SOIL SURVEY

Pittsburg County Oklahoma

Issued May 1971

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
Oklahoma Agricultural Experiment Station

Major fieldwork for this soil survey was done in the period 1956–65. Soil names and descriptions were approved in 1966. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1965. This survey was made cooperatively by the Soil Conservation Service and the Oklahoma Agricultural Experiment Station. It is part of the technical assistance furnished to the Pittsburg County Soil and Water Conservation District.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, and woodlands; in selecting sites for roads, ponds, buildings, or other structures; and in determining the suitability of tracts of land for farming, industry, or recreation.

Locating Soils

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

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

Finding and Using Information

The "Guide to Mapping Units" can be used to find information in this publication. This guide lists all of the soils of the county in alphabetic order by map symbol. It shows the page where each kind of soil is described, and also the page for the capability unit, woodland group, and range site in which the soil has been placed.

Interpretations not included in this survey can be developed by grouping the soils according to their suitability or limitations for a particular use. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and ranchers and those who work with them can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units.

Foresters and others can refer to the section "Use of the Soils for Woodland."

Game managers, sportsmen, and others can find information about soils and wildlife habitat in the section "Use of the Soils for Wildlife."

Ranchers and others can find under "Use of the Soils for Range" groupings of the soils according to their suitability for range and descriptions of the vegetation on each range site.

Engineers and builders can find under "Use of the Soils in Engineering" tables that describe soil properties that affect engineering and show the relative suitability of the soils for specified engineering purposes.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in Pittsburg County may be especially interested in the section "General Soil Map," where broad patterns of soils are described.

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SOIL SURVEY OF PITTSBURG COUNTY, OKLAHOMA

BY LYLE C. SHINGLETON, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE OKLAHOMA AGRICULTURAL EXPERIMENT STATION.

PITTSBURG COUNTY is in the southeastern part of Oklahoma (fig. 1). The total area is 1,359 square miles, or 869,760 acres. McAlester is the county seat.

A large part of the county is fairly rugged and hilly. Post oak and blackjack oak are prevalent in rough, hilly areas in the southern, northwestern, and northeastern parts. They grow on sandstone ridges that have an approximate northeast-southwest trend. The larger prairie areas in the county are in the south-central and north-central parts. The landscape is one of stony ridges and of smoothly rolling to nearly level areas covered with tall native grass.

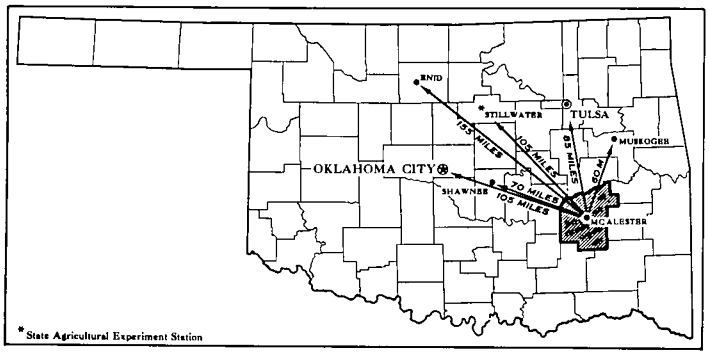

Figure 1.—Location of Pittsburg County in Oklahoma.

The elevation in the county is about 700 feet. The lowest elevation, 616 feet, is in the northeastern part of the county, and the highest, 1,017 feet, is in the southeastern part.

The county has a good drainage system. The South Canadian River, which flows along the northern border, receives about four-fifths of the drainage. A few minor streams flow southward and eventually reach the Red River. Areas on the southeastern side of the divide are drained through Jackfork Creeks, which flow in southeasterly courses toward the Red River.

Climate[1]

Pittsburg County has a warm-temperate, continental climate. Rainfall is usually ample for farm crops and community needs. The heaviest rains and the major weather changes occur when warm, moisture-laden air from the Gulf of Mexico meets cooler, drier air from the Pacific and Arctic regions.

The climate is characterized by pronounced daily and seasonal changes in temperature and variations in seasonal and annual rainfall. The changes between seasons are gradual, but the characteristics of each season are distinct. Winters are comparatively mild and short; there are only brief periods of low temperatures and snow cover. Precipitation is lightest in January. The most variable weather occurs late in spring and early in summer, when local storms are severe and bring large amounts of precipitation. Summers are long and hot. Hot spells are relieved by occasional showers or thunderstorms and moderate winds. A period of maximum precipitation also occurs early in fall and is followed by pleasant, sunny days and cool nights.

Table 1 gives temperature and precipitation data based on records at McAlester for the period 1931 to 1960. The average annual temperature is 62.2° F. The monthly average ranges from 40.7° in January to 82.9° in July and August. Periods of extreme temperatures are eased by a daily range of 22.7°. The lowest temperature on record was 10° below zero, in January 1930, and the highest was 116°, in August 1936. From October through April, freezing temperatures occur on an average of 66 days and daily highs fail to rise above freezing on only 5 of these days. Temperatures of zero and below occur in 1 out of 5 years. The warmest winters on record were those of 1941 and 1952, when the lowest temperature recorded was 19°. From February through October, the temperature reaches 90° and above 85 days each year. From June through September, it reaches 100° or above 19 days each year. Temperatures stay below 100° in only 1 year out of 10. Heating degree days number 3,156 per year. The number ranges from none during the period from June through August to a maximum of 753 in January.

The average annual precipitation ranges from 41 inches in the northwestern part of the county to 47 inches in the southeastern part. Extremes of annual rainfall have ranged from 68 inches, in 1945, to 20.71 inches, in 1963. The annual distribution of rainfall is fairly even. About 32 percent falls in spring, 27 percent in summer, 22 percent in fall, and 19 percent in winter. A daily total of 0.1 inch or more falls on an average of 59 days per year, 0.5 inch or more on 27 days, and 1 inch or more on 12 days. A daily total of 4 to 7 inches is most frequent in May and occurs in 1 out of 3 years.

[1] By STANLEY HOLBROOK, State climatologist, U.S. Weather Bureau.

TABLE 1.—*Temperature and precipitation data*

[All data from McAlester, Pittsburg County, Okla., 1931–60]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—		Average total	One year in 10 will have—		Days with snow cover of 1 inch or more	Average depth of snow on days with snow cover
			Maximum temperature equal to or higher than	Minimum temperature equal to or lower than		Less than—	More than—		
	° F.	*° F.*	*° F.*	*° F.*	*In.*	*In.*	*In.*	*No.*	*In.*
January	50. 9	30. 4	68	12	2. 13	0. 3	4. 5	4	3
February	55. 3	33. 9	72	18	3. 03	. 7	6. 7	1	2
March	63. 4	40. 2	80	24	3. 28	. 4	6. 0	(1)	2
April	72. 8	50. 0	85	35	4. 33	1. 5	7. 8	0	0
May	80. 2	58. 7	89	46	6. 10	1. 5	11. 1	0	0
June	89. 2	67. 6	99	58	4. 57	. 8	10. 3	0	0
July	94. 6	71. 2	104	64	3. 72	. 8	10. 8	0	0
August	95. 1	70. 6	107	62	3. 17	. 5	6. 5	0	0
September	88. 2	62. 4	100	50	3. 66	. 3	7. 5	0	0
October	77. 1	52. 0	90	36	3. 29	. 3	7. 2	0	0
November	62. 2	39. 4	79	24	2. 60	. 3	5. 4	(1)	1
December	53. 5	33. 0	71	18	2. 81	. 4	4. 7	(1)	2
Year	73. 5	50. 8	[2] 106	[3] 6	42. 69	29. 0	53. 1	5	2

[1] Less than 0.5 day. [2] Average annual highest maximum. [3] Average annual lowest minimum.

