., R. 23 E. (Clayey subsoil.)	Permian red-bed shale and sandstone.	SO-216	0-7	A_p	17	1. 79
		SO-217	14-21	B_2	15	1. 89
		SO-218	21-39	B_3	13	1. 95
		SO-219	39-54+	C	17	1. 82
Dalhart fine sandy loam (samples taken in Beaver Co., Okla.):						
600 ft. N. and 50 ft. E. of the SW. cor. of the SW¼ sec. 11, T. 5 N., R. 22 E. (Modal.)	Eolian material	SO-234	0-10	A_{1p} and A_1	[4]	[4]
		SO-235	10-18	B_2	17	1. 81
		SO-236	30-43	C_{ca}	15	1. 82
Dill-Quinlan fine sandy loams:						
200 ft. E. of the Beckham Co. line and Okla. Hwy. No. 34 in sec. 13, T. 12 N., R. 21 W. (Dill sample, modal.)	Weakly cemented sandstone	SO-1913	0-9	A_1	19	1. 70
		SO-1914	9-25	B_2	17	1. 78
		SO-1915	25-49	C	18	1. 78
250 yards N. of the center of sec. 13, T. 12 N., R. 21 W. (Quinlan sample, modal.)	Weakly cemented sandstone	SO-1911	0-12	A_1	21	1. 71
		SO-1912	12-24	C	23	1. 61
Enterprise very fine sandy loam (sample taken in Jackson Co., Okla.):						
1,000 ft. N. and 300 ft. E. of the SW. cor. of sec. 16, T. 3 N., R. 21 W. (Modal.)	Wind-blown material	SO-6600	0-11	A_1	19	1. 73
		SO-6601	12-30	AC	20	1. 72
		SO-6602	34-53	C	20	1. 71
Holdredge silt loam:						
¼ mile S. of the NW. cor. of sec. 5, T. 15 N., R. 26 W. (Modal.)	Silty eolian deposits	SO-1895	0-9	A_p and A_1	19	1. 71
		SO-1896	18-38	B_2	16	1. 87
		SO-1897	38-48	C_1	15	1. 86
Miles fine sandy loam:						
NW. cor. of sec. 16, T. 13 N., R. 26 W. (Modal.)	Sandy, calcareous material	SO-1900	0-6	A_{1p}	16	1. 82
		SO-1901	9-36	B_2	15	1. 85
		SO-1902	36-50	C	15	1. 83
Nobscot and Brownfield fine sands:						
100 yards W. and 25 yards S. of the NE. cor. of sec. 36, T. 13 N., R. 26 W. (Brownfield sample, modal.)	Sandy, eolian material	SO-1903	0-18	A_1 and A_2	[4]	[4]
		SO-1904	18-32	B_2	[4]	[4]
		SO-1905	32-46	C	17	1. 75
100 yards N. and 10 yards W. of the SE. cor. of sec. 25, T. 13 N., R. 26 W. (Nobscot sample, modal.)	Sandy, eolian material	SO-1906	0-11	A_1	[4]	[4]
		SO-1907	14-32	B_{22}	[4]	[4]
		SO-1908	32-50	C	[4]	[4]
Port silt loam:						
0.3 mile E. of the SW. cor. of sec. 7, T. 13 N., R. 22 W. (Modal.)	Silty alluvium	SO-1887	0-6	A_{1p}	17	1. 79
		SO-1888	6-14	A_1	18	1. 74
		SO-1889	24-36	C	16	1. 82
Pratt fine sandy loam (samples taken in Beaver Co., Okla.):						
260 ft. N. of the SE. cor. of the SW¼ sec. 16, T. 6 N., R. 22 E. (Modal.)	Sandy eolian material	SO-237	0-6	A_1	[4]	[4]
		SO-238	6-18	C_1	17	1. 77
		SO-239	30-48	C	16	1. 82
300 ft. N. of the SE. cor. of the NW¼ sec. 11, T. 5 N., R. 24 E. (Clayey subsoil.)	Sandy eolian material	SO-252	0-8	A_1	16	1. 82
		SO-253	8-19	B_2	15	1. 84
		SO-254	19-39+	C	16	1. 81

samples taken from 20 soil profiles

of State Highway Officials (AASHO) (*1*). Unless otherwise indicated, these samples were taken in Roger Mills County, Okla.]

Volumetric change from FME	Mechanical analysis [1]							Liquid limit	Plasticity index	Classification	
	Percentage passing sieve—				Percentage smaller than—					AASHO [2]	Unified [3]
	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 60 (0.25 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.005 mm.	0.002 mm.				
Percent											
21	100	99	97	86	75	25	22	31	9	A-4 (8)	ML-CL.
36	100	99	98	90	80	35	30	39	17	A-6 (11)	CL.
27	100	98	95	84	69	41	32	29	12	A-6 (9)	CL.
22	100	99	98	88	75	24	20	31	10	A-4 (8)	ML-CL.
48	100	99	98	96	90	37	34	44	21	A-7-6 (13)	CL.
54	100	99	98	95	90	42	37	46	21	A-7-6 (13)	ML-CL.
37	100	98	97	91	86	47	40	42	19	A-7-6 (12)	CL.
(4)	100	96	70	24	15	7	6	(5)	(5)	A-2-4 (0)	SM.
14	100	98	86	42	35	19	12	27	9	A-4 (1)	SC.
5	100	96	77	34	26	17	13	20	4	A-2-4 (0)	SM-SC.
3	100	98	96	45	28	15	12	22	3	A-4(2)	SM.
14	100	99	98	59	40	21	19	29	8	A-4(5)	ML-CL.
14	100	98	97	53	45	24	20	29	9	A-4(4)	CL.
2	100	99	98	44	31	13	10	23	2	A-4(2)	SM.
4	100	100	100	55	30	15	11	27	3	A-4(4)	ML.
5	100	98	92	59	35	12	9	23	6	A-4(5)	ML-CL.
0.3	100	98	89	35	23	13	11	22	6	A-2-4(0)	SM-SC.
2	100	97	84	28	18	12	10	22	5	A-2-4(0)	SM-SC.
9	100	99	98	87	77	20	18	26	5	A-4(8)	ML-CL.
28	100	99	97	85	75	28	25	33	13	A-6(9)	CL.
16	100	99	97	83	74	24	21	27	9	A-4(8)	CL.
2	100	94	75	34	19	11	9	19	3	A-2-4(0)	SM.
26	100	96	85	63	55	28	23	32	11	A-6(6)	CL.
5	100	89	65	30	20	11	10	18	2	A-2-4(0)	SM.
(4)	100	86	60	14	10	4	3	(5)	(5)	A-2-4(0)	SM.
(4)	100	90	65	23	19	13	11	(5)	(5)	A-2-4(0)	SM.
20	100	91	67	29	27	21	20	30	10	A-2-4(0)	SC.
(4)	100	90	59	9	6	3	2	(5)	(5)	A-3(0)	SP-SM.
(4)	100	91	57	12	11	9	7	(5)	(5)	A-2-4(0)	SP-SM.
(4)	100	93	37	7	6	6	6	(5)	(5)	A-3(0)	SP-SM.
14	100	99	97	92	85	26	16	29	9	A-4(8)	ML.
27	100	99	99	98	94	36	25	38	13	A-6(9)	ML-CL.
31	100	100	100	99	97	45	30	38	14	A-6(10)	ML-CL.
(4)	100	99	92	30	20	7	6	(5)	(5)	A-2-4(0)	SM.
4	100	99	91	30	20	12	11	21	3	A-2-4(0)	SM.
3	100	98	83	26	20	12	11	19	2	A-2-4(0)	SM.
8	100	98	83	40	30	17	14	21	4	A-4(1)	SM-SC.
14	100	99	89	51	39	22	20	27	10	A-4(3)	CL.
4	100	96	75	28	22	16	13	19	3	A-2-4(0)	SM.

TABLE 9.—*Engineering test data for samples*

Soil type and location of samples	Parent material	Oklahoma report number	Depth	Horizon	Shrinkage Limit	Shrinkage Ratio
Pratt loamy fine sand:			*Inches*			
150 yards W. of the S¼ cor. of sec. 2, T. 15 N., R. 24 W. (Modal.)	Eolian sands	SO-1892	0-10	A_{1p} and A_1	(4)	(4)
		SO-1893	10-20	B_2	20	1.75
		SO-1894	20-40	C	(4)	(4)
Vernon-Quinlan complex:						
220 yards S. and 100 yards E. of the W¼ cor. of sec. 22, T. 14 N., R. 22 W. (Quinlan sample, modal.)	Fine-grained sandstone	SO-1885	0-5	A_1	22	1.68
		SO-1886	5-20+	C	22	1.66
500 yards S. of the NE. cor. of sec. 24, T. 13 N., R. 21 W. (Vernon sample, modal.)	Claystone	SO-1909	0-4	A_1	20	1.75
		SO-1910	4-16	C	19	1.74
Woodward loam:						
200 yards W. of the NE. cor of sec. 29, T. 16 N., R. 21 W. (Modal.)	Weakly cemented sandstone	SO-1916	0-25	A and AC	20	1.65
		SO-1917	25-42	C	(4)	(4)
10 yards S. and 200 yards W. of the NE. cor. of sec. 29, T. 16 N., R. 21 W. (Shallow phase.)	Weakly cemented sandstone	SO-1918	0-15	A	19	1.67
		SO-1919	19-32	C	22	1.61
50 yards SW. of the NE. cor. of sec. 12, T.14 N., R. 24 W. (Deep phase.)	Fine-grained standsone with thin lenses of shale.	SO-1890	0-12	A_{1p} and A_1	18	1.78
		SO-1891	16-30	C	26	1.81
Zavala fine sandy loam:						
300 yards W. and 15 yards N. of the SE. cor. of sec. 9, T. 13 N., R. 26 W. (Modal.)	Sandy recent alluvium	SO-1898	0-18	A_1	(4)	(4)
		SO-1899	18-36	AC	18	1.77

[1] Mechanical analyses according to the AASHO Designation: T 88 (*1*). Results by this procedure frequently differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO 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 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters 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.

taken from 20 soil profiles—Continued

Volumetric change from FME	Mechanical analysis [1]							Liquid limit	Plasticity index	Classification	
	Percentage passing sieve—				Percentage smaller than—						
	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 60 (0.25 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.005 mm.	0.002 mm.			AASHO [2]	Unified [3]
Percent											
(4)	100	92	73	25	28	10	9	(5)	(5)	A-2-4(0)	SM.
3	100	96	86	40	24	12	10	23	3	A-4(1)	SM.
(4)	100	98	92	35	18	10	9	(5)	(5)	A-2-4(0)	SM.
8	100	99	98	92	84	25	16	30	6	A-4(8)	ML-CL.
19	100	96	95	90	83	24	16	37	11	A-6(8)	ML-CL.
13	100	99	99	96	90	24	17	31	8	A-4(8)	ML-CL.
19	100	98	98	97	95	33	20	35	11	A-6(8)	ML-CL.
5	100	100	99	77	44	13	9	25	3	A-4(8)	ML.
(4)	100	100	99	77	32	11	9	(5)	(5)	A-4(8)	ML.
9	100	100	99	80	50	13	9	26	3	A-4(8)	ML.
6	100	99	99	75	65	13	9	27	2	A-4(8)	ML.
11	100	100	99	94	80	22	16	26	6	A-4(8)	ML-CL.
17	100	100	99	98	94	42	27	40	16	A-6(10)	ML-CL.
(4)	100	97	76	15	11	6	5	(5)	(5)	A-2-4(0)	SM.
1	100	96	81	32	18	9	8	20	2	A-2-4(0)	SM.

[2] Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1, Ed. 7): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHO Designation: M 145-49 (*1*).

[3] Based on the Unified Soil Classification System, Tech. Memo. 3-357, v. 1, Waterways Experiment Station, Corps of Engineers. March 1953 (*9*).

[4] Insignificant.

[5] Nonplastic.

TABLE 10.—*Highway engineering interpretations of several soils*

[Based on Soils Manual, 1959, Oklahoma Highway Department, Research Section]

Soil type	Horizon	Suitability for highway construction: Subgrade	Shoulders	Erosion control	Seeding, sodding	Soil binder	Stabilization	Hardness when dry	Permeability [1]	Moisture-holding capacity	Shrink-swell potential
Carey silt loam	A_{1p}	Poor	Poor	Poor	Fair	No	No	Hard	Moderate	Medium	Medium.
	B_1	Poor	Poor	Poor	Fair	No	No	Hard	Moderate	Medium	High.
	C_{ca}	Poor	Poor	Poor	Fair	No	No	Hard	Moderate	Medium	Medium.
Dalhart fine sandy loam	A_{1p}–A_1	Poor	Poor	Poor	Poor	No	Yes	Soft	Moderately rapid.	Low	Low.
	B_2	Poor	Fair	Poor	Good	No	Yes	Hard	Moderate	Medium	Low.
	C_{ca}	Poor	Fair	Poor	Fair	No	Yes	Soft	Moderately rapid.	Low	Low.
Dill-Quinlan fine sandy loams:											
Dill	A_1	Poor	Fair	Poor	Fair	No	Yes	Soft	Moderately rapid.	Medium	Low.
	B_2	Poor	Poor	Poor	Fair	No	No	Hard	Moderate	Medium	Low.
	C	Poor	Poor	Poor	Fair	No	No	Soft	Moderately rapid.	Medium	Low.
Quinlan	A_1	Poor	Poor	Poor	Fair	No	Yes	Hard	Moderate	Medium	Low.
	C	Poor	Poor	Poor	Fair	No	No	Hard	Moderate	Medium	Low.
Enterprise very fine sandy loam.	A_1	Poor	Poor	Poor	Fair	No	No	Soft	Moderately rapid.	Medium	Low.
	A_c	Fair	Fair	Poor	Good	No	Yes	Soft	Moderately rapid.	Medium	Low.
	C	Fair	Fair	Poor	Fair	No	Yes	Soft	Moderately rapid.	Medium	Low.
Holdrege silt loam	A_p-A_1	Poor	Poor	Poor	Fair	No	No	Hard	Moderate	Medium	Low.
	B_2	Poor	Poor	Poor	Fair	No	No	Very hard.	Slow	High	Medium.
	C_1	Poor	Poor	Poor	Fair	No	No	Hard	Slow	High	Medium.
Miles fine sandy loam	A_{1p}	Fair	Fair	Poor	Fair	No	Yes	Soft	Moderately rapid.	Low	Low.
	B_2	Poor	Poor	Poor	Fair	No	No	Hard	Moderate	Medium	Medium.
	C	Fair	Poor	Poor	Fair	No	Yes	Soft	Moderately rapid.	Low	Low.
Nobscot and Brownfield fine sands:											
Brownfield	A_1-A_2	Poor	Poor	Poor	Poor	No	No	Soft	Rapid	Low	Low.
	B_2	Poor	Poor	Poor	Poor	No	Yes	Very hard.	Moderate	Low	Low.
	C	Fair	Fair	Poor	Good	Yes	Yes	Soft	Rapid	Medium	Medium.
Nobscot	A_1	Poor	Poor	Poor	Poor	No	No	Soft	Rapid	Low	Low.
	B_2	Poor	Poor	Poor	Poor	No	No	Hard	Moderately rapid.	Low	Low.
	C	Poor	Poor	Poor	Poor	No	No	Soft	Rapid	Low	Low.

Port silt loam	A_{1p}	Poor	Poor	Fair	Poor	No	No	Hard	Moderate	Medium	Low.
	A_1	Poor	Poor	Fair	Poor	No	No	Hard	Moderate	Medium	Medium.
	C	Poor	Poor	Fair	Poor	No	No	Hard	Moderate	Medium	Medium.
Pratt fine sandy loam	A_1	Poor	Poor	Poor	Poor	No	Yes	Soft	Moderately rapid.	Low	Low.
	C_1	Fair	Fair	Poor	Fair	No	Yes	Soft	Moderately rapid.	Medium	Low.
	C	Fair	Poor	Poor	Fair	No	Yes	Soft	Moderately rapid.	Low	Low.
Pratt loamy fine sand	A_{1p}–A_1	Poor	Poor	Poor	Poor	No	Yes	Soft	Rapid	Low	Low.
	B_2	Poor	Fair	Poor	Fair	No	Yes	Soft	Rapid	Medium	Low.
	C	Poor	Poor	Poor	Poor	No	Yes	Soft	Rapid	Low	Low.
Vernon-Quinlan complex:											
Quinlan	A_1	Poor	Poor	Poor	Poor	No	No	Hard	Moderate	Medium	Low.
	C	Poor	Poor	Poor	Poor	No	No	Hard	Moderate	Medium	Medium.
Vernon	A_1	Poor	Poor	Poor	Poor	No	No	Hard	Moderate	Medium	Low.
	C	Poor	Poor	Poor	Poor	No	No	Very hard.	Slow	Medium	Medium.
Woodward loam	A–AC	Poor	Poor	Poor	Fair	No	No	Hard	Moderate	Medium	Low.
	C	Poor	Poor	Poor	Poor	No	No	Hard	Moderate	Low	Low.
Zavala fine sandy loam	A_1	Fair	Poor	Poor	Poor	No	Yes	Soft	Moderately rapid.	Low	Low.
	AC	Fair	Poor	Poor	Fair	No	Yes	Soft	Moderately rapid.	Low	Low.