A measurable amount of snow falls in 5 out of 6 years. The average fall per season is 6 inches. A total of 10 inches or more falls in only 1 year out of 6. A snowfall of 4 to 6 inches usually remains on the ground a few days. The heaviest fall recorded was January 1944, when subzero temperatures maintained a snow cover 11 inches deep for 11 days.

Table 2 shows the latest dates of specified low temperatures in spring and the earliest dates in fall. These dates vary somewhat, depending on elevation, local ground conditions, vegetation, and surface air drainage. The latest dates of freezing temperatures in spring at McAlester have ranged from February 20, in 1946, to April 22, in 1927. The earliest dates of freezing temperatures in fall have ranged from October 8, in 1952, to November 23, in 1934. The freeze-free season is about 208 days in the northeastern part of the county and about 216 days in the southwestern part.

Interpolations of relative humidity, sunshine, wind, and evaporation are based on records from Fort Smith and other nearby stations. The relative humidity in winter averages nearly 81 percent at night and 61 percent in the afternoon. In summer it averages nearly 86 percent at night and 53 percent in the afternoon. The percentage of possible sunshine ranges from an average of 56 percent in January to 78 percent in August; the annual average is 66 percent. The skies are clear during daylight hours on about 137 days out of the year. The windspeed averages 11 miles per hour for the year and ranges from 13 miles per hour, in March, to 9 miles per hour, in August. South-southeasterly winds prevail except during the months of January and February,

TABLE 2.—*Probabilities of freezing temperatures in spring and fall*

[All data from McAlester; period of record 1921–50]

Probability	Dates for given probability and temperature				
	16° F.	20° F.	24° F.	28° F.	32° F.
Spring:					
1 year in 10 later than	March 5	March 12	March 31	April 10	April 16
2 years in 10 later than	February 24	March 4	March 24	April 4	April 11
5 years in 10 later than	February 7	February 17	March 10	March 22	March 31
Fall:					
1 year in 10 earlier than	November 30	November 20	November 9	October 28	October 19
2 years in 10 earlier than	December 7	November 27	November 16	November 3	October 24
5 years in 10 earlier than	December 19	December 10	November 29	November 14	November 2

when the prevailing winds are northerly. Lake evaporation averages 53 inches annually. Of this amount, 71 percent occurs from May through October.

During the past 92 years, 26 tornadoes have struck somewhere in the county. Only eight of these storms caused death, injury, or heavy property loss. All of the major damaging storms occurred before 1950. Half of the tornadoes moved northeastward and occurred between the hours of 5 p.m. and 10 p.m.

Severe hailstorms are less of a threat than tornadoes, but 13 damaging hailstorms have been recorded within a period of 26 years. More than half of these storms occurred in May or June, between 5 p.m. and midnight. Hailstones have measured between 2 and 3 inches in diameter.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soils are in Pittsburg County, where they are located, and how they can be used. The soil scientists 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 the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey (*5*).[2]

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Choteau and Hartsells, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Choteau loam, 1 to 3 percent slopes, is one of three phases within the Choteau series.

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

A comparison of the detailed soil map of this county with that of Hughes County will show a small area just south of the South Canadian River where soil boundaries that overlap the county lines do not match. Continuing refinement of the soil classification system has resulted in some changes in classification by soil series since correlation of the soils of Hughes County.

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

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping units are shown on the soil map of Pittsburg County: soil complexes and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Hector-Hartsells complex, 2 to 5 percent slopes, is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. The name of an undifferentiated group consists of the names of the dominant soils, joined by "and." Ennis and Verdigris soils, broken, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Mine pits and dumps is a land type in Pittsburg County.

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

But only part of a soil survey is done when the soils have been named, described, and delineated on the map and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and rangeland, and engineers.

[2] Italicized numbers in parentheses refer to Literature Cited, p. 59.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map in this publication shows, in color, the soil associations in Pittsburg County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of farming or other land use. Such a map is also useful in determining the value of an association for a watershed, for woodland, for wildlife habitat, for engineering projects, for recreational areas, and for community development. A general soil map is not suitable for planning the management of a farm or field, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect management.

The seven soil associations of Pittsburg County are described in the following paragraphs.

1. *Yahola-Norwood association*

Nearly level, well-drained, loamy soils on flood plains, in deep, recent alluvium

This association (fig. 2) is on the flood plain of the South Canadian River. It makes up less than 1 percent of the county.

Yahola soils, which make up about 65 percent of the association, have a thick, loamy surface layer and are stratified with heavy loam and fine sandy loam to a depth of about 40 inches. Below this is stratified fine sandy loam and heavy silt loam.

Norwood soils, which make up about 30 percent of the association, have a surface layer of brown silt loam. Below this is stratified silt loam and very fine sandy loam.

The rest of this association consists of Dougherty, Stidham, Eufaula, and Vanoss soils.

About 90 percent of this association is under cultivation. The rest is in bermudagrass pasture. Alfalfa, corn, grain sorghum, and soybeans are the main crops.

2. *Dougherty-Stidham association*

Nearly level to moderately steep, well-drained, sandy soils on forested uplands, in deep, old alluvium

This association (fig. 2) occurs as high benches along the South Canadian River and as an irregular strip about

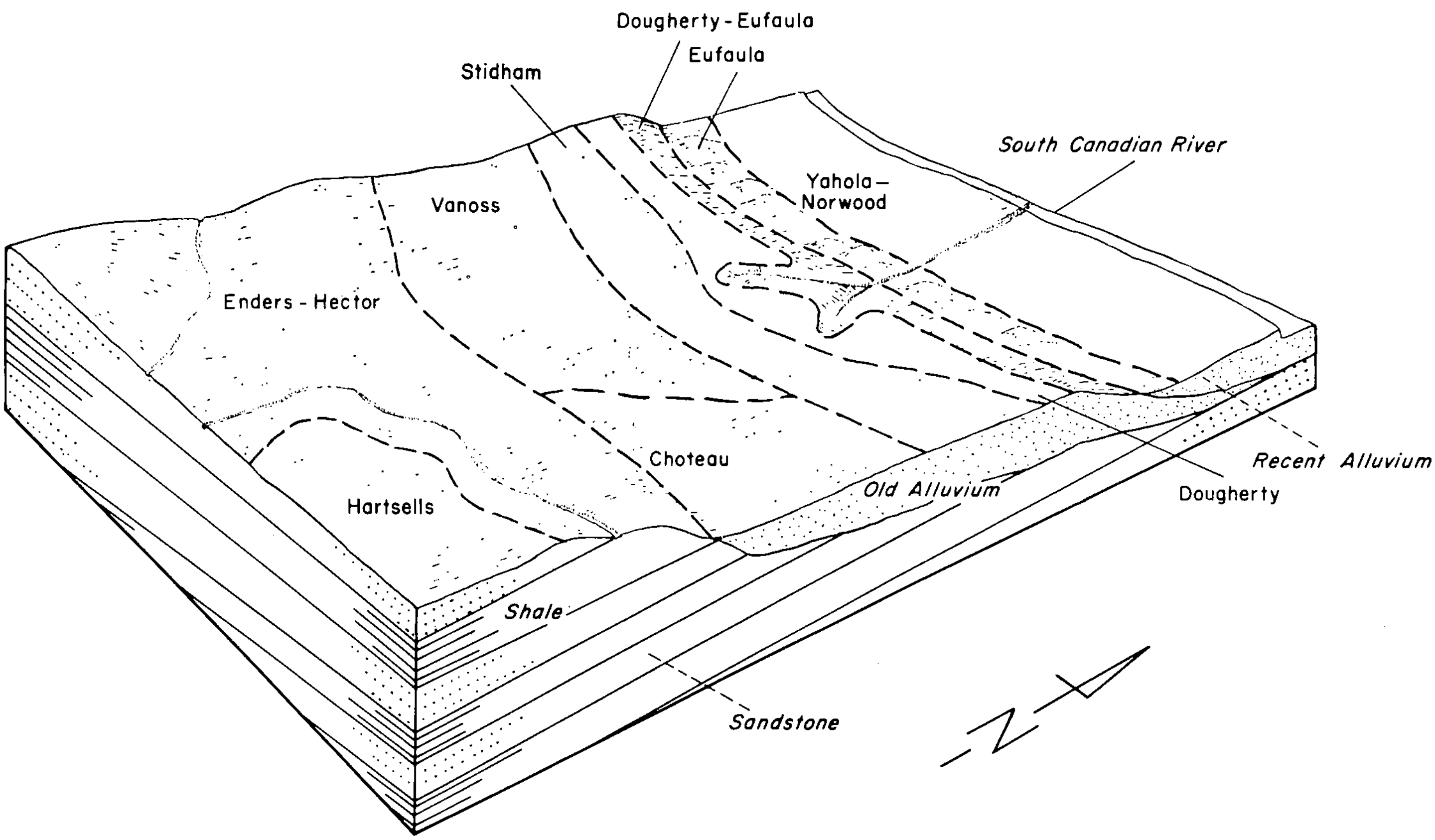

Figure 2.—**Major soils and underlying material in soil associations 1, 2, 3, and 7.**

3 miles wide that extends from Ashland to Hartshorne. There are many short, complex slopes. The original vegetation was mixed oak forest. This association makes up about 6 percent of the county.

The soils in this association formed in old, alkaline, sandy alluvium deposited by the South Canadian River. They have been leached of bases to a depth of about 5 feet. Below this depth, they are neutral to mildly alkaline.

Dougherty soils, which make up about 65 percent of the association, have a surface layer of loamy fine sand about 24 inches thick and a subsoil of red sandy clay loam. They are gently sloping to moderately steep. About a third of the acreage is severely gullied.

Stidham soils, which make up about 30 percent of the association, are much like Dougherty soils except that they are nearly level to very gently sloping and have a brownish-yellow subsoil.

The rest of this association consists of Eufaula, Vanoss, Choteau, Konawa, and Wrightsville soils.

About 80 percent of this association has been cultivated. Now about half is in tame pasture and less than 30 percent is under cultivation. Both soil blowing and water erosion are hazards in cultivated areas. Truck crops, peanuts, rye, vetch, and grain sorghum are the main crops.

3. *Enders-Hector-Hartsells association*

Very gently sloping to steep, well-drained to excessively drained, loamy soils on forested uplands; moderately deep to shallow over shale or sandstone

This association is characterized by smooth hilltops, steep bluffs, rock outcrops, and rough, stony, hilly areas forested with post oak and blackjack oak. The original vegetation consisted of post oak, blackjack oak, and shortleaf pine; shortleaf pine grew mainly in the southeastern part of the county. This association makes up about 53 percent of the county. The larger areas are in the southeastern part.

A representative pattern of soils in associations 3 and 4 is shown in figure 3.

The soils in this association are medium acid to strongly acid.

Enders and Hector soils, which make up about 80 percent of the association, are stony and have the stronger slopes in the association. Enders soils have a surface layer of fine sandy loam and a subsoil of red clay mottled with yellowish brown and gray. Depth to bedrock is generally 20 to 35 inches. Hector soils are fine sandy loam throughout. They are only 5 to 20 inches thick over sandstone.

Hartsells soils make up about 15 percent of the association. They are very gently sloping to strongly sloping

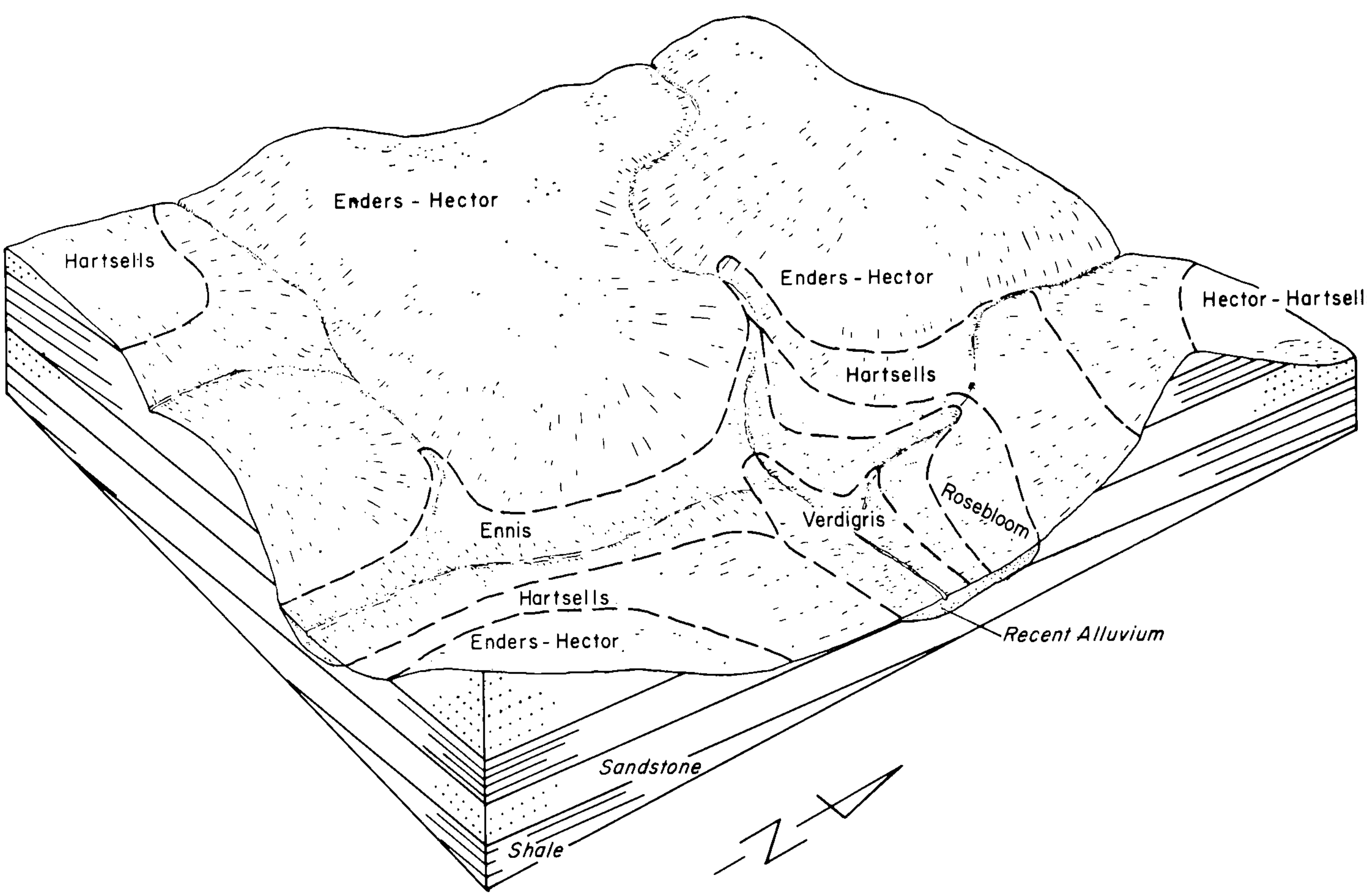

Figure 3.—Major soils and underlying material in soil associations 3 and 4.

and occur on hilltops. Their surface layer is fine sandy loam, and their subsoil is mainly sandy clay loam. They are underlain by sandstone at a depth of about 40 inches. Where Hartsells soils are intermixed with Hector soils, they are generally only 24 inches deep over sandstone. Where they occur on foot slopes, they generally have a layer of mottled yellowish-red, red, and gray sandy clay just below the subsoil.