[1] Of the undisturbed soil.

TABLE 11.—*Conservation engineering properties*

Map symbol	Soil	Soil features affecting use for— Farm ponds: Reservoir areas [1]	Soil features affecting use for— Farm ponds: Embankments
Br	Brazos loamy fine sand	High seepage	Fair stability; high seepage
CaB, CaC	Carey silt loam	Low seepage	Good stability; low seepage
DaB, DaC, DaD	Dalhart fine sandy loam	Moderate seepage	Fair stability; moderate seepage
DfB DfC	Dill-Quinlan fine sandy loams	Moderate seepage	Fair stability; moderate seepage
EnA, EnB, EnC, EnD	Enterprise very fine sandy loam	Moderate seepage	Fair stability; moderate seepage
Er	Eroded sandy land	High seepage	Fair stability; high seepage
HoA, HoB	Holdrege silt loam	Low seepage	Good stability; low seepage
KeA	Kenesaw silt loam	Low seepage	Good stability; low seepage
Ln	Lincoln soils	Not suitable	Not suitable
Ma3	Mansker complex, severely eroded	Low seepage	Good stability; low seepage
MbC	Mansker loam	Low seepage	Good stability; low seepage
Mc	Mansker-Potter complex	Moderate seepage	Fair stability; moderate seepage
MfA, MfB, MfC, MfD	Miles fine sandy loam	Moderate seepage	Fair stability; moderate seepage
MmB	Miles-Dill loamy fine sands	High seepage	Fair stability; high seepage
MnD, MnE	Miles-Nobscot complex	Moderate seepage	Fair stability; moderate seepage
MxC	Miles-Springer complex	Moderate seepage	Fair stability; moderate seepage
NaB	Nobscot fine sand	High seepage	Fair stability; high seepage
NbB, NbC	Nobscot and Brownfield fine sands	High seepage	Fair stability; high seepage
Nc2	Nobscot and Brownfield soils, eroded	High seepage	Fair stability; high seepage
No	Norwood silt loam	Low seepage	Fair stability; moderate seepage
PcE	Pratt complex, hilly	Moderate seepage	Fair stability; moderate seepage
PfB, PfD, PfE	Pratt loamy fine sand	High seepage	Fair stability; high seepage
PsA, PsB, PsC, PsD	Pratt fine sandy loam	Moderate seepage	Fair stability; high seepage
Qu3	Quinlan soils, severely eroded	Moderate seepage	Not suitable
QwC2, QwE	Quinlan-Woodward loams	Moderate seepage	Fair stability; moderage seepage
Ra	Reinach fine sandy loam	Moderate seepage	Fair stability; moderate seepage
Rb	Rough broken land	Not suitable	Not suitable
SaA, SaB, SaC2	St. Paul silt loam	Low seepage	Good stability; low seepage
SfC, SfE	Springer loamy fine sand	High seepage	Fair stability; high seepage
SpA, SpB	Spur and Port silt loams	Low seepage	Fair stability; low seepage
Sw	Sweetwater soils	Not suitable	Not suitable
Vc	Vernon-Quinlan complex	Moderate seepage	Fair stability; low seepage
Wa	Wann soils	Not suitable	Not suitable
WdB, WdC	Woodward fine sandy loam	Moderate seepage	Fair stability; moderate seepage
WoB, WoC, WoD	Woodward loam	Low seepage	Good stability; low seepage
WsB, WsC	Woodward-Quinlan fine sandy loams	Moderate seepage	Fair stability; moderate seepage
WwB, WwC	Woodward-Quinlan loams	Low seepage	Good stability; low seepage
Ya	Yahola fine sandy loam	Not suitable	Not suitable
Za	Zavala fine sandy loam	Not suitable	Not suitable

[1] Includes dug ponds.

of soils in Roger Mills County, Okla.

Soil features affecting use for—Continued			Suitable methods of irrigation
Field terraces and diversion terraces	Waterways: Resistance to erosion	Waterways: Potential for vegetation	
Not suitable	Poor	Good	Sprinkler.
Good stability	Good	Good	Flood, furrow, and sprinkler.
Fair stability; wind erosion hazard	Fair	Fair	Flood, furrow, and sprinkler.
Fair stability; wind erosion hazard	Fair	Good	Furrow and sprinkler.
Fair stability	Poor	Good	Flood, furrow, and sprinkler.
Not suitable	Poor	Poor	Soil not suitable for irrigation.
Good stability	Good	Good	Flood, furrow, and sprinkler.
Good stability	Fair	Good	Flood, furrow, and sprinkler.
Not suitable	Not suitable	Not suitable	Soil not suitable for irrigation.
Not suitable	Poor	Poor	Soil not suitable for irrigation.
Good stability	Fair	Fair	Soil not suitable for irrigation.
Not suitable	Poor	Poor	Soil not suitable for irrigation.
Fair stability; wind erosion hazard	Fair	Fair	Flood, furrow, and sprinkler.
Not suitable	Poor	Good	Sprinkler.
Not suitable	Poor	Poor	Soil not suitable for irrigation.
Not suitable	Poor	Poor	Soil not suitable for irrigation.
Not suitable	Poor	Poor	Soil not suitable for irrigation.
Not suitable	Poor	Poor	Soil not suitable for irrigation.
Not suitable	Poor	Poor	Soil not suitable for irrigation.
Good stability	Good	Good	Flood, furrow, and sprinkler.
Fair stability for diversion terraces; not suitable for field terraces.	Poor	Good	Soil not suitable for irrigation.
Not suitable	Poor	Fair	Soil not suitable for irrigation.
Not suitable	Poor	Good	Flood, furrow, and sprinkler.
Fair stability for diversion terraces; not suitable for field terraces.	Fair	Poor	Soil not suitable for irrigation.
Fair stability	Fair	Good	Furrow and sprinkler.
Fair stability for diversion terraces; not suitable for field terraces.	Poor	Good	Sprinkler.
Not suitable	Not suitable	Not suitable	Soil not suitable for irrigation.
Good stability	Good	Good	Flood, furrow, and sprinkler.
Not suitable	Poor	Fair	Soil not suitable for irrigation.
Good stability	Good	Good	Flood, furrow, and sprinkler.
Not suitable	Not suitable	Not suitable	Soil not suitable for irrigation.
Good stability for diversion terraces; not suitable for field terraces.	Good	Fair	Soil not suitable for irrigation.
Not suitable	Fair	Good	Soil not suitable for irrigation.
Fair stability; wind erosion hazard	Fair	Good	Furrow and sprinkler.
Good stability	Good	Good	Furrow and sprinkler.
Fair stability; wind erosion hazard	Fair	Good	Furrow and sprinkler.
Good stability	Good	Good	Furrow and sprinkler.
Not suitable	Fair	Good	Sprinkler.
Not suitable	Fair	Good	Sprinkler.

Climate

Roger Mills County has a subhumid, temperate, continental climate. Summers are hot, and winters are mild, but severe cold spells sometimes occur. Rainfall is sporadic. It is often of high intensity; consequently, much of the water is lost through runoff.

Moisture moving through the soils speeds up the soil-forming process. The accumulation of organic matter and the leaching of minerals, including the translocation of silicate clay, are more rapid in soils on which moisture collects than in steeper soils that have rapid runoff. For example, the mature St. Paul soils have had lime leached from the surface layer and have an accumulation of clay in the subsoil. The youthful Quinlan soils are calcareous in the surface layer and have no accumulation of clay in the subsoil.

Strong winds and high temperatures in the county cause much of the moisture in the soils to evaporate and thereby retard soil development. Soils having southwesterly exposures are most affected.

Plant and animal life

Plants and animals living on or in the soil are active in the soil-forming processes. Living organisms affect the chemistry of the soil and hasten soil development. They help to decompose plant residues and to convert plant nutrients to a form that is more readily available to higher plants.

Vegetation provides shade and reduces the loss of water from runoff, wind, and heat. It adds organic matter to the soil and thereby influences its structure and physical condition. Plant roots help to keep the soil supplied with minerals by bringing elements from the parent material to the surface in a form more usable to plants.

The two principal types of vegetation in the county are the tall and mid grasses and the shin oak (fig. 18). The fibrous roots of the grasses are near the surface and help to restrict the deep leaching of minerals. The roots of the shin oak go deep into the soil and have little effect on leaching.

Oak leaves have an acid reaction. Therefore, soils that developed under shin oak have characteristics of timbered soils in areas of much higher rainfall. An example of this is Brownfield fine sand, which has a highly leached zone above the subsoil. The acid reaction of the oak leaves has helped to neutralize the lime in the surface layer, and thereby has caused more rapid leaching of minerals and the movement of clay by the deflocculation of clay particles. Pratt loamy fine sand, which developed from similar parent material, has been less subject to leaching and movement of clay because it has had a grass cover.

Many soils in the county show the influence of burrowing animals and insects in the form of casts, holes, and dark-colored streaks in the upper horizons. These are very apparent in Woodward and Carey soils.

Relief

Relief, or the elevations or inequalities of the land surface, considered collectively, influences the soil-forming processes by its effect on runoff and drainage. Moisture must move through the soil to have much effect on profile development. Strongly sloping soils, such as the Quinlan soils, absorb little moisture because of rapid runoff. Their development is further retarded by the continued loss of soil material through erosion.

Figure 18.—Typical vegetative cover in Roger Mills County.

In Roger Mills County, the relief ranges from level to steep. In places, such as in areas of Brownfield and Pratt soils, there is no defined surface-drainage pattern. Here, the soils absorb much of the water that falls, and there is likely to be little erosion. In Rough broken land, the landscape is dissected by deep canyons. In these areas, runoff is rapid and soil materials do not remain in place long enough for horizons to form.

Time

The length of time required for a soil to develop depends on the combined action of the soil-forming factors. If the factors of soil formation have not operated long enough to allow formation of definite horizons, the soil is considered young, or immature. 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.

Few soils in Roger Mills County are mature. There is a possible span of at least 200 million years since the parent rocks were deposited. For the greater part of that time, the Permian rocks from which the Quinlan soils developed probably had an overwash mantle that had to be removed by erosion before the rocks were exposed to soil-forming processes. Consequently, these rocks have been exposed to soil development for a much shorter period than the other parent rocks in the county. Since the Brownfield soils are the most mature soils in the county on the basis of profile development, we find that the oldest soils in the county are on the younger geologic material.

The leaching of carbonates is one of the first indications of soil development. Woodward and Enterprise soils, for example, are calcareous at the surface and are considered young soils. Most soils in the county have a carbonate concentration in the profile at about the depth of the normal penetration of moisture.

Classification of Soils by Higher Categories

Soils are placed in narrow classes for the organization and application of knowledge about their behavior within farms, ranges, or counties. They are placed in broader, more inclusive categories for study and comparison of several counties or larger areas. The lower categories of classification, the soil series, type, and phase, are discussed briefly in the section "How Soils are Named, Mapped, and Classified," and they are defined in the Glossary. Discussed here are the commonly used higher categories, the soil orders and great soil groups, and the placement of the soil series in these categories.

The highest categories of classification are the zonal, intrazonal, and azonal orders. Table 12 shows the classification of the soil series in Roger Mills County by order and by great soil groups and lists some of the factors that have influenced the formation of the soils.

Zonal soils

Zonal soils have well-developed characteristics that reflect the influence of the active factors of soil formation—climate and living organisms, chiefly vegetation. The zonal order is represented in Roger Mills County by the Reddish Chestnut, Chestnut, Reddish-Brown, and Chernozem great soil groups.

REDDISH CHESTNUT SOILS

Reddish Chestnut soils develop under grass in a warm-temperate to hot, semiarid to subhumid climate. The horizons are reddish brown in color, have gradual boundaries, and become lighter colored with depth. Normally, there is a layer of accumulated calcium carbonate at a depth of 2 feet or more. The Reddish Chestnut soils in Roger Mills County, however, receive more rainfall than most; consequently, calcium carbonate is leached to a greater depth than is typical of most Reddish Chestnut soils, and the calcareous layer is weaker than normal or is lacking entirely.

The Reddish Chestnut soils are represented in the county by the Carey, Dill, and Miles series.

The Carey series consists of deep, well-drained, moderately developed, reddish-brown soils that formed in calcareous material weathered from silty red beds. These silty soils are on nearly level to gently sloping uplands. They are associated with St. Paul and Woodward soils. They are lighter colored in the A horizon than St. Paul soils and are less clayey in the B horizon. Woodward soils lack a B horizon and are calcareous.

Carey soils are of minor extent in the county but occur throughout the red-bed areas.

Typical profile of Carey silt loam, in a cultivated field, 1,200 feet south of the NE. corner of sec. 14, T. 14 N., R. 21 W.:

A_{1p} 0 to 6 inches, reddish-brown or dark reddish-brown (5YR 4/4 dry; 3/4 moist) silt loam; weak, medium, granular structure; friable when moist; noncalcareous; pH 7.4; plowed boundary.

A_1 6 to 9 inches, reddish-brown or dark reddish-brown (5YR 4/3 dry; 3/3 moist) silt loam; moderate, medium, granular structure; friable when moist; noncalcareous; pH 7.4; gradual boundary.

B_2 9 to 30 inches, reddish-brown or dark reddish-brown (2.5YR 4/4 dry; 3/4 moist) silt loam; moderate, medium and fine, granular structure; friable when moist; noncalcareous; pH 7.8; gradual boundary.

C_{ca} 30 to 44 inches, red or dark-red (2.5YR 4/6 dry; 3/6 moist) loam; about 5 percent $CaCO_3$ concretions; strongly calcareous; hard when dry; pH 8.3; structureless.

D_r 44 inches +, slightly weathered silty red-bed material.

The A horizon ranges from fine sandy loam to heavy silt loam in texture, and from brown (7.5YR 5/2) to dark reddish brown (5YR ¾) in color when dry. The B_2 horizon ranges from heavy loam to light silty clay loam in texture and from reddish brown (5YR 4/3) to yellowish red (5YR 4/6) in color when dry. The depth to the calcareous C horizon ranges from 20 to 36 inches. The depth to the red beds ranges from 30 to 60 inches.

The Dill series consists of reddish, noncalcareous, sandy soils that formed in material weathered from the soft Elk City sandstone or packsand of the Quartermaster formation of the Permian Red Beds. These soils formed under a cover of tall grasses. They have a weak, but normally distinct, B_2 horizon.

Dill soils are more red than Miles soils, have a less strongly developed B_2 horizon, and are alkaline in reaction. Pratt soils are brown and have a less distinct B_2 horizon. Springer soils are more sandy, less red, and slightly acid.

Typical profile of Dill sandy loam, 200 feet east of the SW. corner of the SE¼ sec. 13, T. 12 N., R. 21 W.:

A_1 0 to 9 inches, weak-red or dusky-red (10R 4/4 dry; 3/4 moist) fine sandy loam; weak, fine, granular structure; very friable when moist, soft when dry; noncalcareous; pH 8.0; gradual boundary.

B_2 9 to 25 inches, red or dark-red (10R 4/6 dry; 3/6 moist) fine sandy loam; compound structure—weak coarse prismatic, and weak fine granular; few worm casts; porous; friable when moist, slightly hard when dry; noncalcareous; pH 7.8; gradual boundary.

C 25 to 49 inches, red (10R 5/6 dry; 4/6 moist) fine sandy loam; weak, fine, granular structure; few worm casts; porous; friable when moist, slightly hard when dry; pH 7.5; noncalcareous.

D_r 49 inches +, red (2.5YR 5/6 dry; 4/6 moist), soft, fine-grained sandstone; pH 7.3; noncalcareous.

The A_1 horizon ranges from fine sandy loam to loamy fine sand in texture and from weak red to reddish brown (hues 10R and 2.5YR) in color; the loamy fine sand is browner. The B_2 horizon ranges from heavy fine sandy loam to light loam in texture. The depth to the D_r horizon ranges from 20 to 50 inches or more.

The Miles series consists of brownish, strongly developed, sandy soils that formed in sediments from plains outwash, probably of Pliocene origin. These soils developed under a cover of tall grasses and some shin oak and sand sagebrush. They occur on nearly level to steep uplands, generally near exposures of the Permian Red Beds. They are slightly acid and have a subsoil of sandy clay loam.

These soils are associated with Nobscot, Brownfield, Springer, Dalhart, and Dill soils. They have a less sandy, more shallow A horizon than Nobscot and Brownfield soils, and they lack an A_2 horizon. They have a more strongly developed, more clayey B_2 horizon than Springer soils. They have a reddish B_2 horizon that is more clayey than that of Dalhart soils, and they are more acid than Dalhart soils. They have a more clayey B_2 horizon than Dill soils, and they are less red and more acid.