The rest of this association consists of Talihina, Eram, Bates, Collinsville, and Dennis soils.

About 85 percent of this association is forested with post oak and blackjack oak and is used as range. About 15 percent of the association has been cultivated, but now almost all of this has been planted to bermudagrass. Only a small acreage is cultivated.

4. Ennis-Verdigris-Rosebloom association

Nearly level, moderately well drained to poorly drained soils on flood plains, in deep, old alluvium

This association (fig. 3) is on flood plains and is subject to occasional overflow. It makes up about 8 percent of the county.

Ennis soils, which make up about 37 percent of the association, have a surface layer of pale-brown silt loam and a subsoil of light yellowish-brown silt loam mottled with strong brown in the lower part. They are moderately well drained and strongly acid.

Verdigris soils, which make up about 27 percent of the association, have a surface layer of grayish-brown silt loam. They are mottled with yellowish brown below a depth of about 30 inches. They are moderately well drained and medium acid.

Rosebloom soils, which make up about 15 percent of the association, have a surface layer of light brownish-gray silt loam. They are mottled throughout with yellowish brown and grayish brown. They are poorly drained and very strongly acid.

The rest of this association consists of Chastain and Ochlockonee soils.

About 40 percent of this association has been under cultivation. Now less than 10 percent is cultivated. The main crops are corn, cotton, alfalfa, and grain sorghum. Rosebloom soils are used mostly as pasture. A small acreage is in grain sorghum.

5. Dennis-Parsons-Bates association

Nearly level to gently sloping, somewhat poorly drained to well drained, loamy soils on prairie uplands; deep to moderately deep over shale or sandstone

This association occurs on uplands throughout the county. One of the largest areas is in the Pittsburg-Kiowa vicinity. This association makes up about 19 percent of the county.

A representative pattern of soils is shown in figure 4. The soils in this association formed under tall prairie grass in material derived from sandstone and shale of Pennsylvanian age. They are medium to very strongly acid.

Dennis soils, which make up about 40 percent of the association, have a surface layer of grayish-brown loam and a subsoil of light clay or clay loam.

Parsons soils, which make up about 16 percent of the association, have a surface layer of grayish-brown silt loam about 12 inches thick and a subsoil of dense clay.

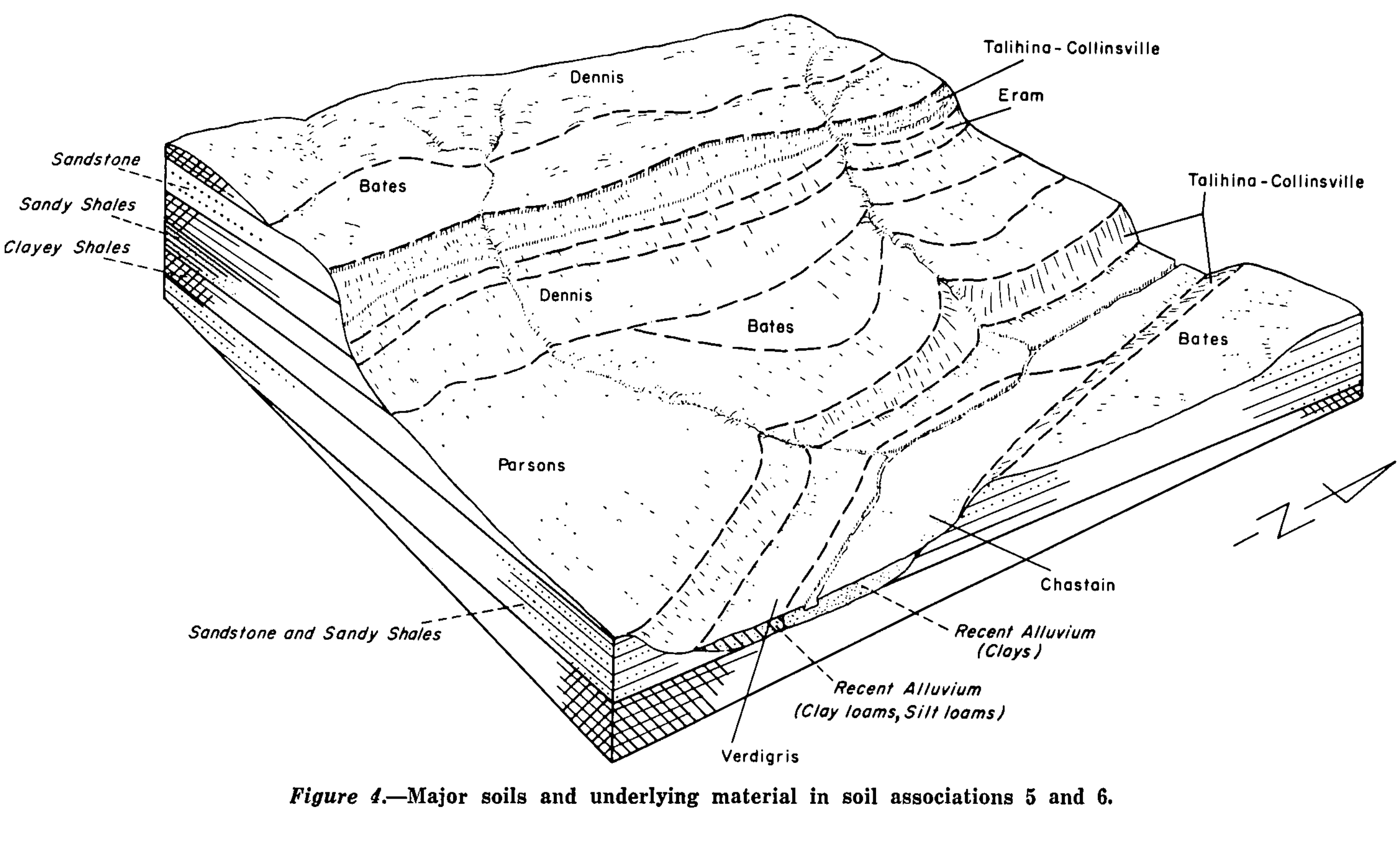

***Figure 4.*—Major soils and underlying material in soil associations 5 and 6.**

Bates soils, which make up about 14 percent of the association, have a surface layer of grayish-brown fine sandy loam and a subsoil of fine sandy loam and sandy clay loam. They are 24 to 48 inches deep over sandstone.

The rest of this association consists of Eram, Taloka, Woodson, Summit, Collinsville, and Talihina soils. Verdigris and Chastain soils occur on flood plains that pass through this association.

Almost all of the native grass meadows in the county are on this association. About half of the association has been under cultivation. Now most of this acreage is in bermudagrass. Only about 10 percent is cultivated.

6. *Talihina-Eram-Collinsville association*

Gently sloping to moderately steep, well drained to moderately well drained, stony, loamy soils on prairie uplands; very shallow to moderately deep over shale or sandstone

This association is one of gently sloping ridgetops and moderately steep slopes on uplands. It occurs as small areas throughout the county. One of the largest areas extends from Pittsburg to Hartshorne. This association makes up about 11 percent of the county.