TABLE 12.—*Classification of soil series according to soil orders and great soil groups, and some characteristics that affect morphology*

ZONAL ORDER

Great soil group and series	Relief	Parent material	Profile development	Native vegetation
Reddish Chestnut:				
Carey	Gently sloping to sloping	Calcareous Permian sandstone.	Medium	Tall and mid grasses.
Dill	Gently sloping to strongly sloping.	Sandy, noncalcareous, weakly consolidated Permian sandstone.	Weak	Tall and mid grasses.
Miles	Nearly level to hilly	Sandy Tertiary outwash	Medium	Tall and mid grasses; scattered shin oak.
Chestnut:				
Dalhart	Nearly level to strongly sloping.	Sandy Tertiary outwash or eolian material.	Medium	Tall and mid grasses.
Pratt	Nearly level to duny	Sandy, eolian Tertiary or Quaternary material.	Weak	Tall and mid grasses and sand sagebrush.
St. Paul	Nearly level to sloping	Calcareous Permian sandstone, generally influenced by silty deposits.	Strong	Tall and mid grasses.
Reddish Brown:				
Springer	Gently sloping to hilly	Sandy Tertiary outwash	Weak	Tall and mid grasses; scattered shin oak.
Nobscot	Gently sloping to steep	Sandy, wind-worked Tertiary outwash.	Weak	Shin oak and tall grasses.
Brownfield	Nearly level to steep	Sandy, wind-worked Tertiary outwash.	Strong	Shin oak and tall grasses.
Chernozem:				
Holdrege	Nearly level to gently sloping	Silty, eolian Tertiary and Quaternary material.	Medium	Tall and mid grasses.
Kenesaw	Nearly level to gently sloping	Silty, eolian Quaternary material.	Weak	Tall and mid grasses.

INTRAZONAL ORDER

Great soil group and series	Relief	Parent material	Profile development	Native vegetation
Calcisol:				
Mansker	Gently sloping to steep	Loamy, calcareous Tertiary outwash.	Weak	Mid and short grasses.

AZONAL ORDER

Great soil group and series	Relief	Parent material	Profile development	Native vegetation
Alluvial:				
Brazos	Nearly level	Sandy alluvium	Weak	Tall and mid grasses.
Lincoln	Nearly level	Sandy, recent alluvium	Weak	Tall grasses and bottomland hardwoods.
Norwood	Nearly level	Silty, calcareous, recent alluvium.	Weak	Tall grasses and bottomland hardwoods.
Port	Nearly level to gently sloping	Silty alluvium	Weak	Tall grasses.
Reinach	Nearly level to gently sloping	Loamy to sandy alluvium	Weak	Tall grasses.
Spur	Nearly level to gently sloping	Silty, calcareous alluvium	Weak	Tall grasses.
Sweetwater	Nearly level	Silty and sandy, recent alluvium.	Week	Tall grasses and wet-land vegetation.
Wann	Nearly level	Sandy and loamy, recent alluvium.	Weak	Tall grasses and bottomland hardwoods.
Yahola	Nearly level	Sandy and loamy, calcareous, recent alluvium.	Weak	Tall grasses and bottomland hardwoods.
Zavala	Nearly level	Sandy, recent alluvium	Weak	Tall grasses and bottomland hardwoods.

AZONAL ORDER—Continued

Great soil group and series	Relief	Parent material	Profile development	Native vegetation
Regosol:				
Quinlan	Gently sloping	Very soft, calcareous Permian sandstone.	Weak	Mid and tall grasses.
Regosol intergrading to Chestnut:				
Enterprise	Gently sloping to steep	Silty, calcareous, eolian Quaternary (Recent) material.	Weak	Tall grasses and sand sagebrush.
Woodward	Gently sloping to steep	Calcareous Permian sandstone	Weak	Tall and mid grasses.
Lithosol:				
Potter	Strongly sloping to steep	Tertiary caliche beds	Weak	Mid and short grasses.
Vernon	Gently sloping to steep	Calcareous Permian claystone or siltstone.	Weak	Short and mid grasses.

Typical profile of Miles fine sandy loam, in a cultivated field, 1/4 mile north and 100 yards west of the SE. corner of sec. 8, T. 12 N., R. 25 W.:

A_1 0 to 6 inches, reddish-brown (5YR 5/3 dry; 4/3 moist) fine sandy loam; weak, fine, granular structure; friable when moist, slightly hard when dry; noncalcareous; pH 6.8; clear boundary.

B_1 6 to 12 inches, reddish-brown or dark reddish-brown (5YR 4/3 dry; 3/3 moist) sandy clay loam; moderate to strong, coarse, subangular blocky structure; firm when moist, very hard when dry; discontinuous clay films; noncalcareous; pH 6.5; gradual boundary.

B_2 12 to 32 inches, yellowish-red (5YR 5/6 dry; 4/6 moist) sandy clay loam; moderate, coarse, blocky structure; nearly continuous clay films; firm when moist, very hard when dry; noncalcareous; pH 6.5; gradual boundary.

C_1 32 to 40 inches, yellowish-red (5YR 5/8 dry; 4/8 moist) sandy clay loam or fine sandy loam; massive; porous; firm when moist, hard when dry; pH 7.0; noncalcareous.

In color, the A_1 horizon ranges from reddish brown to brown and the B horizon from reddish brown to yellowish red. The surface layer is 6 to 14 inches thick. The subsoil ranges from sandy clay loam to heavy fine sandy loam. Miles loamy fine sands and the steeper phases of Miles fine sandy loams have a less clayey subsoil. Most of these soils contain many waterworn pebbles.

CHESTNUT SOILS

Chestnut soils develop under mid and tall grasses in a temperate, semiarid climate. They have a dark-brown or dark grayish-brown surface layer and lighter colored horizons below. Normally, there is a white, calcareous layer at a depth of 2 feet or less, but in the Chestnut soils in Roger Mills County, the calcareous layer is at a greater depth and is much less pronounced. The Dalhart, Pratt, and St. Paul series represent the Chestnut soils in this county.

The Dalhart series consists of normally developed, brownish, sandy soils that formed under a cover of tall grasses in sandy plains outwash, probably of Pliocene origin.

These soils are associated mainly with Holdrege, Pratt, Enterprise, and Springer soils. They are more sandy throughout than Holdredge soils, and they have a more strongly developed B_2 horizon than Pratt, Enterprise, and Springer soils. In Enterprise soils, the calcareous layer is nearer the surface. In Springer soils, the B_2 horizon is reddish.

Dalhart soils are at the higher elevations in the northwestern part of the county. They are not extensive but are important where they occur. Most of the more gently sloping areas are cultivated.

Typical profile of Dalhart fine sandy loam, 100 yards north of the NE. corner of the SE1/4 sec. 18, T. 16 N., R. 25 W.:

A_1 0 to 8 inches, dark-brown (7.5YR 4/2 dry; 3/2 moist) fine sandy loam; moderate, medium, granular structure; friable when moist, slightly hard when dry; noncalcareous; pH 7.5; gradual boundary.

B_2 8 to 32 inches, dark-brown (10YR 4/3 dry; 3/3 moist) sandy clay loam; compound structure—moderate medium granular, and weak coarse prismatic; discontinuous clay films; friable when moist, hard when dry; noncalcareous; pH 7.5; gradual boundary.

C 32 to 48 inches, brown or dark-brown (10YR 5/3 dry; 4/3 moist) light sandy clay loam; moderate, fine, granular structure; friable when moist, hard when dry; calcareous.

In color, the A horizon is brown or grayish brown (hues 10YR or 7.5YR). It is 6 to 14 inches thick. The B_2 horizon ranges from sandy clay loam to heavy fine sandy loam in texture. The depth to the calcareous horizon ranges from 30 to 50 inches. Buried horizons of clay loam or silty clay are not uncommon.

The Pratt series consists of weakly developed, brownish soils that formed in wind-worked, alkaline, sandy Tertiary or Quaternary material, under a cover of tall grasses and sand sage. These soils have slightly more clay in the

B horizon than in the A horizon. They are associated with Enterprise, Dalhart, Holdrege, Springer, and Nobscot soils. They are more sandy and less calcareous than Enterprise soils. They have less profile development than Dalhart and Holdrege soils and are more sandy than Holdrege soils. They are less acid in reaction than Springer and Nobscot soils, and their subsoil is brown instead of reddish.

Pratt soils are nearly level to hilly. They occur mostly in the northern and western parts of the county, within a few miles of the South Canadian and Washita Rivers.

Typical profile of Pratt loamy fine sand, 150 feet northeast of the intersection of U.S. Highway No. 283 and Oklahoma Highway No. 33; or 450 feet west of the SE. corner of the SW¼ sec. 2, T. 15 N., R. 24 W.:

A 0 to 10 inches, dark-brown (10YR 4/3 dry; 3/3 moist) loamy fine sand; structureless; very friable when moist, loose when dry; noncalcareous; pH 7.2; gradual boundary.

B_2 10 to 20 inches, brown or dark-brown (10YR 5/3 dry; 4/3 moist) heavy loamy fine sand; structureless; very friable when moist, loose when dry; noncalcareous; pH 6.8; gradual boundary.

C 20 to 60 inches, light yellowish-brown or yellowish-brown (10YR 6/4 dry; 5/4 moist) loamy fine sand; structureless; very friable when moist, loose when dry; noncalcareous; pH 7.6.

The A horizon is 8 to 16 inches thick. The B horizon is loamy sand to sandy loam and contains more clay than the A horizon.

The St. Paul series consists of well-developed, dark reddish-brown soils that formed under a cover of mid and tall grasses in calcareous material weathered from silty red beds or from the mantle directly over the red beds.

These soils are on nearly level to moderately sloping uplands. They are associated with Carey soils. They have a darker colored surface layer than Carey soils, and they have more clay in the B horizon and are leached to a greater depth. Woodward soils are more reddish in color and do not have an accumulation of clay in the underlying layer. Holdrege soils are brownish in color and have less clay in the B horizon than St. Paul soils.

Typical profile of St. Paul silt loam, in a cultivated field, 1,320 feet north and 400 feet east of the SW. corner of sec. 14, T. 15 N., R. 21 W.:

A 0 to 12 inches, dark reddish-gray or dark reddish-brown (5YR 4/2 dry; 3/2 moist) silt loam; moderate, fine and medium, granular structure; friable when moist, slightly hard when dry; noncalcareous; pH 6.8; gradual boundary.

B_2 12 to 32 inches, reddish-brown or dark reddish-brown (5YR 4/3 dry; 3/3 moist) clay loam; weak, medium, blocky structure; thin, nearly continuous clay films; few fine pores and rootlets penetrating ped faces; firm when moist, hard when dry; noncalcareous; pH 7.2; clear boundary.

B_3 32 to 42 inches, reddish-brown or dark reddish-brown (5YR 4/4 dry; 3/4 moist) clay loam that contains slightly less clay than B_2 horizon; moderate, fine and medium, subangular blocky structure; patchy clay films; firm when moist, hard when dry; slightly calcareous; few small $CaCO_3$ concretions in lower part; pH 7.6; clear boundary.

C 42 to 54 inches, reddish-brown or dark reddish-brown (2.5YR 4/4 dry; 3/4 moist) silt loam or light silty clay loam; friable when moist, slightly hard when dry; calcareous; some worm casts; porous; pH 8.0.

The surface layer ranges from silty clay loam to silt loam or loam. The subsoil ranges from clay loam to silty clay loam. The depth to the calcareous zone is 30 to 45 inches. In some places, the profile is nearly free of sand. In others, it contains an appreciable amount of sand and waterworn pebbles.

REDDISH-BROWN SOILS

Reddish-Brown soils develop in a warm-temperate, semiarid or subhumid climate under a cover of grasses and shrubs. Normally, the profile includes a whitish or pinkish horizon of lime accumulation. In Roger Mills County, this great soil group is represented by the Springer, Nobscot, and Brownfield series. In all of these, the calcareous zone is at a greater depth than in the typical Reddish-Brown soils.

The Springer series is made up of weakly developed sandy soils that formed in sandy outwash material of the Pliocene or Pleistocene epochs. The native vegetation consists of tall grasses and some shin oak and sand sagebrush.

These soils are on gently sloping to hilly uplands. They are associated with Pratt, Dalhart, Miles, Nobscot, and Brownfield soils. They are more acid than Pratt soils, and their subsoil is reddish instead of brown. They have less clay in the B horizon than Dalhart and Miles soils. Springer soils do not have the leached A_2 horizon that is normal in Nobscot and Brownfield soils, and they have less sandy A horizons than soils of those series.

Typical profile of Springer loamy fine sand, 100 feet southeast of wellhouse No. 2, in the NW¼ sec. 36, T. 14 N., R. 21 W.:

A 0 to 14 inches, reddish-brown or dark reddish-brown (5YR 4/3 dry; 3/3 moist) coherent loamy fine sand; weak, fine, granular structure or structureless; very friable when moist, soft when dry; noncalcareous; pH 6.7; gradual boundary.

B_2 14 to 36 inches, reddish-brown or dark reddish-brown (5YR 4/4 dry; 3/4 moist) fine sandy loam; compound structure—weak fine granular, and weak coarse prismatic; very friable when moist, soft when dry; noncalcareous; pH 6.5; gradual boundary.

C 36 to 52 inches +, red or dark-red (2.5YR 4/6 dry; 3/6 moist) loamy fine sand; structureless (single grain); loose; noncalcareous; pH 7.0.

In a few places the A horizon is brown. The B_2 horizon ranges from heavy loamy sand to heavy fine sandy loam in texture. In places it contains some fine pebbles. It is red to reddish brown in color. The C horizon is calcareous in some places.

The Nobscot series consists of soils that have a very sandy A_1 horizon; a lighter colored A_2 horizon; and a B_2 horizon of reddish, fine sandy loam. These soils developed under a cover of tall grasses and shin oak, in sandy Pliocene or Pleistocene outwash material that has been altered by wind. They are associated with Brownfield soils but have less clay in the B_2 horizon. They are more sandy than Miles and Pratt soils. Their B_2 horizon is more weakly developed than that of Miles soils, and it is more strongly developed than that of Pratt soils. They are more sandy in the surface layer than Springer soils, and they have an A_2 horizon.

Typical profile of Nobscot fine sand, 660 feet east of the NW. corner of the NE¼ sec. 35, T. 13 N., R. 25 W.:

A_1 0 to 5 inches, brown or dark-brown (10YR 5/3 dry; 4/3 moist) fine sand; structureless (single grain); loose; noncalcareous; pH 6.5; gradual boundary.

A_2 5 to 34 inches, pale-brown or brown (10YR 6/3 dry; 5/3 moist) fine sand; structureless (single grain); loose; noncalcareous; pH 6.0; gradual boundary.

B_2 34 to 50 inches, yellowish-red (5YR 5/6 dry; 4/6 moist) fine sandy loam; porous; massive (structureless); friable when moist, slightly hard when dry; noncalcareous; clay bridges between particles; pH 5.7; gradual boundary.

C 50 to 70 inches, yellowish-red (5YR 5/6 dry; 4/6 moist) fine sand; structureless (single grain); loose; noncalcareous; thin lenses of fine sandy loam or sandy clay loam; pH 6.5.

The A horizon ranges from dark grayish brown to pale brown in color. It ranges from 12 to 34 inches in thickness, but in most places it is between 18 and 24 inches thick. The B_2 horizon is yellowish red to reddish yellow and is fine sandy loam to loamy sand. It contains appreciably more clay than the A horizon.

The Brownfield series is made up of soils that formed under a cover of tall grasses and shin oak, in very sandy outwash material, probably of the Pliocene or Pleistocene epochs. These soils were later reworked by wind. They have an A_1 horizon of fine sand; a lighter colored, leached A_2 horizon; and a B_2 horizon of reddish sandy clay loam. Brownfield soils are members of the Reddish-Brown great soil group, but in Roger Mills County they have some characteristics of the Red-Yellow Podzolic great soil group.

These soils are associated with Miles, Nobscot, Springer, and Pratt soils. They are sandier than all except the Nobscot soils, and normally have a leached A_2 horizon. Miles and Springer soils are darker colored, have more fine particles in the A horizon, and do not have an A_2 horizon. Springer and Nobscot soils have a B horizon of fine sandy loam, and Pratt soils have a B horizon of brown loamy fine sand.

Typical profile of Brownfield fine sand, in a native pasture, 100 yards west and 25 yards south of the NE. corner of sec. 36, T. 13 N., R. 25 W.:

A_1 0 to 6 inches, brown (7.5YR 5/2 dry; 4/2 moist) fine sand; structureless; loose; noncoherent; noncalcareous; pH 6.5; gradual boundary.

A_2 6 to 18 inches, very pale brown or light yellowish-brown (10YR 7/4 dry; 6/4 moist) fine sand; structureless; loose; noncoherent; noncalcareous; pH 6.2; clear boundary.

B_2 18 to 30 inches, reddish-yellow or yellowish-red (5YR 6/6 dry; 5/6 moist) sandy clay loam; moderate, medium, blocky structure; discontinuous clay films; firm when moist, very hard when dry; few roots and pores; noncalcareous; pH 6.0; gradual boundary.

C 30 to 72 inches, reddish-yellow (7.5YR 7/8 dry; 6/8 moist) loamy fine sand; structureless (single grain); loose; noncalcareous; lenses of yellowish-red fine sandy loam; pH 6.6.

The A_2 horizon is less apparent in areas that have been deep plowed. In most places, the B_2 horizon is sandy clay loam and is blocky or subangular blocky in structure. The depth to the B_2 horizon ranges from 12 to 24 inches.

CHERNOZEMS

Chernozems are dark-brown, silty soils that develop under a cover of tall grasses. These soils are calcareous in the lower part of the solum and have only a slight to moderate accumulation of clay in the subsoil. The Holdrege and Kenesaw series represent this great soil group in Roger Mills County.

The Holdrege series consists of weakly developed or moderately developed soils that formed in loess-capped plains outwash. These deep, silty, dark-brown or dark grayish-brown soils are on the nearly level to gently sloping uplands. They are associated with Dalhart, Pratt, and Enterprise soils. They have a deeper, darker colored, more silty A horizon and a less sandy B horizon than Dalhart soils. They are darker colored and more silty than Pratt soils and have a more clayey B_2 horizon. Enterprise soils are calcareous and do not have a B_2 horizon.

Holdrege soils are of limited extent in this county. They occur at the higher altitudes in the vicinity of Durham and Antelope Hills, near the divide between the Canadian River and the Washita River watersheds. These soils are well suited to small grain, and most of the acreage is cultivated.

Typical profile of Holdrege silt loam, in a cultivated field, ¼ mile south of the NW. corner of sec. 5, T. 15 N., R. 26 W.:

A_1 0 to 9 inches, very dark grayish-brown or very dark brown (10YR 3/2 dry; 2/2 moist) silt loam; moderate, medium and fine, granular structure; friable when moist, slightly hard when dry; noncalcareous; pH 7.3; gradual boundary.

B_1 9 to 18 inches, very dark grayish-brown or very dark brown (10YR 3/2 dry; 2/2 moist) light silty clay loam; moderate, fine and medium, granular structure; friable when moist, slightly hard when dry; porous; numerous worm casts; noncalcareous; pH 7.4; gradual boundary.

B_2 18 to 38 inches, dark grayish-brown or very dark grayish-brown (10YR 4/2 dry; 3/2 moist) silty clay loam; compound structure—moderate medium granular, and coarse prismatic; friable when moist, slightly hard when dry; noncalcareous; pH 7.8; gradual boundary.

C_1 38 to 52 inches, brown or dark-brown (7.5YR 4/2 dry; 3/2 moist) silty clay loam; friable when moist; porous; noncalcareous, pH 8.0; gradual boundary.

C_2 52 to 80 inches, brown or dark-brown (7.5YR 4/2 dry; 3/2 moist) light silty clay loam; friable when moist; porous; calcareous; pH 8.3.

In about 2 percent of the acreage, the B_2 horizon is heavy silty clay loam or clay loam. In 40 to 50 percent of the acreage, there is a buried soil at a depth of about 40 to 48 inches. This buried soil is more clayey than the normal substratum.

The Kenesaw series consists of slightly developed, well-drained, silty, brownish soils that formed under a cover of tall grasses in calcareous, windblown silt and very fine sand.

These soils are associated with Enterprise, Dalhart, Holdrege, and Pratt soils. They are less sandy and darker colored than Enterprise, Dalhart, and Pratt soils, and they have less profile development than Dalhart and Pratt soils. Holdrege soils have a silty clay loam B horizon and are deeper to the calcareous zone.

The Kenesaw soils in this county are nearly level. They occur within a few miles of the South Canadian River. The total acreage is small.

Typical profile of Kenesaw silt loam, in a cultivated field, 450 feet north and 50 feet east of the SW. corner of sec. 23, T. 16 N., R. 24 W.:

A 0 to 25 inches, dark grayish-brown or very dark grayish-brown (10YR 4/2 dry; 3/2 moist) silt loam; moderate, medium and fine, granular structure; friable when moist, slightly hard when dry; porous; noncalcareous; pH 7.5; gradual boundary.

C 25 to 70 inches +, brown or dark-brown (10YR 4/3 dry; 3/3 moist) silt loam; moderate, medium, granular structure; friable when moist, slightly hard when dry; porous; calcareous; pH 8.3.

These soils are uniform in texture, except for some overwash or overblown material on the surface. In color, they range from brown to dark grayish brown. The depth to the calcareous zone is 20 to 40 inches.

Intrazonal soils

Intrazonal soils have evident, genetically related horizons that reflect the dominant influence of a local factor of relief or parent material over the effects of climate and living organisms.

In Roger Mills County the intrazonal order is represented by the Calcisol great soil group.

CALCISOLS

Calcisols develop in highly calcareous material in semiarid or subhumid areas. Accumulated calcium carbonate forms a prominent horizon. These soils differ from zonal soils in having no accumulation of clay in the subsoil. The Mansker series represents this great soil group in Roger Mills County.

The Mansker series consists of brown to grayish-brown soils that developed under a cover of mid and short grasses in highly calcareous Tertiary loams and clay loams.

Mansker soils are of limited extent in the county. They occur in small areas, generally at the higher elevations.

Typical profile of Mansker loam, in a cultivated field, 1,500 feet south and 1,000 feet west of the NE. corner of sec. 10, T. 12 N., R. 21 W.:

A_{1p} 0 to 5 inches, brown or dark-brown (10YR 4/3 dry; 3/3 moist) loam; structureless; friable when moist, slightly hard when dry; few $CaCO_3$ concretions on the surface; calcareous; plowed boundary.

A_1 5 to 9 inches, dark grayish-brown or very dark grayish-brown (10YR 4/2 dry; 3/2 moist) loam; moderate to strong, medium, granular structure, many worm casts; friable when moist, slightly hard when dry; calcareous; gradual boundary.

AC 9 to 16 inches, brown or dark-brown (10YR 5/3 dry; 4/3 moist) clay loam; strong, medium, granular structure; friable when moist, slightly hard when dry; strongly calcareous; granules have gray coating; few $CaCO_3$ concretions; few rust-colored, slightly indurated concretions; clear boundary.

C_{ca} 16 to 30 inches, pale-brown or brown (10YR 6/3 dry; 5/3 moist) clay loam; moderate, fine, granular structure; friable when moist, hard when dry; splotches of yellowish-brown sand give mottled appearance; calcareous, about 10 percent soft, segregated $CaCO_3$; gradual boundary.

C 30 to 48 inches, very pale brown or pale brown (10YR 7/3 dry; 6/3 moist) very fine sandy loam; thin clay lenses; calcareous.

These soils range from fine sandy loam to clay loam in texture, and from dark brown to grayish brown in color. The depth to the segregated lime is 8 to 20 inches.

Azonal soils

Azonal soils have little or no profile development. Either the soil material has not been in place long enough for horizons to develop, or the parent material or relief are such that the normal development of profile characteristics is prevented (*8*).

The Azonal order is represented in Roger Mills County by the Alluvial, Regosol, and Lithosol great soil groups.

ALLUVIAL SOILS

Alluvial soils consist of transported and relatively recently deposited material. They have little or no profile development. This great soil group is represented in Roger Mills County by the Brazos, Lincoln, Norwood, Port, Reinach, Spur, Sweetwater, Wann, Yahola, and Zavala series.

The Brazos series consists of young, reddish, sandy, noncalcareous soils that are above the normal flood plains. These soils are slightly darker colored in the surface layer than in the lower part of the profile, and they are somewhat stratified below a depth of 3 feet. They are associated with Reinach and Port soils. They are coarser textured than Reinach soils and are noncalcareous to a greater depth. They are less silty than Port soils.

The only Brazos soil mapped in the county is in red-bed areas along the Washita River.

Typical profile of Brazos loamy fine sand, in the SE¼NE¼ sec. 23, T. 14 N., R. 23 W.:

A_{1p} 0 to 5 inches, reddish-brown (5YR 5/3 dry; 4/3 moist) loamy fine sand; structureless; loose; noncalcareous; pH 7.5; plowed boundary.

A_1 5 to 24 inches, reddish-gray or dark reddish-gray (5YR 5/2 dry; 4/2 moist) loamy fine sand; weak, medium, granular structure; friable when moist, soft when dry; noncalcareous; pH 7.5; gradual boundary.

C_1 24 to 38 inches, light reddish-brown or reddish-brown (5YR 6/4 dry; 5/4 moist) loamy fine sand; structureless; very friable when moist, loose when dry; noncalcareous; pH 7.0; gradual boundary.

C_2 38 to 42 inches, reddish-yellow or yellowish-red (5YR 6/6 dry; 5/6 moist) loamy fine sand; structureless; loose; pH 7.5; noncalcareous.

In some areas, these soils are more red than described, and in places the C horizon is more stratified.

The Lincoln series consists of mixed, young, brownish to grayish-brown, calcareous soils that are on flood plains and are subject to frequent damage by overflow. The soil material consists of sediments from sandy-land areas, but along the Washita River in the eastern part of the county, it includes sediments from red-bed areas.

These soils are associated with Wann, Sweetwater, and Yahola soils. They are better drained than Wann and Sweetwater soils but are lower than Wann soils. They are lower than Yahola soils and are less uniform in characteristics, more sandy, and brownish in color instead of reddish.

Profile of a Lincoln soil, 100 yards east of the Washita River bridge on Oklahoma Highway No. 30, sec. 24, T. 15 N., R. 26 W.:

A 0 to 12 inches, brown or dark-brown (10YR 5/3 dry; 4/3 moist) fine sandy loam; thin strata of yellowish-brown sand, 3 to 4 inches apart; weak, fine, granular structure; very friable when moist, soft when dry; calcareous; gradual boundary.

AC 12 to 20 inches, light yellowish-brown or yellowish-brown (10YR 6/4 dry; 5/4 moist) loamy fine sand; structureless; loose when moist or dry; calcareous; gradual boundary.

C 20 to 40 inches, very pale brown (10YR 8/4 dry; 7/4 moist) fine sand; structureless; loose when moist or dry; calcareous.

These soils are so varied in characteristics that the profile described cannot be considered typical. The A horizon ranges in texture from fine sand to clay loam, but generally it is sandy. In most places the underlying layer is fine sand, but it contains strata of all textures.

The Norwood series consists of young, reddish, calcareous, silty soils on flood plains along the larger streams that drain the red-bed areas.

These soils are associated with Yahola and Lincoln soils. Yahola soils are more sandy than Norwood soils, and the underlying layer is fine sandy loam. Lincoln soils are less uniform in characteristics and are more subject to damaging overflow. Wann soils have a fluctuating, moderately high water table. Spur soils are at slightly higher elevations and are darker colored. Port soils have a noncalcareous, darker colored surface layer and are above the normal flood plains. Reinach soils are sandier throughout than are the Norwood soils.

Norwood soils occupy the larger part of the flood plains in the county and are fertile and productive.

Typical profile of Norwood silt loam, in a cultivated field, 1/4 mile north of the SE. corner of sec. 22, T. 13 N., R. 22 W.:

A_1 0 to 22 inches, red or dark-red (2.5YR 4/6 dry; 3/6 moist) silt loam; moderate, medium, granular structure; friable when moist, slightly hard when dry; porous; many worm casts; calcareous; gradual boundary.

AC 22 to 40 inches, reddish-brown or dark reddish-brown (2.5YR 4/4 dry; 3/4 moist) silt loam; moderate, medium, granular structure; friable when moist, slightly hard when dry; porous; calcareous; gradual boundary.

C 40 to 60 inches, red to dark-red (2.5YR 4/6 dry; 3/6 moist) silt loam; porous; calcareous; strata of fine sandy loam below a depth of 48 inches.

The A_1 horizon ranges from loam to silty clay loam in texture. Thin strata ranging from loamy fine sand to silty clay loam in texture commonly occur in the AC and C horizons. The colors described are typical, but the hue ranges from 10R to 5YR.

The Port series is made up of young, silty soils on low terraces above the flood plains of the larger streams in the county. The soil material consists of sediments from the red beds. The native vegetation consists of tall grasses.

These soils are associated with Norwood, Spur, Reinach, Brazos, and Yahola soils. Norwood and Spur soils have about the same texture as Port soils but are more red, have a lighter colored A horizon, and are calcareous at the surface. Reinach, Brazos, and Yahola soils are more sandy in all horizons.

Typical profile of Port silt loam, 750 feet northeast of the SW. corner of the SE1/4 sec. 16, T. 13 N., R. 22 W.:

A 0 to 13 inches, dark reddish-brown (5YR 3/2 dry; 2/2 moist) silt loam; moderate, medium, granular structure; friable when moist, slightly hard when dry; porous; many worm casts; noncalcareous; pH 7.8; gradual boundary.

AC 13 to 24 inches, reddish-brown or dark reddish-brown (5YR 4/3 dry; 3/3 moist) silt loam; moderate, medium, granular structure; friable when moist, slightly hard when dry; porous; few worm casts; calcareous; gradual boundary.

C 24 to 40 inches, red or dark-red (2.5YR 4/6 dry; 3/6 moist) silt loam; weak, fine, granular structure; friable when moist, slightly hard when dry; porous; calcareous.

These soils range from silty clay loam to loam in texture. The color of the A horizon ranges from 2.5YR to 5YR in hue and from 2 to 4 in chroma and value. The color of the AC horizon ranges from 10R to 5YR in hue and from 3 to 6 in chroma and value. The thickness of the noncalcareous zone ranges from 10 to about 30 inches.

The Reinach series consists of young, noncalcareous, reddish, moderately sandy soils that occur above the present flood plains of the larger streams that drain the red-bed areas of the county.

These soils are associated with Port, Norwood, Yahola, and Brazos soils. They are more sandy than Port soils and are leached to a greater depth; they are more sandy than Norwood soils; they are noncalcareous and are less subject to overflow than Norwood and Yahola soils; and they are less sandy than Brazos soils.

Typical profile of Reinach fine sandy loam, in a cultivated field, 600 feet east of the SW. corner of sec. 33, T. 14 N., R. 23 W.:

A_{1p} 0 to 7 inches, dark-brown (7.5YR 4/2 dry; 3/2 moist) fine sandy loam; weak, medium, granular structure; friable when moist, slightly hard when dry; noncalcareous; pH 7.5; plowed boundary.

A_1 7 to 14 inches, reddish-brown or dark reddish-brown (5YR 4/3 dry; 3/2 moist) fine sandy loam; weak, very fine, granular structure; friable when moist, hard when dry; noncalcareous; pH 7.3; gradual boundary.

AC 14 to 22 inches, dark reddish-brown (5YR 3/2 dry; 2/2 moist) fine sandy loam; weak, medium, granular structure; friable when moist, slightly hard when dry; porous; few worm casts; noncalcareous; pH 7.0; gradual boundary.

C_1 22 to 34 inches, reddish-brown to dark reddish-brown (5YR 4/3 dry; 3/3 moist) fine sandy loam; moderate, medium, granular structure; very friable when moist, slightly hard when dry; porous; many worm casts; noncalcareous; pH 7.3; gradual boundary.

C_2 34 to 40 inches, reddish-brown or dark reddish-brown (2.5YR 4/4 dry; 3/4 moist) fine sandy loam; very friable when moist, slightly hard when dry; porous; many worm casts; noncalcareous; pH 7.6.

The color of these soils ranges from brown to reddish brown (hues 2.5YR to 7.5YR). In some small areas, the texture is silt loam to loamy fine sand. The underlying layer is stratified. In some places there is a thin calcareous layer at the surface, but ordinarily the profile is noncalcareous to a depth of 40 inches or more.

The Spur series is made up of reddish-brown, calcareous, silty soils that are on low terraces a few feet above the flood plains of the Washita River and its larger tributaries. These soils consist of alluvial material that was deposited by small streams that drain the red-bed areas. The native vegetation consists of tall grasses.

Spur soils are associated with Port soils, but they are more calcareous throughout and have a lighter colored A horizon. They are higher and slightly darker colored than Norwood soils. They are more silty than Reinach, Brazos, and Yahola soils.

Profile of Spur silt loam, 285 feet west and 75 feet south of the NE. corner sec. 24, T. 14 N., R. 25 W.:

A 0 to 16 inches, reddish-brown or dark reddish-brown (5YR 4/4 dry; 3/4 moist) silt loam; weak, fine, granular structure; friable when moist, slightly hard when dry; porous; many roots and worm casts; calcareous; gradual boundary.

AC 16 to 34 inches, dark reddish-gray or dark reddish-brown (5YR 4/2 dry; 3/2 moist) silt loam; moderate, fine, granular structure; friable when moist, hard when dry; porous; few roots; worm casts common; calcareous; gradual boundary.

C 34 to 42 inches +, red or dark-red (2.5YR 4/6 dry; 3/6 moist) silt loam; very friable when moist, slightly hard when dry; few roots and pores; calcareous.

Generally, these soils are reddish brown (hue 2.5YR or 5YR). The texture ranges from loam to light silty clay loam.