The soils in this association formed under tall prairie grass in material derived from sandstone or shale of Pennsylvanian age. Most areas are stony.

Talihina soils, which make up about 45 percent of the association, are generally the steeper parts. Their surface layer is grayish-brown stony clay loam, and their subsoil is brown clay. Shale is at a depth of 8 to 20 inches.

Eram soils, which make up about 30 percent of the association, are gently sloping. Their surface layer is dark grayish-brown clay loam, and their subsoil is clay. Shale is at a depth of about 32 inches.

Collinsville soils, which make up about 15 percent of the association, occupy ridge tops. Their surface layer is grayish-brown fine sandy loam. Sandstone is at a depth of less than 20 inches.

The rest of this association consists of Dennis, Bates, and Talpa soils, and areas of rock outcrop.

This association is used mostly as native grass range. A few areas that are not too stony are in native hay.

7. *Vanoss-Choteau association*

Nearly level to very gently sloping, well drained to moderately well drained, loamy soils on prairie uplands, in deep, old alluvium

This association occurs as broad, smooth, upland areas in the northern part of the county, near Indianola. It makes up about 2 percent of the county.

The soils formed under tall prairie grass in sediments of Pleistocene age.

Vanoss soils, which make up about 40 percent of the association, have a thick surface layer of granular loam and a subsoil of clay loam.

Choteau soils, which make up about 30 percent of the association, have a thick surface layer of granular loam or very fine sandy loam and a subsoil of clay loam.

The rest of this association consists mainly of Wrightsville, Counts, and Taloka soils.

366-405—71——2

About 90 percent of this association is under cultivation. Grain sorghum, soybeans, peanuts, cotton, and alfalfa are the main crops. The rest of the association is in bermudagrass or native grass pasture.

Descriptions of the Soils

This section describes the soil series and mapping units of Pittsburg County. The approximate acreage and the proportionate extent of each mapping unit are given in table 3.

A general description of each soil series is given, and this is followed by brief descriptions of the mapping units in that series. For full information on any one mapping unit, it is necessary to read the description of the soil series as well as the description of the mapping unit.

Each series description contains a short description of a typical soil profile and a much more detailed description of the same profile that scientists, engineers, and others can use in making highly technical interpretations.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of the description of each mapping unit are the capability unit, the range site, and the woodland group in which the mapping unit has been placed. The page on which a given capability unit, range site, or woodland group is described can be found readily by referring to the "Guide to Mapping Units" at the back of this survey.

The color descriptions are for dry soil, unless otherwise stated. Many terms used in soil descriptions and other sections of the survey are defined in the Glossary.

TABLE 3.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent
	Acres	*Percent*
Bates fine sandy loam, 1 to 3 percent slopes	5, 120	0. 6
Bates fine sandy loam, 3 to 5 percent slopes	1, 985	. 2
Bates fine sandy loam, 2 to 5 percent slopes, eroded	7, 500	. 9
Bates-Collinsville fine sandy loams, 2 to 5 percent slopes	12, 050	1. 4
Chastain silty clay loam	2, 770	. 3
Choteau loam, 0 to 1 percent slopes	1, 640	. 2
Choteau loam, 1 to 3 percent slopes	1, 995	. 2
Choteau very fine sandy loam, 0 to 3 percent slopes	5, 135	. 6
Counts loam, 0 to 2 percent slopes	5, 475	. 6
Dennis loam, 1 to 3 percent slopes	21, 995	2. 5
Dennis loam, 3 to 5 percent slopes	2, 905	. 3
Dennis loam, 2 to 5 percent slopes, eroded	24, 820	2. 8
Dennis-Dwight complex, 2 to 5 percent slopes, severely eroded	24, 765	2. 8
Dougherty loamy fine sand, 3 to 8 percent slopes	12, 090	1. 4
Dougherty-Eufaula complex, 8 to 20 percent slopes	1, 570	. 2
Enders-Hector complex, 5 to 30 percent slopes	307, 015	35. 3
Enders-Hector complex, 30 to 60 percent slopes	57, 315	6. 6
Ennis silt loam	11, 740	1. 3
Ennis and Verdigris soils, broken	40, 055	4. 6
Eram clay loam, 2 to 5 percent slopes	15, 340	1. 8
Eram clay loam, 2 to 5 percent slopes, eroded	5, 660	. 6
Eufaula fine sand, 0 to 3 percent slopes	1, 215	. 1

TABLE 3.—*Approximate acreage and proportionate extent of the soils*—Continued

Soil	Area	Extent
	Acres	*Percent*
Guin gravelly sandy loam, 5 to 20 percent slopes	960	.1
Hartsells fine sandy loam, 1 to 3 percent slopes	5,760	.7
Hartsells fine sandy loam, 3 to 5 percent slopes	5,825	.7
Hartsells fine sandy loam, 2 to 5 percent slopes, eroded	18,800	2.2
Hector-Hartsells complex, 2 to 5 percent slopes	20,885	2.4
Hector-Hartsells complex, 3 to 8 percent slopes, severely eroded	17,115	2.0
Konawa fine sandy loam, 1 to 3 percent slopes	1,965	.2
Konawa soils, 3 to 8 percent slopes, severely eroded	15,025	1.7
Mine pits and dumps	720	.1
Ochlockonee fine sandy loam	910	.1
Parsons silt loam, 0 to 1 percent slopes	17,045	2.0
Parsons silt loam, 1 to 3 percent slopes	10,215	1.2
Parsons-Dwight complex, 1 to 3 percent slopes, eroded	6,725	.8
Rosebloom silt loam	11,530	1.3
Stidham loamy fine sand, 0 to 3 percent slopes	7,760	.9
Summit silty clay loam, 1 to 3 percent slopes	800	.1
Talihina-Collinsville complex, 5 to 20 percent slopes	83,995	9.7
Taloka silt loam, 0 to 1 percent slopes	1,975	.2
Taloka silt loam, 1 to 3 percent slopes	1,030	.1
Talpa-Rock outcrop complex, 5 to 30 percent slopes	5,505	.6
Vanoss loam, 0 to 1 percent slopes	2,285	.3
Vanoss loam, 1 to 3 percent slopes	2,860	.3
Verdigris silt loam	8,630	1.0
Woodson silt loam	1,665	.2
Wrightsville silt loam	3,150	.4
Yahola-Norwood complex	1,400	.2
Water	45,070	5.2
Total	869,760	100.0

Bates Series

The Bates series consists of moderately deep soils on uplands. These soils are moderately permeable and well drained. They formed in material weathered from thinly bedded, noncalcareous sandstone interbedded with sandy and silty shale. The native vegetation is tall prairie grass.

In a typical profile (fig. 5) the surface layer is grayish-brown fine sandy loam about 14 inches thick. The subsoil extends to a depth of about 39 inches. The uppermost 11 inches is pale-brown, very friable heavy fine sandy loam. The lower part is pale-brown light sandy clay loam. Below a depth of about 39 inches is partly weathered sandstone.

Much of the acreage has been used for cultivated crops. About half the acreage is now in tame pasture.

A typical profile of Bates fine sandy loam, 1 to 3 percent slopes, is in a native grass meadow 1,320 feet west and 100 feet south of the northeast corner of sec. 23, T. 7 N., R. 15 E.

A1—0 to 14 inches, grayish-brown (10YR 5/2) fine sandy loam; very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; very friable; pH 6.0; clear boundary; 10 to 16 inches thick.

B1—14 to 25 inches, pale-brown (10YR 6/3) heavy fine sandy loam; brown (10YR 4/3) when moist; weak, medium, granular structure; very friable; pH 5.7; gradual boundary; 3 to 15 inches thick.