The Sweetwater series consists of stratified, dark-colored soils on flood plains along streams that drain the sandy-land areas. The normal flow of these streams has been restricted by sediments. Consequently, in most places the soils are mottled and have an accumulation of soluble salts. Salt-tolerant plants make up part of the vegetation.

In Sweetwater soils, the water table is seldom as much as 2 feet below the surface, and it is often at or near the surface. In Wann soils, it is seldom less than 3 feet below the surface.

Sweetwater soils occur mostly along small creeks, but there are some small areas along the Washita River.

Typical profile of Sweetwater soils, on the flood plains of a small drain at the east side of the SE¼ sec. 4, T. 13 N., R. 26 W.:

- A 0 to 12 inches, dark-brown (10YR 4/3 dry; 3/3 moist) silty clay loam; weak, subangular, blocky structure; sticky when wet, hard when dry; calcareous; thin strata of fine sand; clear boundary.
- AC 12 to 30 inches, light yellowish-brown or yellowish-brown (10YR 6/4 dry; 5/4 moist) fine sand; common, coarse mottles of yellow or brownish yellow (10YR 7/8 dry; 6/8 moist); structureless (single grain); loose; calcareous; water table at 24 inches; abrupt boundary.
- C 30 to 37 inches, dark grayish-brown or very dark grayish-brown (10YR 4/2 dry; 3/2 moist) clay loam; slightly sticky when wet; calcareous; gradual boundary.
- C_u 37 to 40 inches, very dark gray or black (10YR 3/1 dry; 2/1 moist) loam; nonplastic when wet; calcareous.

These soils range from fine sand to silty clay in texture. Generally the texture is more sandy than that of the profile described.

The Wann series consists of young, brown or grayish-brown, calcareous, sandy or moderately sandy soils that have a fluctuating, moderately high water table.

These soils occur mostly on the flood plains of the Washita River, but there are small areas along the South Canadian River. They are associated with Yahola, Norwood, and Lincoln soils. They are less uniform in characteristics than Yahola soils, and they have a moderately high water table and are brownish instead of reddish. They are more sandy than Norwood soils. They are more uniform in characteristics than Lincoln soils, are subirrigated, and are less subject to overflow. In Wann soils, the depth to the water table is 3 feet or more; in Sweetwater soils, it is seldom more than 2 feet.

Profile of a Wann soil, 120 feet northwest of the SE. corner of sec. 26, T. 15 N., R. 25 W.:

- A 0 to 22 inches, dark-brown (7.5YR 4/2 dry; 3/2 moist) fine sandy loam stratified with thin bands of fine sand; weak, medium, granular structure; very friable when moist, slightly hard when dry; calcareous; gradual boundary.
- AC 22 to 52 inches, very pale brown (10YR 8/3 dry; 7/3 moist) fine sand; structureless (single grain); loose when moist, soft when dry; weakly calcareous; gradual boundary.
- C 52 to 70 inches, very pale brown to light yellowish-brown (10YR 7/4 dry; 6/4 moist) fine sand; few faint mottles of yellowish red; structureless (single grain); calcareous; water table at 60 inches.

These soils are not uniform in characteristics. In most places the A horizon is more than 20 inches thick and is fine sandy loam, but it ranges from clay loam to fine sand. The lower horizons are stratified. They are predominantly loamy sand or sand but contain 1- to 5-inch strata of various other textures.

The Yahola series is made up of young, calcareous, reddish, sandy soils on the flood plains of streams that drain the red-bed areas in the county. These soils are associated with Norwood, Port, Reinach, and Wann soils. They are more sandy throughout than Norwood soils. They are less sandy than Wann soils and are reddish in color instead of brownish. Unlike the Port and Reinach soils, they are subject to normal overflow and are calcareous throughout.

Yahola soils occur in the eastern two-thirds of the county.

Typical profile of Yahola fine sandy loam, 300 feet south and 100 feet west of the Washita River bridge on U.S. Highway No. 283, sec. 5, T. 14 N., R. 23 W.:

- A 0 to 10 inches, reddish-brown or dark reddish-brown (5YR 4/4 dry; 3/4 moist) fine sandy loam; weak, medium, granular structure; very friable when moist, slightly hard when dry; calcareous; diffuse boundary.
- C 10 to 40 inches, red or dark-red (2.5YR 4/6 dry; 3/6 moist) fine sandy loam; nearly structureless; very friable when moist, slightly hard when dry; porous; few worm casts; calcareous.

The A horizon commonly is fine sandy loam. However, in some small areas it is loamy fine sand to silty clay loam, and in some large areas it is loam or silt loam. The underlying layer ranges in texture from coherent loamy sand to fine sandy loam, and it contains strata of various textures.

The Zavala series is made up of brown, stratified, sandy soils that occur on the flood plains of small drainageways in the sandy-land areas of the county. These soils consist of sandy alluvium that was washed from areas of Nobscot, Brownfield, Miles, Springer, and Pratt soils. The native vegetation consists of tall grasses, shin oak, and scattered bottom-land hardwoods.

Zavala soils are associated with Lincoln, Wann, and Sweetwater soils. Lincoln soils are calcareous, less uniform in characteristics, and subject to more serious damage by flooding. Wann and Sweetwater soils have a moderately high or high water table, are less uniform in characteristics, and are calcareous. Yahola soils are reddish in color and are calcareous.

Typical profile of Zavala fine sandy loam, at the SW. corner of sec. 35, T. 14 N., R. 26 W.:

- A 0 to 24 inches, dark-brown (10YR 4/3 dry; 3/3 moist) fine sandy loam stratified with thin bands of loamy sand; structureless; very friable when moist, soft when dry; calcareous in uppermost 2 inches; pH 7.0; gradual boundary.
- C 24 to 70 inches, light brownish-gray or grayish-brown (10YR 6/2 dry; 5/2 moist) loamy fine sand; structureless; loose; noncalcareous; pH 7.8.

The A horizon varies to some extent in color and in texture because of recent deposits of material. In many places lighter colored sand or loamy sand has been deposited over the sandy loam.

REGOSOLS

Regosols consist of deep, unconsolidated deposits, other than recent alluvium. They have no definite genetic profiles. The Regosols in Roger Mills County have a dark-colored A horizon but no textural B horizon. Except for accumulation of organic matter in the A horizon, they show little evidence of soil formation. There is little evidence of leaching of carbonates or of translocation of silicate clay minerals in these soils.

The Regosol great soil group is represented in Roger Mills County by the Quinlan series. Enterprise and Woodward soils are considered Regosols that are intergrading to Chestnut soils. They are described elsewhere in this subsection.

The Quinlan series is made up of reddish soils that consist of material weathered from calcareous, weakly cemented sandstone and siltstone of the Permian Red Beds. These reddish soils are predominantly steep, but in places they are gently sloping. The vegetation consists of mid and tall grasses.

Quinlan soils are associated with Carey, St. Paul, Woodward, and Vernon soils. They are more shallow than all but the Vernon soils. Carey and St. Paul soils are better developed and have a clayey B_2 horizon. Vernon soils are silty to somewhat clayey and are shallow over massive claystone or siltstone.

Typical profile of Quinlan silt loam, 200 yards west and 100 yards north of the SW. corner of the SE¼ sec. 20, T. 14 N., R. 24 W.:

- A 0 to 6 inches, reddish-brown or dark reddish-brown (2.5YR 5/4 dry; 3/4 moist) silt loam; moderate, medium, granular structure; friable when moist, slightly hard when dry; calcareous; gradual boundary.
- AC 6 to 13 inches, reddish-brown or dark reddish-brown (2.5YR 4/4 dry; 3/4 moist) silt loam; weak, medium, granular structure; friable when moist, hard when dry; porous; calcareous; gradual boundary.
- C_1 13 to 17 inches, red (2.5YR 5/6 dry; 4/6 moist) silt loam; weak, fine, granular structure; friable when moist, hard when dry; porous; calcareous; some concretions; gradual boundary.
- C_2 17 inches +, red (2.5YR 5/6 dry; 4/6 moist), weakly cemented siltstone or fine-grained sandstone; calcareous.

The depth to the parent rock ranges from 8 to 20 inches. The parent rock ranges in texture from medium-grained sandstone to siltstone. Consequently, the texture of these soils ranges from fine sandy loam to silt loam. The reaction ranges from weakly calcareous to strongly calcareous. In some places the parent rock is calcareous only in the seams.

REGOSOLS INTERGRADING TO CHESTNUT SOILS

Regosols that are intergrading to Chestnut soils have a well-developed A horizon, no textural B horizon, and an incipient to moderately developed horizon of carbonate accumulation.

The Enterprise and Woodward series represent this group in the county.

The Enterprise series consists of young, brownish soils that formed under a cover of tall grasses in recent, eolian mantles of calcareous silts and very fine sand. These deep soils are calcareous at or near the surface. They occur on nearly level to very steep slopes near the South Canadian River. They are associated with Pratt, Dalhart, Kenesaw, and Holdrege soils. Pratt soils are more sandy, have a weak textural B horizon, and are noncalcareous. Dalhart and Holdrege soils are leached to a greater depth and have a weak to moderate textural B horizon. Kenesaw soils are more silty, darker colored, and leached to a greater depth.

Typical profile of Enterprise very fine sandy loam, in a cultivated field, ¼ mile south and 50 yards east of the NW. corner of sec. 27, T. 16 N., R. 23 W.:

- A 0 to 20 inches, brown or dark-brown (10YR 4/3 dry; 3/3 moist) very fine sandy loam; weak, medium, granular structure; friable when moist, slightly hard when dry; calcareous; gradual boundary.
- C 20 to 60 inches, brown (10YR 5/3 dry; 4/3 moist) very fine sandy loam; weak, very fine, granular structure; friable when moist, slightly hard when dry; calcareous, with threads of calcium carbonate.

The Woodward series is made up of reddish, moderately deep soils that formed in material weathered from calcareous siltstone and sandstone of the red beds. These soils are on the gently sloping to steep uplands. They are associated mostly with St. Paul, Carey, Quinlan, and Vernon soils. They differ from St. Paul and Carey soils in having no textural B horizon and in being calcareous to the surface. They are deeper than Quinlan and Vernon soils.

Typical profile of Woodward loam, in a cultivated field, 100 yards north of the SE. corner of the NE¼ sec. 20, T. 14 N., R. 24 W.:

- A 0 to 12 inches, reddish-brown or dark reddish-brown (2.5YR 4/4 dry; 3/4 moist) loam; moderate, medium, granular structure; friable when moist, slightly hard when dry; calcareous; gradual boundary.
- AC 12 to 24 inches, weak-red to dusky-red (2.5YR 4/2 dry; 3/2 moist) silt loam; moderate, medium, granular structure; friable when moist, slightly hard when dry; porous; worm casts common; calcareous; gradual boundary.
- C 24 to 40 inches, red or dark-red (2.5YR 4/6 dry; 3/6 moist) silt loam; structureless; friable when moist, slightly hard when dry; calcareous; few soft sandstone fragments.

The texture is loam or silt loam. The color ranges from 10R to 5YR in hue and from 2 to 4 in chroma and value. The depth to the weathered red beds is 20 to 50 inches or more. The greatest depth is on foot slopes.

LITHOSOLS

Lithosols are weakly developed and are shallow over rock. They consist of material derived from rock that weathers slowly and are sometimes called skeletal soils. They strongly resemble the rock from which they are derived.

The Potter and Vernon series represent this great soil group in Roger Mills County.

The Potter series is made up of soils that consist of erosional remnants of the Ogallala formation. This formation is represented in the county by the Antelope Hills and the Twin Hills, which were once part of the High Plains caprock. These soils are more shallow than Mansker soils, and they have a layer of caliche near the surface.

Typical profile of Potter loam in the NE¼ sec. 33, T. 17 N., R. 25 W.:

- A 0 to 8 inches, grayish-brown or dark grayish-brown (10YR 5/2 dry; 4/2 moist) loam; strong, medium, granular structure; friable when moist, slightly hard when dry; calcareous, few $CaCO_3$ concretions; abrupt boundary.
- D_r 8 inches +, light-gray (10YR 7/1) sandy caliche.

The A horizon ranges from sandy loam to loam. The depth to the caliche is 2 to 10 inches.

The Vernon series is made up of reddish, loamy, very shallow soils that consist of material weathered from Doxey siltstone or claystone of the Quartermaster formation of the Permian Red Beds. The native vegetation consists of mid and short grasses. These soils are associated mostly with Quinlan and Woodward soils. They are more silty than Quinlan soils, and the underlying siltstone or claystone is more dense. They are more shallow than Woodward soils.

Typical profile of Vernon silt loam, 100 feet south and 50 feet east of the NW. corner of sec. 36, T. 13 N., R. 21 W.:

A 0 to 8 inches, dark reddish-brown (2.5YR 3/4 dry ; 2/4 moist) silt loam; strong, medium, granular structure; porous; friable when moist, slightly hard when dry; calcareous; siltstone fragments in lower part; clear boundary.

D_r 8 inches +, red or dark-red (2.5YR 4/6 dry; 3/6 moist) siltstone in upper part; breaks readily into fragments ⅛ inch to ½ inch square; calcareous only in seams.

These soils range from silty clay loam to loam, but in most places they are silt loam. The depth to the siltstone is 4 to 12 inches on convex slopes, but in concave areas it is 24 inches or more.

Physical and Chemical Analysis

This section consists of three main parts. The first part states the methods of analysis used in the field and laboratory. The second part is a brief discussion of the physical and chemical properties of the samples analyzed. It includes two tables that list the analytical data obtained in the testing of six soil samples. Although these samples were not taken from Roger Mills County, the soils are essentially the same as those of the same series mapped in the county. The third part of this section describes the profiles of the soils tested.

Field and laboratory methods

All samples used to obtain the data in tables 13 and 14 were collected from carefully selected sites. The samples are considered representative of the soil material that is made up of particles less than three-quarters of an inch in diameter. Estimates of the fraction of the sample consisting of particles larger than three-quarters of an inch were made during the sampling. If necessary, the sample was sieved after it was dried and rock fragments larger than three-quarters of an inch in diameter were discarded. Then the material made up of particles less than three-quarters of an inch in diameter was rolled, crushed, and sieved and rock fragments larger than 2 millimeters in diameter were removed. The fraction that consisted of particles between 2 millimeters and three-quarters of an inch in diameter was recorded on the data sheets and is listed in table 13 as the percentage greater than 2 millimeters.

Unless otherwise noted, laboratory analysis was made on material that passed the 2-millimeter sieve and that was oven dry.

Standard methods of the Soil Survey laboratory were used to obtain most of the data in tables 13 and 14. Determinations of clay were made by the pipette method (*3, 4, 5*). The reaction of the saturated paste (1:1) and that of a 1:10 water suspension were measured with a glass electrode. Organic carbon was determined by wet combustion, using a modification of the Walkley-Black method (*6*). Nitrogen was determined by using a modification of the procedure of the Association of Official Agricultural Chemists (*2*). The calcium carbonate equivalent was determined by measuring the volume of carbon dioxide evolved from soil samples treated with concentrated hydrochloric acid. The methods of the U.S. Salinity Laboratory were used to obtain the moisture tensions (*7*). The cation exchange capacity was determined by direct distillation of adsorbed ammonia. (*6*). To determine the extractable calcium and magnesium, calcium was separated as calcium oxalate and magnesium as magnesium ammonium phosphate (*6*). Extractable sodium and potassium were determined on original extracts with a flame spectrophotometer. Soluble sodium and potassium were determined on the saturation extract with a flame spectrophotometer. The saturation extract was obtained by using the methods of the U.S. Salinity Laboratory (*7*).

Physical and chemical properties of soils analyzed

Tables 13 and 14 show the physical and chemical properties of Carey silt loam, Nobscot fine sand, and St. Paul silt loam. These soils are among the more highly developed soils in the county, and they are similar in many properties. In each, the content of clay is higher in the subsoil than in the surface layer or the substratum. St. Paul silt loam is the most strongly developed and has the greatest accumulation of clay in the subsoil.

The pH of Carey silt loam and St. Paul silt loam increases with depth. This indicates that there is a downward movement of bases as the soils develop. The pH does not increase in Nobscot fine sand, probably because calcareous material is constantly being deposited on this soil by wind.

In all of the soils tested, the amount of organic carbon is greatest in the surface layer and decreases with depth. The figures shown for organic-carbon content can be converted to the more common terms for organic-matter content by multiplying by 1.72. An accumulation of organic matter in the surface layer probably is the first apparent indication of soil development. Nobscot fine sand, which is still under native vegetation, shows a high organic-carbon content and a high carbon-nitrogen ratio.

Electrical conductivity measures the concentration of salts present. Conductivity of less than 4.0 millimhos per centimeter shows that the soils are normal, or nonsaline-nonalkali soils. For few, if any, of the arable soils in Roger Mills County does the figure approach 4.0. The low sodium content shown in the column "Extractable cations" also indicates that the soils are nonalkaline.

Cation exchange capacity is a measure of the soil's potential ability to hold plant nutrients. The base saturation percentage indicates the amount of available plant nutrients present in relation to the capacity of the soil to hold such nutrients. The amounts are expressed as milliequivalents per 100 grams of dry soil. The base saturation percentages are rather high in most of the soils in Roger Mills County.

Profiles of soils analyzed

Following are detailed descriptions of the profiles from which samples for laboratory analysis were taken.

CAREY SILT LOAM

Location of profile: 7 miles N. of Arapaho, Okla.; 950 feet N. and 1,000 feet E. of SW. corner of sec. 13, T. 14 N., R. 17 W., Custer County

A_{1p} 0 to 7 inches, reddish-brown (5YR 4/4; 3/3 moist) silt loam; weak, fine, granular structure; very friable when moist, soft when dry; plowed boundary.

B_{21} 7 to 17 inches, reddish-brown (5YR 4/4; 3/4 moist) light clay loam; moderate, medium and fine, granular structure; many worm casts; friable when moist, slightly hard when dry; diffuse boundary.

B_{22} 17 to 23 inches, reddish-brown (5YR 4/4; 3/4 moist) light clay loam; moderate, medium, granular structure; few worm casts; friable when moist, slightly hard when dry; gradual boundary.

B_3 23 to 30 inches, red (2.5YR 4/6; 3/4 moist) heavy loam; moderate to strong, fine, granular structure; friable when moist, hard when dry; calcareous; a few (less than 1 percent) hard lime concretions; weak, coarse prisms filmed with dark stains; gradual boundary.

C–1 30 to 40 inches, red (2.5YR 4/6; 3/6 moist) loam; large, nearly vertical cleavage faces, weakly coated with darker stains and with lime films and blotches; few hard lime concretions and limy seams; no discernible boundary.

C–2 40 to 50 inches, red (2.5YR 4/6; 3/6 moist) loam; large, nearly vertical cleavage faces, weakly coated with darker stains and with lime films and blotches; few hard lime concretions and limy seams; gradual boundary.

C_{ca} 50 to 57 inches, red (2.5YR 5/6) loam coarsely mottled with many reddish-yellow (5YR 7/6) lime blotches; friable when moist, sticky when wet; highly calcareous; many (25 percent) large, hard lime concretions.

Dark-colored krotovinas are common throughout the profile.

CAREY SILT LOAM

Location of profile: 2 miles S. of Butler, Okla.; 362 feet S. and 137 feet W. of NE. corner of SE¼ sec. 11, T. 13 N., R. 19 W., Custer County

A_{1p} 0 to 7 inches, dark reddish-gray (5YR 4/2; 3/2 moist) silt loam; weak, fine, granular structure; very friable when moist, soft when dry; numerous fine roots; plowed boundary.

A_{12} 7 to 13 inches, dark reddish-gray (5YR 4/2; 3/2 moist) loam; moderate, fine, granular structure; abundant worm casts; very friable when moist, soft when dry; numerous fine roots; gradual boundary.

B_{21} 13 to 17 inches, reddish-brown (5YR 4/3; 3/3 moist) light clay loam; moderate, fine, granular structure; abundant worm casts; friable when moist, slightly hard when dry; many fine roots; diffuse boundary.

B_{22} 17 to 25 inches, reddish-brown (5YR 4/3; 3/3 moist) light clay loam; moderate to strong, fine, granular structure; many worm casts; friable when moist, slightly hard when dry; calcareous; faint films and streaks of segregated lime in lower part; many fine roots; gradual boundary.

B_{31} 25 to 34 inches, reddish-brown (10YR 4/4; 3/4 moist) clay loam; weak, fine, granular structure; few worm casts; friable when moist, slightly hard when dry; calcareous; very few hard lime concretions about 10 millimeters in diameter; light lime films on few large cleavage planes; few fine roots; diffuse boundary.

B_{32} 34 to 41 inches, reddish-brown (5YR 4/4; 3/4 moist) clay loam; weak, fine, granular structure; friable when when moist, slightly hard when dry; calcareous; few (less than 1 percent) small (5 to 8 millimeters), hard lime concretions and prominent lime films and streaks; few fine roots; clear boundary.

C_{ca} 41 to 48 inches, light-red (2.5YR 6/6; 4/6 moist) light silty clay loam mottled with lighter colored lime blotches (2.5YR 7/6); nearly structureless; no worm activity; friable when moist, hard when dry; highly calcareous; few coarse (1.5 to 2.5 centimeters), hard lime concretions; very few fine roots; diffuse boundary.

C 48 to 58 inches+, light-red (2.5YR 6/6; 4/6 moist) silty clay loam; lighter colored lime blotches; structureless and more dense than horizons above; slightly firm when moist, hard when dry.

Dark-colored krotovinas are common above a depth of 41 inches.

NOBSCOT FINE SAND

Location of profile: 16 miles W. and 6 miles N. of Vici, Okla.; 1,630 feet W. and 195 feet N. of SE. corner of sec. 5, T. 20 N., R. 22 W., Woodward County

A_{00} 0 to ¼ inch, partially decomposed leaf mold; dark gray when dry, black when moist; not sampled as a separate horizon.

A_1 ¼ to 5 inches, grayish-brown (10YR 5/2; 3/2 moist) fine sand; single grain; very friable when moist, loose when dry; wavy to irregular, clear boundary; 3 to 7 inches thick.

A_{21} 5 to 13 inches, pale-brown (10YR 6/3; 5/3 moist) fine sand; single grain; very friable when moist, loose when dry; diffuse boundary.

A_{22} 13 to 20 inches, pale-brown (10YR 6/3; 5/3 moist) fine sand; many, very fine, strong-brown (7.5YR 5/6; 4/6 moist) mottles; massive; very friable when moist, slightly hard when dry; clear, very irregular or wavy boundary; 6 to 14 inches thick.

B_{21} 20 to 32 inches, reddish-yellow (5YR 6/8; 5/8 moist) fine sand; massive; banded with distinct, very irregular layers of yellowish-red (5YR 5/6; 4/6 moist) loamy sand; fine sand, very friable when moist, slightly hard when dry; loamy sand, very friable when moist, very hard when dry; bands about 1½ inches thick and 2 inches apart; diffuse boundary.

B_{22} 32 to 44 inches, reddish-yellow (5YR 6/8; 5/8 moist) fine sand; massive; banded with distinct, very irregular layers of yellowish-red (5YR 5/6; 4/6 moist) loamy sand, about 1 inch thick and 2 to 6 inches apart; fine sand, very friable when moist, slightly hard when dry; loamy sand, very friable when moist, very hard when dry; fine and coarse roots common; diffuse boundary.

B^3 44 to 54 inches, reddish-yellow (5YR 6/8; 5/8 moist) fine sand; massive; banded with prominent, very irregular to broken layers of yellowish-red (5YR 5/6; 4/6 moist) loamy sand, about ½ inch thick and 4 to 8 inches apart and having abrupt boundaries; fine sand is very friable when moist, slightly hard when dry; loamy sand is very friable when moist, very hard when dry; diffuse boundary.

C 54 to 65 inches +, reddish-yellow (5YR 6/8; 5/8 moist) fine sand; massive; banded with distinct, very irregular to broken layers of yellowish-red (5YR 5/6; 4/6 moist) loamy sand, about ¼ inch thick and 6 to 12 inches apart and having abrupt boundaries; fine sand is very friable when moist, slightly hard when dry; loamy sand is very friable when moist, very hard when dry.

TABLE 13.—*Physical analysis*

[Dashes indicate

Soil type, location of sample, sample and laboratory numbers	Depth	Horizon	Size class and diameter of particles						
			Very coarse sand (2–1 mm.)	Coarse sand (1–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.10 mm.)	Very fine sand (0.10–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (less than 0.002 mm.)
	Inches		*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Carey silt loam: *Location:* 7 miles N. of Arapaho, Okla.; 950 feet N. and 1,000 feet E. of SW. corner of sec. 13, T. 14 N., R. 17 W., I.M., Custer County. (*Sample No.* S 59–Okla–20–1 (1–7); *laboratory No.* 11458–11464.)	0–7	A_{1p}	<0.1	0.2	0.2	6.9	34.5	39.4	18.8
	7–17	B_{21}	<.1	.1	.2	6.1	29.8	40.9	22.9
	17–23	B_{22}	<[1] .1	[2] .2	[2] .3	[2] 8.2	35.0	33.6	22.7
	23–30	B_3	[1] .2	[1] .4	[3] .4	[2] 7.4	[2] 39.1	31.5	21.0
	30–40	C_1	[1] .6	[1] .4	[3] .3	[2] 7.2	[2] 42.4	34.2	16.9
	40–50	C_2	[1] .2	[1] .3	[3] .2	[2] 6.6	[2] 41.1	36.6	15.0
	50–57	C_{ca}	[1] 3.2	[1] 2.6	[1] 1.2	[3] 4.6	[3] 30.3	43.7	14.4
Carey silt loam: *Location:* 2 miles S. of Butler, Okla.; 362 feet S. and 137 feet W. of NE. corner of SE¼ sec. 11, T. 13 N., R. 19 W., I.M., Custer County. (*Sample No.* S 59–Okla–20–2 (1–8); *laboratory No.* 11465–11472.)	0–7	A_{1p}	.1	.2	.3	2.0	28.8	50.4	18.2
	7–13	A_{12}	<.1	.1	.2	1.8	26.7	52.1	19.1
	13–17	B_{21}	.1	.1	.2	1.9	25.9	52.0	19.8
	17–25	B_{22}	[2] .2	[2] .2	[2] .4	[2] 2.2	[2] 25.7	49.8	21.5
	25–34	B_{31}	[3] .5	[3] .2	[3] .3	[3] 2.2	[2] 22.1	52.2	22.5
	34–41	B_{32}	[3] .2	[3] .4	[3] .4	[3] 1.8	[2] 16.2	53.6	27.4
	41–48	C_{ca}	[1] .9	[1] 1.6	[3] 1.2	[3] 3.3	[3] 13.1	56.1	23.8
	48–58	C	[1] .8	[1] 1.3	[1] 1.0	[3] 3.4	[3] 13.8	58.5	21.2
Nobscot fine sand: *Location:* 16 miles W. and 6 miles N. of Vici, Okla.; 1,630 feet W. and 195 feet N. of SE. corner of sec. 5, T. 20 N., R. 22 W., I.M., Woodward County. (*Sample No.* S 59–Okla–77–1 (1–7); *laboratory No.* 11473–11479.)	¼–5	A_1	.2	3.7	20.8	57.9	7.5	7.9	2.0
	5–13	A_{21}	<.1	2.9	21.0	61.5	8.2	4.9	1.5
	13–20	A_{22}	<.1	2.7	19.8	63.8	8.5	3.3	1.9
	20–32	B_{21}	<.1	2.1	18.0	60.6	6.5	3.7	9.1
	32–44	B_{22}	<.1	2.3	19.8	61.8	6.9	2.1	7.1
	44–54	B_3	<.1	3.3	21.1	62.0	6.0	1.7	5.9
	54–65	C	<.1	2.5	19.5	61.7	8.6	2.5	5.2
Nobscot fine sand: *Location:* 16 miles W. and 10½ miles N. of Vici, Okla.; 445 feet E. and 106 feet S. of W¼ corner of sec. 20, T. 20 N., R. 22 W., I.M., Woodward County. (*Sample No.* S 59–Okla–77–2 (1–7); *laboratory No.* 11480–11486.)	0–5	A_1	.1	2.5	20.4	53.3	9.3	10.8	3.6
	5–13	A_{21}	<.1	2.9	23.9	54.9	9.4	6.8	2.1
	13–21	A_{22}	<.1	2.8	24.3	57.6	8.4	5.0	1.9
	21–30	A_{23}	<.1	2.9	23.4	53.1	8.0	7.1	5.5
	30–40	B_{21}	<.1	2.2	19.7	52.3	6.7	7.5	11.6
	40–51	B_{22}	<.1	2.9	24.6	55.9	6.4	3.9	6.3
	51–56	C	<.1	2.9	22.3	57.8	7.6	3.3	6.1
St. Paul silt loam: *Location:* ¾ mile N. and 1¼ miles E. of Mutual, Okla.; 1,480 feet W. and 1,090 feet N. of center of sec. 5, T. 20 N., R. 18 W., I.M., Woodward County. (*Sample No.* S 59–Okla–77–3 (1–8); *laboratory No.* 11487–11494.)	0–7	A_{1p}	<.1	.2	.8	4.6	29.6	51.3	18.5
	7–14	A_{12}	<.1	.2	.9	4.6	25.7	49.8	18.8
	14–20	A_{13}	<.1	.3	1.1	5.5	25.5	46.7	20.9
	20–28	B_1	<.1	.4	1.4	6.9	25.1	43.2	23.0
	28–34	B_{21}	<.1	.2	1.0	6.1	19.7	42.4	30.6
	34–46	B_{22}	<.1	.1	.6	5.5	20.0	43.9	29.9
	46–55	B_3	<.1	.1	1.0	12.3	30.0	35.2	21.4
	55–65	C_{ca}	[1] .1	[2] .1	[2] .7	[2] 14.8	[2] 46.1	23.7	14.5
St. Paul silt loam: *Location:* 2¼ miles SE. of Seiling, Okla.; 1,700 feet E. and 480 feet S. of NW. corner of sec. 15, T. 19 N., R. 16 W., I.M., Dewey County. (*Sample No.* S 59–Okla–22–1 (1–9); *laboratory No.* 11495–11503.)	0–7	A_{1p}	<.1	.1	.3	2.2	28.4	54.3	14.7
	7–14	A_{12}	.2	.1	.2	1.7	22.8	54.6	20.4
	14–20	A_{13}	.1	.1	.2	1.8	22.5	53.0	22.3
	20–28	B_{11}	<.1	.1	.2	1.9	21.4	52.6	23.8
	28–36	B_{12}	<.1	.1	.2	2.0	21.7	51.6	24.4
	36–45	B_{21}	<.1	.2	.4	2.6	16.9	48.8	31.1
	45–50	B_{22}	<.1	.2	.5	3.3	17.4	41.2	37.4
	50–58	B_3	[1] .3	[1] .4	[2] .8	[2] 4.7	[2] 23.4	39.0	31.4
	58–65	C	[1] .2	[1] .4	[2] .8	[2] 5.7	[2] 27.7	37.4	27.8

[1] Many calcium carbonate concretions.
[2] Trace of calcium carbonate concretions.

of important soils

values not determined]

Size class and diameter of particles—Continued: International classification: II (0.2–0.02 mm.)	Size class and diameter of particles—Continued: International classification: III (0.02–0.002 mm.)	Larger than 2 mm.	Textural class	Bulk density	Moisture held at tensions of—: 1/10 atmosphere	Moisture held at tensions of—: 1/5 atmosphere	Moisture held at tensions of—: 15 atmospheres	Moisture at saturation
Percent	*Percent*	*Percent*		*Gm./cu. cm.*	*Percent*	*Percent*	*Percent*	*Percent*
68.1	12.2		Loam		31.5	18.1	7.1	43.0
60.8	15.6		Loam	1.49	34.5	21.1	9.1	49.9
63.8	12.4	(4)	Loam		31.9	19.4	8.9	45.7
66.2	11.2	(4)	Loam	1.63	31.8	19.6	8.4	42.7
69.1	12.3	(4)	Loam		30.4	18.6	7.3	42.4
70.9	13.1	(4)	Loam	1.64	28.6	17.5	6.5	43.7
56.0	21.8	(4)	Loam		25.6	17.9	5.7	38.8
69.6	11.0		Silt loam		32.8	20.1	7.5	42.5
68.5	11.6		Silt loam	1.35	33.4	18.5	7.9	47.3
67.7	11.6	(4)	Silt loam		30.5	18.2	8.2	47.7
62.8	14.3	(4)	Loam and silt loam	1.32	28.9	18.8	8.5	45.8
60.0	15.9	(4)	Silt loam		29.0	19.9	9.0	48.4
49.5	21.6	(4)	Silty clay loam and silt loam	1.39	31.4	22.3	10.8	52.0
40.4	30.8	(4)	Silt loam		30.5	22.5	7.8	45.2
42.5	32.0	(4)	Silt loam		27.2	20.8	6.5	39.8
39.4	1.8		Fine sand		7.7	3.6	2.0	27.8
40.3	.5		Fine sand		4.0	1.4	.6	27.9
38.3	.5		Fine sand		3.8	1.2	.8	25.2
37.5	.7		Fine sand	1.69	10.2	6.8	4.3	30.1
34.0	.5		Fine sand		7.6	4.4	2.7	25.0
32.1	.3		Fine sand	1.66	6.5	3.6	1.9	28.1
38.6	.4		Fine sand		6.0	3.2	1.7	27.3
38.7	2.3		Fine sand		10.9	4.9	2.6	34.8
37.5	.7		Fine sand		5.0	1.4	.8	27.2
34.8	.6		Fine sand		4.1	1.2	.5	25.9
34.1	1.1		Loamy fine sand and fine sand		7.9	4.0	1.9	22.8
35.0	.9		Fine sandy loam	1.73	13.6	8.2	4.6	25.6
31.1	1.5		Fine sand		7.8	4.6	2.6	24.4
34.5	.5		Fine sand		6.3	3.6	2.2	24.6
78.8	11.8		Silt loam		30.6	14.4	5.7	35.9
66.3	12.4		Loam and silt loam	1.47	35.3	18.9	7.9	41.2
63.8	12.3		Loam		35.1	29.0	8.5	43.3
60.5	12.5		Loam	1.55	32.5	27.8	9.3	45.2
49.2	17.2		Clay loam		35.7	33.5	12.4	51.6
46.8	21.2		Clay loam		34.1	33.0	12.1	50.6
58.8	15.8		Loam	1.66	30.3	28.5	8.9	43.7
73.2	8.9		Very fine sandy loam		26.3	23.1	6.6	37.9
72.1	12.3		Silt loam		30.3	13.8	6.3	36.8
64.9	13.8		Silt loam		33.7	17.2	8.5	45.8
62.8	14.1		Silt loam	1.43	34.7	18.5	9.3	45.6
60.3	15.2		Silt loam		33.9	20.0	10.2	49.4
58.9	16.0		Silt loam		30.8	18.3	9.7	46.8
48.1	19.6		Clay loam and silty clay loam	1.70	33.1	22.7	12.5	52.1
43.3	17.8		Clay loam		36.0	25.4	15.0	58.7
50.8	15.2		Clay loam		34.1	22.8	12.8	51.5
55.6	13.9	(4)	Clay loam		33.9	20.2	11.3	48.8

[3] Few calcium carbonate concretions.
[4] Trace.