Figure 5.—**Profile of Bates fine sandy loam.**

B2t—25 to 39 inches, pale-brown (10 YR 6/3) light sandy clay loam; brown (10YR 4/3) when moist; common, medium, faint mottles of yellowish brown (10YR 5/6); moderate, medium, subangular structure; clay films on ped faces and in pores; pH 5.6; 8 to 30 inches thick.

R—39 inches +, partly weathered sandstone.

The A horizon ranges from brown to grayish brown. Its texture is dominantly fine sandy loam but ranges to loam. The B2t horizon is generally pale brown mottled with yellowish brown, but fine red mottling occurs in places. The texture of this horizon is generally sandy clay loam but ranges to light clay loam. Sandstone is at depths ranging from 20 to 48 inches. The entire profile ranges from medium acid to slightly acid.

Bates soils are associated with Collinsville and Dennis soils. They are downslope from Collinsville soils and differ from those soils in being deeper and in having a B2t horizon. They are upslope from Dennis soils, which overlie shale, and they have a less clayey subsoil than those soils. Bates soils are similar to Hartsells and Vanoss soils, but they do not have the pale-brown A2 horizon that Hartsells soils have, and they are shallower than Vanoss soils.

Bates fine sandy loam, 1 to 3 percent slopes (BaB).—This soil has the profile described as typical for the series. It occurs on smooth ridges. Included in mapping were small areas of Dennis loam.

This Bates soil is well suited to most crops commonly grown in the county. It is subject to moderate erosion if unprotected. (Capability unit IIe-1; Loamy Prairie range site; no woodland classification)

Bates fine sandy loam, 3 to 5 percent slopes (BaC).—This soil has a slightly thinner surface layer and subsoil, but its profile is otherwise similar to the one described as typical for the series. It is only 30 inches deep over sandstone. It occurs on side slopes of ridges. Included in mapping were small areas of Dennis loam and Collinsville fine sandy loam.

This Bates soil is suitable for cultivation, but it is subject to severe erosion if cultivated and not protected.

(Capability unit IIIe–2; Loamy Prairie range site; no woodland classification)

Bates fine sandy loam, 2 to 5 percent slopes, eroded (BaC2).—Erosion has removed between 25 and 75 percent of the original surface layer from this soil. There are light-colored areas where tillage has mixed what is left of the original surface layer with material from the subsoil. Also, there are rills and shallow gullies. Included in mapping were small areas of Dennis loam and Collinsville fine sandy loam.

This Bates soil is suitable for cultivation, but it is subject to severe erosion if cultivated and not protected. (Capability unit IIIe–5; Loamy Prairie range site; no woodland classification)

Bates-Collinsville fine sandy loams, 2 to 5 percent slopes (BcC).—This complex is 50 percent Bates soils and 40 percent Collinsville soils. Included in mapping were small areas of Dennis loam and Eram clay loam.

The Bates soil is only 20 to 30 inches deep over sandstone. It has a thinner surface layer and subsoil, but its profile is otherwise similar to the one described for the Bates series.

Except for being relatively free of stones and slightly deeper over sandstone, the profile of the Collinsville soil is similar to the one described for the Collinsville series.

The soils in this complex can be cultivated, but they are subject to very severe erosion if cultivated and not protected. (Capability unit IVe–5; no woodland classification. Bates soil: Loamy Prairie range site; Collinsville soil: Shallow Prairie range site)

Chastain Series

The Chastain series consists of deep, level to slightly depressed soils on flood plains. These soils are poorly drained to ponded and are very slowly permeable. They formed in clayey alluvial sediments along the larger creeks of this county.

In a typical profile the surface layer is light-gray silty clay loam about 17 inches thick. Below this is light-gray, very firm clay. All layers are mottled with yellowish brown.

The original vegetation consisted of haw, winged elm, sedges, and bluestem. Most of the acreage is in tame pasture. Some areas are used for grain sorghum.

A typical profile of Chastain silty clay loam is 2,640 feet west and 1,350 feet south of the northeast corner of sec. 4, T. 5 N., R. 13 E.

Ap—0 to 7 inches, light-gray (10YR 6/1) silty clay loam, dark gray (10YR 4/1) when moist; few, fine, faint, yellowish-brown mottles; weak, fine, granular structure; firm when moist, hard when dry; pH 5.5; clear boundary; 4 to 9 inches thick.

A1—7 to 17 inches, light-gray (10YR 7/1) silty clay loam, gray (10YR 5/1) when moist; few, fine, faint, yellowish-brown mottles; weak, medium, granular structure; firm when moist, hard when dry; pH 5.0; clear, wavy boundary; 4 to 14 inches thick.

C1g—17 to 50 inches, light-gray (10YR 6/1) clay, dark gray (10YR 4/1) when moist; many, fine, faint, yellowish-brown mottles; weak, coarse, blocky structure; very firm when moist, extremely hard when dry; pH 5.0; diffuse boundary; 10 to 38 inches thick.

C2g—50 to 96 inches +, light-gray (10YR 6/1) clay, dark gray (10YR 4/1) when moist; common, fine, distinct, yellowish-brown (10YR 5/6) mottles; weak, fine, blocky structure; patchy clay films; very firm when moist, extremely hard when dry; pH 6.0.

The A horizon ranges from light gray to dark grayish brown. It is 8 to 20 inches thick. Its texture is dominantly silty clay loam, but in a few areas it is silt loam or clay loam. The Cg horizon ranges from light gray to very dark gray and is mottled with yellowish brown, strong brown, and yellowish red. Its texture is dominantly clay. The profile ranges from very strongly acid to medium acid.

Chastain soils are similar to Ennis, Rosebloom, and Verdigris soils. They differ from those soils in having a grayer surface layer and in being more clayey in the lower part of the profile.

Chastain silty clay loam (Ca). This soil occurs as level to slightly depressed areas on flood plains. It is subject to occasional flooding. Included in mapping were areas of Rosebloom soils, which make up as much as 8 percent of an individual area, and areas of Verdigris soils, which make up as much as 4 percent of an area.

This Chastain soil can be cultivated but generally needs a drainage system. Excess water severely limits the choice of plants. (Capability unit IIIw–1; Heavy Bottomland range site; no woodland classification)

Choteau Series

The Choteau series consists of deep, level to very gently sloping soils on uplands. These soils are moderately slowly permeable. They formed under tall prairie grass in mildly alkaline old alluvium.

In a typical profile the surface layer is brown loam in the upper 7 inches and grayish-brown loam in the lower 9 inches. The subsurface layer is a 6-inch layer of pale-brown loam. To a depth of about 50 inches, the subsoil is brownish-yellow, firm clay loam mottled with pale brown, brown, strong brown, and light brownish gray. Below this is mottled brownish-yellow and light-gray clay loam.

Most of the acreage is under cultivation.

A typical profile of Choteau loam, 1 to 3 percent slopes, is in a cultivated field 200 feet east and 100 feet south of the northwest corner of sec. 22, T. 8 N., R. 14 E.

Ap—0 to 7 inches, brown (10YR 5/3) loam, dark brown (10YR 3/3) when moist; weak, medium, granular structure; friable when moist; pH 6.5; clear boundary; 6 to 10 inches thick.

A1—7 to 16 inches, grayish-brown (10YR 5/2) loam, very dark grayish-brown (10YR 3/2) when moist; weak, medium, granular structure; friable when moist; pH 6.0; clear boundary; 8 to 20 inches thick.

A2—16 to 22 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) when moist; weak, fine, granular structure; few, fine, black concretions; friable when moist; pH 5.5; gradual boundary; 4 to 10 inches thick.