TABLE 14.—*Chemical analysis*

[Dashes indicate values

Soil type, location of sample, sample and laboratory numbers	Depth	Horizon	Reaction			Organic matter			Free iron
			1:1	1:5	1:10	Organic carbon	Nitrogen	C/N ratio	
Carey silt loam:	*In.*					*Pct.*	*Pct.*		
Location: 7 miles N. of Arapaho, Okla.; 950 feet N. and 1,000 feet E. of SW. corner of sec. 13, T. 14 N., R. 17 W., I.M., Custer County. (*Sample No.* S 59–Okla–20–1 (1–7); *laboratory No.* 11458–11464.)	0–7	A_{1p}	7.8	8.2	8.3	0.65	0.061	11	1.1
	7–17	B_{21}	7.9	8.2	8.3	.64	.062	10	1.3
	17–23	B_{22}	8.0	8.4	8.6	.41	.048	8	1.2
	23–30	B_3	8.1	8.5	8.7	.29	.035	8	1.2
	30–40	C_1	8.2	8.7	8.9	.14	----	----	1.2
	40–50	C_2	8.3	8.8	9.0	.08	----	----	1.2
	50–57	C_{ca}	8.5	9.0	9.2	.06	----	----	.9
Carey silt loam:									
Location: 2 miles S. of Butler, Okla.; 362 feet S. and 137 feet W. of NE. corner of SE¼ sec. 11, T. 13 N., R. 19 W., I.M., Custer County. (*Sample No.* S 59–Okla–20–2 (1–8); *laboratory No.* 11465–11472.)	0–7	A_{1p}	8.0	8.4	8.6	.91	.080	11	1.2
	7–13	A_{12}	8.0	8.2	8.4	.80	.072	11	1.1
	13–17	B_{21}	8.0	8.2	8.4	.73	.071	10	1.2
	17–25	B_{22}	8.1	8.6	8.8	.60	.061	10	1.1
	25–34	B_{31}	8.2	8.6	8.9	.52	----	----	1.1
	34–41	B_{32}	8.2	8.7	8.9	.43	----	----	1.3
	41–48	C_{ca}	8.3	8.6	9.0	.31	----	----	1.1
	48–58	C	8.4	8.7	9.1	.10	----	----	1.1
Nobscot fine sand:									
Location: 16 miles W. and 6 miles N. of Vici, Okla.; 1,630 feet W. and 195 feet N. of SE. corner of sec. 5, T. 20 N., R. 22 W., I.M., Woodward County. (*Sample No.* S 59–Okla–77–1 (1–7); *laboratory No.* 11473–11479.)	¼–5	A_1	6.6	6.9	7.1	.86	.049	18	.2
	5–13	A_{21}	6.1	6.3	6.5	.18	.018	10	.1
	13–20	A_{22}	5.7	5.9	6.2	.13	.008	16	.1
	20–32	B_{21}	5.3	5.4	5.6	.24	.019	13	.4
	32–44	B_{22}	5.2	5.7	6.2	.09	----	----	.3
	44–54	B_3	5.9	6.1	6.3	.06	----	----	.2
	54–65	C	6.3	6.7	6.6	.04	----	----	.2
Nobscot fine sand:									
Location: 16 miles W. and 10½ miles N. of Vici, Okla.; 445 feet E. and 106 feet S. of W¼ corner of sec. 20, T. 20 N., R. 22 W., I.M., Woodward County. (*Sample No.* S 59–Okla–77–2 (1–7); *laboratory No.* 11480–11486.)	0–5	A_1	6.9	7.1	7.0	1.05	.069	15	.2
	5–13	A_{21}	6.6	6.7	6.6	.12	.009	13	.1
	13–21	A_{22}	6.7	6.9	6.6	.06	.006	10	.2
	21–30	A_{23}	6.2	6.4	6.5	.09	.008	11	.2
	30–40	B_{21}	5.2	5.6	5.7	.13	----	----	.4
	40–51	B_{22}	5.8	6.0	6.2	.06	----	----	.3
	51–56	C	5.9	6.2	6.3	.06	----	----	.2
St. Paul silt loam:									
Location: ¾ mile N. and 1¼ miles E. of Mutual, Okla.; 1,480 feet W. and 1,090 N. of center of sec. 5, T. 20 N., R. 18 W., I.M., Woodward County. (*Sample No.* S 59–Okla–77–3 (1–8); *laboratory No.* 11487–11494.)	0–7	A_{1p}	6.2	6.6	6.7	.86	.068	13	.7
	7–14	A_{12}	6.6	7.0	7.0	.81	.068	12	.9
	14–20	A_{13}	7.0	7.4	7.5	.64	.055	12	.9
	20–28	B_1	7.3	7.4	7.7	.52	.050	10	.9
	28–34	B_{21}	7.5	7.7	7.9	.53	----	----	1.0
	34–46	B_{22}	7.5	8.0	8.0	.47	----	----	1.0
	46–55	B_3	7.9	8.3	8.5	.30	----	----	.7
	55–65	C_{ca}	8.1	8.8	8.9	.17	----	----	.6
St. Paul silt loam:									
Location: 2¼ miles SE. of Seiling, Okla.; 1,700 feet E. and 480 feet S. of NW. corner of sec. 15, T. 19 N., R. 16 W., I.M., Dewey County. (*Sample No.* S 59–Okla–22–1 (1–9); *laboratory No.* 11495–11503.)	0–7	A_{1p}	6.3	6.8	6.9	.76	.066	12	.9
	7–14	A_{12}	6.8	7.0	7.3	.84	.072	12	1.0
	14–20	A_{13}	7.2	7.4	7.6	.72	.065	11	1.0
	20–28	B_{11}	7.2	7.5	7.7	.55	.052	10	1.1
	28–36	B_{12}	7.3	7.5	7.8	.45	----	----	1.1
	36–45	B_{21}	7.4	7.7	7.8	.48	----	----	1.2
	45–50	B_{22}	7.3	7.7	8.0	.43	----	----	1.3
	50–58	B_3	7.9	8.2	8.5	.25	----	----	1.3
	58–65	C	8.1	8.4	8.5	.24	----	----	1.2

of important soils

not determined]

Electrical conductivity (Ec x 10³)	$CaCO_3$ equivalent	Cation exchange capacity (NH_4Ac)	Extractable cations: Ca	Mg	H	Na	K	Base saturation (NH_4Ac)	Base saturation (Sum)	Sum of extractable bases	Sum of extractable cations	Ca/Mg
millimhos per cm. at 25° C.	*Pct.*	*meq./100 gm.*	*meq./100 gm.*	*meq./100 gm.*	*meq./100 gm.*	*meq./100 gm.*	*meq./100 gm.*	*Pct.*	*Pct.*	*meq./100 gm.*	*meq./100 gm.*	
0.4	<1	12.2	9.8	3.4	1.0	<0.1	0.4	111	93	13.6	14.6	2.9
.4	<1	14.4	10.2	5.2	1.7	.1	.3	110	90	15.8	17.5	2.0
.4	2	13.6	14.3	4.7	.7	.1	.3	143	96	19.4	20.1	3.0
.4	1	12.4	----	----	----	.1	.3	----	----	----	----	----
.4	2	9.9	----	----	----	<.1	.2	----	----	----	----	----
.4	1	8.8	----	----	----	.1	.2	----	----	----	----	----
.4	20	6.3	----	----	----	.1	.2	----	----	----	----	----
.5	<1	14.1	17.4	1.8	.5	<.1	.5	140	98	19.7	20.2	9.7
.6	<1	15.1	14.1	2.6	1.2	<.1	.4	113	93	17.1	18.3	5.4
.5	<1	15.3	14.0	3.5	.7	<.1	.3	116	96	17.8	18.5	4.0
.4	4	13.4	----	----	----	<.1	.3	----	----	----	----	----
.4	6	13.7	----	----	----	.1	.3	----	----	----	----	----
.4	9	16.4	----	----	----	.1	.3	----	----	----	----	----
.5	31	9.5	----	----	----	.1	.2	----	----	----	----	----
.5	30	7.4	----	----	----	.1	.2	----	----	----	----	----
.4	<1	4.1	3.3	.4	1.9	<.1	.1	93	67	3.8	5.7	8.2
.2	----	1.5	1.0	.2	.7	<.1	<.1	80	63	1.2	1.9	5.0
.2	----	1.3	.7	.1	.7	<.1	<.1	62	53	.8	1.5	7.0
.3	----	7.1	3.6	1.5	2.8	<.1	.2	75	65	5.3	8.1	2.4
.3	----	4.6	2.9	1.0	1.6	<.1	.1	87	71	4.0	5.6	2.9
.2	----	3.5	2.2	.8	1.4	<.1	.1	88	69	3.1	4.5	2.8
.3	----	3.0	1.9	.8	1.2	<.1	.1	93	70	2.8	4.0	2.4
.4	<1	5.8	5.0	.7	1.4	<.1	.2	102	81	5.9	7.3	7.1
.3	<1	1.4	1.2	.4	.5	<.1	.1	121	77	1.7	2.2	3.0
.2	<1	1.1	.8	.1	.5	<.1	.1	91	67	1.0	1.5	8.0
.3	----	3.3	2.1	.8	1.2	<.1	.1	91	71	3.0	4.2	2.6
.3	----	7.5	4.3	1.9	3.3	<.1	.2	85	66	6.4	9.7	2.3
.3	----	4.2	2.7	1.0	1.6	<.1	.1	90	70	3.8	5.4	2.7
.3	----	3.5	2.1	1.0	1.2	<.1	.1	91	73	3.2	4.4	2.1
.5	----	10.1	6.1	2.5	2.8	<.1	1.0	95	77	9.6	12.4	2.4
.4	<1	13.3	9.2	3.9	2.6	<.1	.8	103	84	13.9	16.5	2.4
.4	<1	14.6	10.2	4.3	1.7	<.1	.6	103	90	15.1	16.8	2.4
.4	<1	15.9	11.4	5.2	1.9	<.1	.6	108	90	17.2	19.1	2.2
.3	<1	19.4	13.5	6.7	2.2	.1	.9	109	90	21.2	23.4	2.0
.4	<1	19.8	13.6	7.2	1.7	.1	.9	110	93	21.8	23.5	1.9
.5	<1	15.5	11.3	6.2	1.0	.1	.6	117	95	18.2	19.2	1.8
.5	2	11.3	15.9	5.3	<.1	.1	.5	193	100	21.8	21.8	3.0
.4	----	11.0	7.4	2.6	3.1	<.1	.9	99	78	10.9	14.0	2.8
.4	<1	14.5	10.9	3.4	2.6	<.1	.5	102	85	14.8	17.4	3.2
.4	<1	16.0	12.0	4.0	2.2	.1	.5	104	88	16.6	18.8	3.0
.4	<1	16.7	12.3	4.4	2.2	.1	.5	104	89	17.3	19.5	2.8
.4	<1	16.9	12.4	4.8	1.7	.1	.4	105	91	17.7	19.4	2.6
.4	<1	20.7	14.8	6.3	1.9	.2	.5	105	92	21.8	23.7	2.3
.4	<1	23.8	17.5	7.6	2.0	.2	.6	109	93	25.9	27.9	2.3
.5	1	19.5	21.2	6.7	.7	.1	.6	147	98	28.6	29.3	3.2
.4	1	16.4	20.7	6.1	<.1	.1	.5	167	100	27.4	27.4	8.4

NOBSCOT FINE SAND

Location of profile: 16 miles W. and 10½ miles N. of Vici, Okla.; 445 feet E. and 106 feet S. of W¼ corner of sec. 20, T. 20 N., R. 22 W., Woodward County

A_1 0 to 5 inches, grayish-brown (10YR 5/2; 3/1 moist) fine sand; single grained; loose and very friable; clear, wavy boundary; 3 to 8 inches thick.

A_{21} 5 to 13 inches, light-gray (10YR 7/2; 5/2 moist) fine sand; massive; very friable when moist, slightly hard when dry; very faint, diffuse boundary.

A_{22} 13 to 21 inches, very pale brown (10YR 8/3; 6/3 moist) fine sand; massive; very friable when moist, slightly hard when dry; weak salt-and-pepper effect, with very fine brownish-yellow (10YR 6/6, dry) spots; diffuse boundary.

A_{23} 21 to 30 inches, mottled very pale brown (10YR 7/3 moist or dry) and light-brown (7.5YR 6/4 moist or dry) fine sand; massive; very friable when moist, hard when dry; abrupt, very irregular to broken boundary; thickness of A_2 horizons, 20 to 35 inches.

B_{21} 30 to 40 inches, reddish-yellow (7.5YR 6/6; 5/6 moist) fine sand; massive; coarsely banded with very irregular to broken, often merging layers of yellowish-red (5YR 4/8 moist or dry) loamy sand, 2 to 3 inches thick and 6 inches apart; fine sand is very friable when moist, slightly hard when dry; loamy sand is very friable when moist, very hard when dry; many fine and coarse roots; diffuse boundary.

B_{22} 40 to 51 inches, reddish-yellow (7.5YR 6/6; 5/6 moist) fine sand; massive; coarsely banded with very irregular to broken, often merging layers of yellowish-red (5YR 4/8 moist or dry) loamy sand, 1 to 1½ inches thick and 8 to 12 inches apart; fine sand, very friable when moist, slightly hard when dry; loamy sand, very friable when moist, very hard when dry; diffuse boundary.

C 51 to 56 inches, reddish-yellow (7.5YR 6/6; 5/6 moist) fine sand; massive; coarsely banded with very irregular to broken, often merging layers of yellowish-red (5YR 4/8 moist or dry) loamy sand, ¼ inch thick and about 8 to 12 inches apart; fine sand, very friable when moist, slightly hard when dry; loamy sand, very friable when moist, very hard when dry.

ST. PAUL SILT LOAM

Location of profile: ¾ mile N. and 1¼ miles E. of Mutual, Okla.; 1,480 feet W. and 1,090 feet N. of center of sec. 5, T. 20 N., R. 18 W., Woodward County

A_{1p} 0 to 7 inches, grayish-brown (10YR 5/2; 3/2 moist) silt loam; weak, fine, granular structure; very friable when moist, slightly hard when dry; upper 2 inches weakly stratified with darker layers; plowed boundary.

A_{12} 7 to 14 inches, dark grayish-brown (10YR 4/2; 2/2 moist; 3/2 crushed) silt loam; moderate, fine, granular structure, abundant worm casts; very friable when moist, slightly hard when dry; gradual boundary.

A_{13} 14 to 20 inches, brown (7.5YR 4/2; 3/2 moist or crushed) heavy silt loam; moderate, fine, granular structure; numerous worm casts; friable when moist, hard when dry; clear, smooth boundary.

B_1 20 to 28 inches, brown (7.5YR 4/2; 3/2 moist or crushed) light silty clay loam; moderate, medium and fine, granular structure; numerous worm casts; friable when moist, hard when dry; few thin clay skins; gradual boundary.

B_{21} 28 to 34 inches, brown (7.5YR 4/2; 3/2 moist or crushed) silty clay loam; moderate, medium and fine, subangular blocky structure; clay films continuous; few worm casts; friable when moist, hard when dry; clear, smooth boundary.

B_{22} 34 to 46 inches, brown (7.5YR 4/2; 2/2 moist; 3/2 crushed) light silty clay; very weak, coarse prisms break to strong, fine and medium, subangular blocky structure; moderate, continuous clay films; slightly firm when moist, very hard when dry; gradual boundary.

B_3 46 to 55 inches, brown (7.5YR 4/2; 3/2 moist) silty clay loam; weak, coarse prisms break to moderate, medium, subangular blocky structure; slightly calcareous, no visible segregated lime; clear boundary.