B21t—22 to 32 inches, brownish-yellow (10YR 6/6) clay loam, yellowish brown (10YR 5/6) when moist; few, fine, faint, very pale brown and strong-brown mottles; moderate, medium, subangular blocky structure; continuous clay films on peds; firm when moist, very hard when dry; pH 6.0; diffuse boundary; 8 to 10 inches thick.

B22t—32 to 50 inches, brownish-yellow (10YR 6/8) heavy clay loam, yellowish brown (10YR 5/6) when moist; common, medium, distinct, brown (10YR 5/3) and light brownish-gray (10YR 6/2) mottles; moderate, medium, subangular blocky structure; firm when moist, very hard when dry; continuous clay films; pH 6.0; diffuse boundary; 8 to 20 inches thick.

B3—50 to 72 inches, mottled brownish-yellow (10YR 6/6) and light-gray (10YR 6/1) clay loam; fine sand grains prominent through hand lens; weak subangular blocky structure; pH 6.5.

The A1 horizon ranges from brown and grayish brown to very dark grayish brown. Its texture ranges from fine sandy loam to loam. The A2 horizon is a half to two values higher in color than the A1 horizon and in places is slightly more clayey. The B2t horizon is mottled with varying amounts of yellowish brown and grayish brown. It is not seasonally wet. Its texture is clay loam high in silt and very fine sand. Below a depth of about 50 inches, the texture changes in places to light sandy clay. The profile ranges from strongly acid to neutral.

Choteau soils are associated with Vanoss soils but differ from those soils in having an A2 horizon and a less friable subsoil. They are similar to Dennis and Taloka soils. They differ from Dennis soils in having an A2 horizon and a thicker A horizon. They differ from the Taloka soils in having a less clayey B2 horizon.

Choteau loam, 0 to 1 percent slopes (ChA).—This soil occurs as broad, smooth areas, the largest of which are near Indianola. There are a few small wet spots. Included in mapping were small areas of Taloka silt loam and Vanoss loam.

This Choteau soil has few limitations that restrict its use. It is well suited to all crops grown in the county, and it is suited to post lots. (Capability unit I–2; Loamy Prairie range site; no woodland classification)

Choteau loam, 1 to 3 percent slopes (ChB).—This soil has the profile described as typical for the series. It occurs as broad, smooth areas, the largest of which are near Indianola. Included in mapping were small areas of Vanoss loam.

This Choteau soil is well suited to all crops grown in the county but is subject to moderate erosion if cultivated and not protected. It is suited to post lots. Most of the acreage is under cultivation. (Capability unit IIe–2; Loamy Prairie range site; no woodland classification)

Choteau very fine sandy loam, 0 to 3 percent slopes (CoB).—This soil has a slightly sandier profile than that described as typical for the series. It occurs as broad, smooth areas, mostly near Ashland.

This soil is well suited to all crops commonly grown in the county but is subject to moderate erosion if cultivated and not protected. It is suited to post lots. (Capability unit IIe–2; Loamy Prairie range site; no woodland classification)

Collinsville Series

The Collinsville series consists of upland soils that are very shallow to shallow over thinly bedded sandstone and sandy, silty shale. These soils occur as low ridges. They are well drained and moderately rapidly permeable. They formed under tall grass.

In a typical profile (fig. 6) the surface layer is grayish-brown fine sandy loam about 7 inches thick. Below this is about 4 inches of yellowish-brown fine sandy loam mixed with sandstone. At a depth of about 11 inches is acid sandstone.

The original vegetation was tall native grass. About 10 percent of the acreage has been cultivated. Most of the acreage is used for tame pasture.

The Collinsville soils in this county are mapped with Bates and Talihina soils.

A typical profile of a Collinsville fine sandy loam is in a native grass pasture 1,500 feet west and 500 feet north of the southeast corner of sec. 2, T. 4 N., R. 15 E.

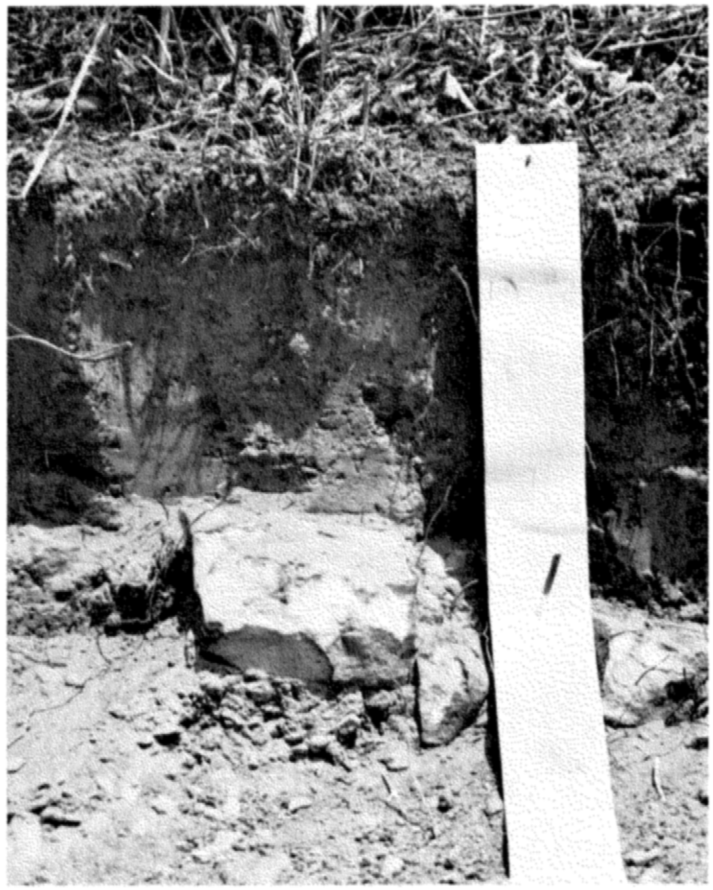

Figure 6.—**Profile of Collinsville fine sandy loam.**

A1—0 to 7 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, granular structure; friable when moist, slightly hard when dry; numerous large and small sandstones on the surface and in the surface layer; pH 6.0; 4 to 15 inches thick.

C—7 to 11 inches, mixture of yellowish-brown (10YR 5/4) fine sandy loam and sandstone; 0 to 6 inches thick.

R—11 inches +, hard, fractured sandstone.

The A horizon ranges from grayish brown to dark brown. Its texture is dominantly fine sandy loam but ranges to stony fine sandy loam and stony loam. Some areas are 10 to 50 percent stony fine sandy loam and stony loam; other areas are relatively free of stones. Partly weathered, fractured sandstone is at a depth of 4 to 20 inches. The profile ranges from medium acid to slightly acid.

Collinsville soils lack an A2 horizon and a B horizon, both of which are typical of Hector soils. They are thinner than Bates soils. They differ from Talihina soils in overlying sandstone instead of shale.

Counts Series

The Counts series consists of nearly level to very gently sloping upland soils that are generally more than 5 feet deep over shale. These soils are somewhat poorly drained and are very slowly permeable. They formed in old alluvium or shaly, clayey sediments.

In a typical profile the surface layer is dark grayish-brown loam about 4 inches thick. The subsurface layer is very pale brown loam about 6 inches thick. To a depth of 46 inches, the subsoil is dark yellowish-brown, very firm clay distinctly mottled with light gray, yellowish red, yellowish brown, and strong brown. Below this is mottled gray, yellowish-brown, and reddish-yellow, very firm clay.