C_{ca} 55 to 65 inches, reddish-brown (5YR 4/4; 3/3 moist; 4/6 crushed) loam; high content of fine sand; weak, coarse prisms with slightly darkened faces; friable when moist, slightly hard when dry; calcareous with few faint lime blotches.

ST. PAUL SILT LOAM

Location of profile: 2¼ miles SE. of Seiling, Okla., 1,700 feet E. and 480 feet S. of NW. corner of sec. 15, T. 19 N., R. 16 W., Dewey County

A_{1p} 0 to 7 inches, dark-brown (10YR 4/3; 3/2 moist or crushed) silt loam; weak, fine, granular structure; very friable when moist, soft when dry; plowed boundary.

A_{12} 7 to 14 inches, dark grayish-brown (10YR 4/2; 2/2 moist; 3/2 crushed) silt loam; moderate, fine, granular structure; numerous worm casts; very friable when moist, soft when dry; no discernible boundary.

A_{13} 14 to 20 inches, dark grayish-brown (10YR 4/2; 2/2 moist; 3/2 crushed) heavy silt loam; strong, fine, granular structure; abundant worm casts; very friable when moist, soft when dry; gradual, indistinct boundary.

B_{11} 20 to 28 inches, brown (7.5YR 4/2; 3/2 moist or crushed) light silty clay loam; moderate to weak, fine, granular structure; many worm casts; friable when moist, slightly hard when dry; gradual boundary.

B_{12} 28 to 36 inches, brown (7.5YR 4/2; 3/2 moist; 4/2 crushed) silty clay loam; moderate, fine, subangular blocky structure; thin, patchy clay films; slightly firm when moist, hard when dry; clear boundary.

B_{21} 36 to 45 inches, dark-brown (7.5YR 4/2; 3/2 moist or crushed) heavy silty clay loam; moderate, medium to fine, subangular blocky structure; thin, continuous clay films; slightly firm when moist, hard when dry; clear boundary.

B_{22} 45 to 50 inches, reddish-brown (5YR 4/3; 3/3 moist; 4/3 crushed) silty clay; strong, fine and medium, angular blocky structure; moderate, continuous clay films; firm when moist, very hard when dry; rootlets penetrate peds; clear boundary.

B_3 50 to 58 inches, reddish-brown (5YR 4/4; 3/4 moist or crushed) sticky clay loam; moderate to strong, medium, angular blocky structure; thin, nearly continuous clay films; friable when moist, hard when dry; weakly calcareous, grading with depth to moderately calcareous with very few soft and hard lime concretions; clear boundary.

C 58 to 65 inches, yellowish-red (5YR 5/6; 4/5 moist or crushed) light clay loam; very weak, medium and fine, subangular blocky structure; friable when moist, slightly hard when dry; strongly calcareous with many lime veinlets and blotches and a few small, hard lime concretions.

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Glossary

Aggregate. Many fine particles held in a single mass or cluster, such as a clod, crumb, block, or prism. Many properties of the aggregate differ from those of an equal mass of unaggregated soil.

Alluvium. Fine material, such as sand, silt, and clay, deposited on land by streams.

Calcareous. Of a soil, containing enough calcium carbonate to effervesce (fizz) when treated with dilute hydrochloric acid. Alkaline in reaction because of the presence of free calcium carbonate.

Caliche. More or less strongly cemented deposits of calcium carbonate in many soils of warm-temperate areas. When near the surface or exposed by erosion, the material hardens.

Chisel. A tillage machine that has one or more soil-penetrating points that can be drawn through the soil to loosen or shatter the subsoil to a depth of 12 to 18 inches.

Clay. (1) As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. (2) As a soil textural class, soil that is 40 percent or more clay, as defined under (1); less than 45 percent sand, and less than 40 percent silt. See Sand and Silt.

Clay film. Thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat; clay skin.

Climax (ecology). The stabilized plant community on a given site; it reproduces itself and does not change so long as the environment remains unchanged.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A mapping unit consisting of different kinds of soils that occur together in such small individual areas or in such an intricate pattern that they cannot be shown separately on a publishable soil map.

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 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, 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.

Deep plowing. A tillage practice, generally used as a protective measure against wind erosion, whereby the finer textured subsoil is turned up and mixed with the sandy surface layer. In Roger Mills County, the soil is usually broken to depths of 20 to 24 inches by deep plowing.

Horizon, soil. A layer of soil, approximately parallel to the soil surface, that has distinct characteristics produced by soil-forming processes.

Permeability, soil. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are—*very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Permian. A period of geologic time that occurred between 185 and 210 million years ago; also, geologic material deposited during the Permian period.

Phase, soil. A subdivision of a soil type, series, or other unit in the soil classification system made because of differences that affect management but do not affect the classification of the soil in the natural landscape. A soil type, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects management.

Pleistocene. An epoch in geologic time that occurred between 25 thousand and 1 million years ago; also, geologic material deposited during this epoch.

Pliocene. An epoch in geologic time that occurred between 1 million and 12 million years ago; also, geologic material deposited during this epoch.

Plowpan. A compacted layer formed in the soil just below the plowed layer.

Profile, soil. A vertical section of the soil through all of its horizons and extending into the parent material. See Horizon, soil.

Quaternary. A period of geologic time that began about 1 million years ago and continues to the present.

Range site. An area of range where climate, soil, and topography are sufficiently uniform to produce a distinct kind of climax vegetation.

Reaction. The degree of acidity or alkalinity, 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	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

All the soils in Roger Mills County are slightly acid, neutral, or mildly alkaline (pH 6.1 to 8.0).

Recent. The current epoch of geologic time; a division of the Quaternary period.

Sand. (1) As a soil separate, the rock or mineral fragments between 0.05 millimeter and 2.0 millimeters in diameter. Sand grains are mostly quartz, but they may be of any mineral composition. (2) As a textural class, soil that is 85 percent or more sand and not more than 10 percent clay.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Silt. (1) As a soil separate, the individual mineral particles between 0.002 millimeter and 0.05 millimeter in diameter. (2) As a textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated soil particles. Structure is classified according to grade, class, and type.

Grade refers to the degree of distinctness of aggregation; it is described as *weak, moderate,* or *strong.*

Class refers to the size of the aggregate. It is described as *very fine* or *very thin; fine* or *thin; medium; coarse* or *thick;* and *very coarse* or *very thick.*

Type refers to the shape and arrangement of the aggregate. The common types are—platy (laminated); prismatic (vertical axis of aggregates longer than horizontal); columnar (prisms with rounded tops); blocky (angular or subangular); and granular. Structureless soils are (1) single grain (each grain by itself, as in dune sand); or (2) massive (the particles adhering without any regular cleavage, as in many claypans and hardpans).

Stubble mulch. A mulch consisting of the stubble and other crop residues left in and on the surface of the soil as a protective cover during the preparation of a seedbed and during at least part of the growing period of the succeeding crop.

Subsoil. Technically, the B horizon; roughly, that part of the profile below plow depth.

Surface soil. Technically, the A horizon; commonly, the part of the upper profile stirred by plowing.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surplus runoff so that it may soak into the soil or flow slowly to a prepared outlet without causing harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep sodded channel.

Texture, soil. The relative proportion of sand, silt, and clay particles in a mass of soil. (See also Clay, Sand, and Silt.) The basic textural classes in order of increasing proportions of fine particles, are as follows: *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."

Type, soil. A subdivision of the soil series that is made on the basis of differences in the texture of the surface layer.

GUIDE TO MAPPING UNITS

[See table 6, p. 11, for approximate acreage and proportionate extent of soils; table 7, p. 32, for estimated productivity ratings of each soil; and tables 9, 10, and 11, pp. 42, 46, and 48, respectively, for information on the engineering properties of soils]

Map symbol	Soil	Page	Capability unit Symbol	Capability unit Page	Range site Name	Range site Page
Br	Brazos loamy fine sand	12	IIIe-4	28	Deep Sand	34
CaB	Carey silt loam, 1 to 3 percent slopes	12	IIe-1	26	Loamy Prairie	35
CaC	Carey silt loam, 3 to 5 percent slopes	12	IIIe-1	28	Loamy Prairie	35
DaB	Dalhart fine sandy loam, 1 to 3 percent slopes	12	IIIe-3	28	Sandy Prairie	35
DaC	Dalhart fine sandy loam, 3 to 5 percent slopes	13	IVe-3	29	Sandy Prairie	35
DaD	Dalhart fine sandy loam, 5 to 8 percent slopes	13	IVe-3	29	Sandy Prairie	35
DfB	Dill-Quinlan fine sandy loams, 1 to 3 percent slopes	13	IIIe-3	28	Sandy Prairie	35
DfC	Dill-Quinlan fine sandy loams, 3 to 5 percent slopes	13	IIIe-3	28	Sandy Prairie	35
EnA	Enterprise very fine sandy loam, 0 to 1 percent slopes	13	IIe-3	27	Loamy Prairie	35
EnB	Enterprise very fine sandy loam, 1 to 3 percent slopes	13	IIe-3	27	Loamy Prairie	35
EnC	Enterprise very fine sandy loam, 3 to 5 percent slopes	14	IIIe-1	28	Loamy Prairie	35
EnD	Enterprise very fine sandy loam, 5 to 8 percent slopes	14	IVe-1	29	Loamy Prairie	35
Er	Eroded sandy land	14	VIe-3	30	Eroded Sandy Land	35
HoA	Holdrege silt loam, 0 to 1 percent slopes	14	IIc-1	27	Loamy Prairie	35
HoB	Holdrege silt loam, 1 to 3 percent slopes	14	IIe-1	26	Loamy Prairie	35
KeA	Kenesaw silt loam, 0 to 1 percent slopes	14	IIc-1	27	Loamy Prairie	35
Ln	Lincoln soils	15	VIw-1	30	Sandy Bottom Land	36
Ma3	Mansker complex, severely eroded	15	VIe-1	30	Eroded Prairie	36
MbC	Mansker loam, 2 to 5 percent slopes	15	IVe-5	29	Loamy Prairie	35
Mc	Mansker-Potter complex	15	VIe-6	30	Shallow Prairie	36
MfA	Miles fine sandy loam, 0 to 1 percent slopes	15	IIe-5	27	Sandy Prairie	35
MfB	Miles fine sandy loam, 1 to 3 percent slopes	16	IIIe-3	28	Sandy Prairie	35
MfC	Miles fine sandy loam, 3 to 5 percent slopes	16	IIIe-3	28	Sandy Prairie	35
MfD	Miles fine sandy loam, 5 to 8 percent slopes	16	IVe-3	29	Sandy Prairie	35
MmB	Miles-Dill loamy fine sands, 1 to 4 percent slopes	16	IIIe-4	28	Deep Sand	34
MnD	Miles-Nobscot complex, 5 to 8 percent slopes	16	IVe-2	29	Sandy Prairie	35
MnE	Miles-Nobscot complex, 8 to 15 percent slopes	16	VIe-2	30	Sandy Prairie	35
MxC	Miles-Springer complex, 3 to 5 percent slopes	16	IIIe-2	28	Sandy Prairie	35
NaB	Nobscot fine sand, 0 to 4 percent slopes	16	IVe-4	29	Deep Sand Savannah	34
NbB	Nobscot and Brownfield fine sands, 0 to 4 percent slopes	16	IVe-4	29	Deep Sand Savannah	34
NbC	Nobscot and Brownfield fine sands, 4 to 8 percent slopes	16	VIe-5	30	Deep Sand Savannah	34
Nc2	Nobscot and Brownfield soils, eroded	16	VIe-3	30	Eroded Sandy Land	35
No	Norwood silt loam	17	I-1	26	Loamy Bottom Land	36
PcE	Pratt complex, hilly	18	VIe-2	30	Sandy Prairie	35
PfB	Pratt loamy fine sand, undulating	18	IIIe-4	28	Deep Sand	34
PfD	Pratt loamy fine sand, hummocky	18	IVe-6	30	Deep Sand	34
PfE	Pratt loamy fine sand, hilly	18	VIe-4	30	Deep Sand	34
PsA	Pratt fine sandy loam, 0 to 1 percent slopes	18	IIe-2	26	Sandy Prairie	35
PsB	Pratt fine sandy loam, 1 to 3 percent slopes	18	IIIe-2	28	Sandy Prairie	35
PsC	Pratt fine sandy loam, 3 to 5 percent slopes	18	IVe-2	29	Sandy Prairie	35
PsD	Pratt fine sandy loam, 5 to 8 percent slopes	18	IVe-2	29	Sandy Prairie	35
Qu3	Quinlan soils, severely eroded	18	VIe-1	30	Eroded Prairie	36
QwC2	Quinlan-Woodward loams, 1 to 5 percent slopes, eroded	19	IVe-5	29	Loamy Prairie	35
QwE	Quinlan-Woodward loams, 5 to 20 percent slopes	19	VIe-6	30	Shallow Prairie	36
Ra	Reinach fine sandy loam	19	IIe-2	26	Sandy Prairie	35
Rb	Rough broken land	19	VIIs-1	31	Red Shale	36
SaA	St. Paul silt loam, 0 to 1 percent slopes	19	IIc-1	27	Loamy Prairie	35
SaB	St. Paul silt loam, 1 to 3 percent slopes	19	IIe-1	26	Loamy Prairie	35
SaC2	St. Paul silt loam, 3 to 5 percent slopes, eroded	20	IIIe-1	28	Loamy Prairie	35
SfC	Springer loamy fine sand, hummocky	20	IVe-6	30	Deep Sand	34
SfE	Springer loamy fine sand, hilly	20	VIe-4	30	Deep Sand	34
SpA	Spur and Port silt loams, 0 to 1 percent slopes	20	I-1	26	Loamy Bottom Land	36
SpB	Spur and Port silt loams, 1 to 3 percent slopes	20	IIe-6	27	Loamy Bottom Land	36
Sw	Sweetwater soils	21	Vw-1	30	Subirrigated	37
Vc	Vernon-Quinlan complex	21	VIIs-1	31	Red Shale	36
Wa	Wann soils	21	IIIw-1	29	Loamy Bottom Land	36
WdB	Woodward fine sandy loam, 1 to 3 percent slopes	21	IIe-3	27	Loamy Prairie	35
WdC	Woodward fine sandy loam, 3 to 5 percent slopes	22	IIIe-5	28	Loamy Prairie	35
WoB	Woodward loam, 1 to 3 percent slopes	22	IIe-1	26	Loamy Prairie	35
WoC	Woodward loam, 3 to 5 percent slopes	22	IIIe-1	28	Loamy Prairie	35
WoD	Woodward loam, 5 to 8 percent slopes	22	IVe-1	29	Loamy Prairie	35
WsB	Woodward-Quinlan fine sandy loams, 1 to 3 percent slopes	22	IIIe-5	28	Loamy Prairie	35
WsC	Woodward-Quinlan fine sandy loams, 3 to 5 percent slopes	22	IVe-5	29	Loamy Prairie	35
WwB	Woodward-Quinlan loams, 1 to 3 percent slopes	22	IIIe-1	28	Loamy Prairie	35
WwC	Woodward-Quinlan loams, 3 to 5 percent slopes	22	IVe-5	29	Loamy Prairie	35
Ya	Yahola fine sandy loam	22	IIe-4	27	Loamy Bottom Land	36
Za	Zavala fine sandy loam	23	IIe-4	27	Loamy Bottom Land	36

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If you wish to file an employment complaint, you must contact your agency's EEO Counselor (http://directives.sc.egov.usda.gov/33081.wba) within 45 days of the date of the alleged discriminatory act, event, or personnel action. Additional information can be found online at http://www.ascr.usda.gov/complaint_filing_file.html.

To File a Program Complaint

If you wish to file a Civil Rights program complaint of discrimination, complete the USDA Program Discrimination Complaint Form, found online at http://www.ascr.usda.gov/complaint_filing_cust.html or at any USDA office, or call (866) 632-9992 to request the form. You may also write a letter containing all of the information requested in the form. Send your completed complaint form or letter by mail to U.S. Department of Agriculture; Director, Office of Adjudication; 1400 Independence Avenue, S.W.; Washington, D.C. 20250-9419; by fax to (202) 690-7442; or by email to program.intake@usda.gov.

Persons with Disabilities

If you are deaf, are hard of hearing, or have speech disabilities and you wish to file either an EEO or program complaint, please contact USDA through the Federal Relay Service at (800) 877-8339 or (800) 845-6136 (in Spanish).

If you have other disabilities and wish to file a program complaint, please see the contact information above. If you require alternative means of communication for program information (e.g., Braille, large print, audiotape, etc.), please contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

Supplemental Nutrition Assistance Program

For additional information dealing with Supplemental Nutrition Assistance Program (SNAP) issues, call either the USDA SNAP Hotline Number at (800) 221-5689, which is also in Spanish, or the State Information/Hotline Numbers (http://directives.sc.egov.usda.gov/33085.wba).

All Other Inquiries

For information not pertaining to civil rights, please refer to the listing of the USDA Agencies and Offices (http://directives.sc.egov.usda.gov/33086.wba).