The original vegetation consisted of post oak and blackjack oak and a grass understory. Some areas have been cleared and cultivated but are now used as pasture. Only a small acreage is under cultivation.

A typical profile of Counts loam, 0 to 2 percent slopes, is 2,750 feet south and 100 feet east of the northwest corner of sec. 7, T. 2 N., R. 17 E.

A1—0 to 4 inches, dark grayish-brown (10YR 4/2) loam, light brownish gray (10YR 6/2) when dry; weak, fine, granular structure; friable when moist; pH 5.5; clear boundary; 2 to 8 inches thick.

A2—4 to 10 inches, very pale brown (10YR 7/3) loam, brown (10YR 5/3) when moist; massive; friable when moist; pH 5.0; clear, wavy boundary; 4 to 10 inches thick.

B21t—10 to 24 inches, dark yellowish-brown (10YR 4/6) light clay, yellowish brown (10YR 5/6) when dry; common, medium, distinct, light-gray (10YR 6/1) and yellowish-red (5YR 4/6) mottles; moderate, medium, blocky structure; clay films on ped faces; very firm when moist, extremely hard when dry; pH 5.0; gradual, wavy boundary; 8 to 18 inches thick.

B22t—24 to 46 inches, dark yellowish-brown (10YR 4/4) light clay, yellowish brown (10YR 5/4) when dry; coarsely mottled with light gray (10YR 6/1), strong brown (7.5YR 5/6), and yellowish red (5YR 4/6); moderate, medium, blocky structure; clay films on ped faces; very firm when moist, extremely hard when dry; pH 5.5; diffuse, wavy boundary; 14 to 30 inches thick.

B3—46 to 64 inches +, mottled gray (10YR 6/1), yellowish-brown (10YR 5/4), and reddish-yellow (5YR 6/6) light clay; weak, coarse, blocky structure; very firm when moist, extremely hard when dry; thin patchy clay films; pH 7.0; 10 to 26 inches thick.

The A horizon ranges from very pale brown to dark grayish brown. Its thickness ranges from 6 to 16 inches. The Bt horizon ranges from dark brown to olive yellow; where the chroma is less than 6, there are many coarse mottles redder than 7.5 in hue. In texture the Bt horizon ranges from heavy clay loam and heavy silty clay loam to silty clay or clay. The clay content ranges from 35 to 50 percent. The upper part of the Bt horizon is medium acid to very strongly acid. Mottles in the Bt horizon range from light gray and gray to strong brown, reddish brown, and red. Mottles with chroma of 2 or less occur within 30 inches of the soil surface. The lower boundary of the horizon in which silicate clay has accumulated extends to a depth of more than 50 inches. The B3 horizon ranges from medium acid to moderately alkaline. The material becomes alkaline or only slightly acid within a depth of 5 feet.

Counts soils occur near Stidham and Wrightsville soils. They have a more mottled, less grayish subsoil than Wrightsville soils. They have a thinner, less sandy surface layer and subsoil than Stidham soils.

Counts loam, 0 to 2 percent slopes (CuA).—This soil is mostly in the north-central part of the county. Wet spots are common. Included in mapping were small areas of Wrightsville silt loam.

This soil is subject to moderate erosion if cultivated and not protected. Droughtiness limits the choice of crops. Most areas that were cleared for cultivation are used for tame grass pasture. (Capability unit IIe-4; Loamy Savannah range site; woodland group 3)

Dennis Series

The Dennis series consists of deep, very gently sloping to gently sloping soils on uplands. These soils are moderately well drained and slowly permeable. They formed under tall prairie grass in material weathered from shale.

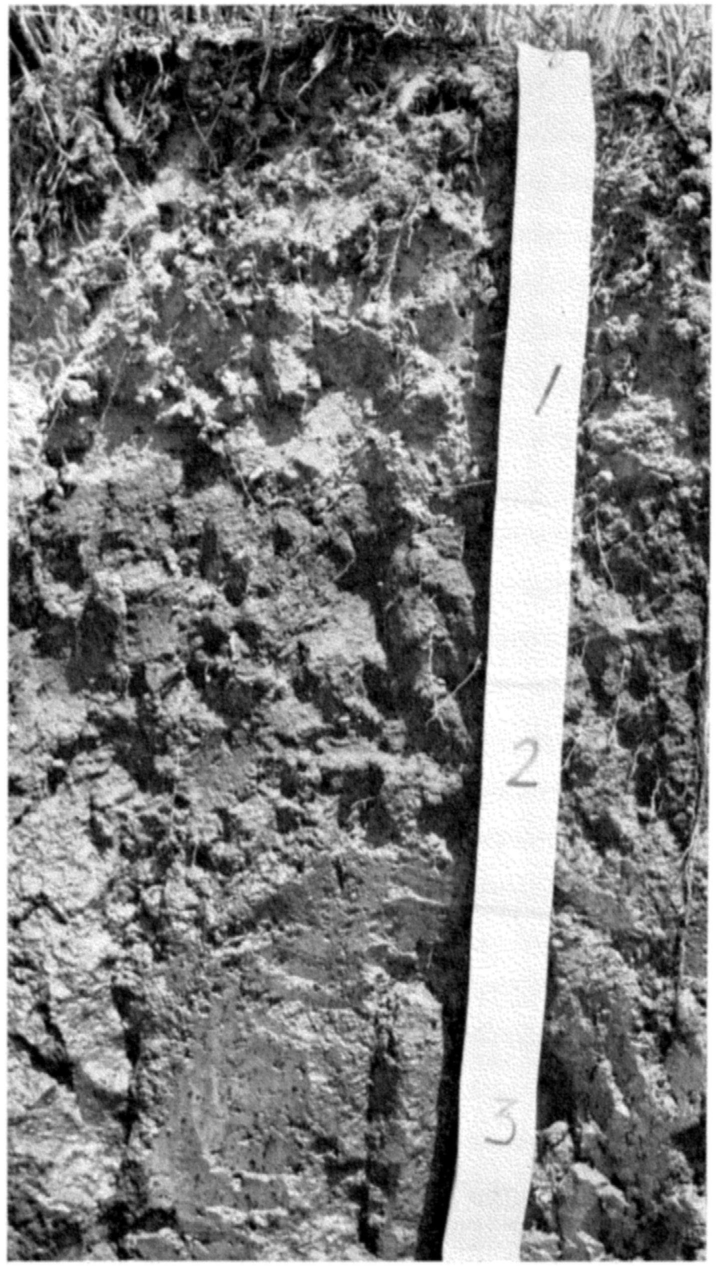

***Figure 7.*—Profile of Dennis loam.**

In a typical profile (fig. 7) the surface layer is grayish-brown loam 13 inches thick. The uppermost 6 inches of the subsoil is light yellowish-brown, friable clay loam. The rest is yellowish-brown, very firm light clay and clay mottled with red, grayish brown, and gray.

About 60 percent of the acreage has been cultivated. Approximately 40 percent of the acreage is now in tame pasture.

A typical profile of Dennis loam, 1 to 3 percent slopes, is 600 feet west and 150 feet south of the northeast corner of sec. 19, T. 3 N., R. 14 E.

A1—0 to 13 inches, grayish-brown (10YR 5/2) loam; very dark grayish-brown (10YR 3/2) when moist; weak, granular structure; friable when moist, slightly hard when dry; pH 5.5; clear boundary; 10 to 16 inches thick.

B1—13 to 19 inches, light yellowish-brown (10YR 6/4) clay loam; yellowish brown (10YR 5/4) when moist; in lower part common, medium, distinct, mottles that are yellowish-red (5YR 4/6) when moist; moderate, medium, subangular blocky structure; friable when moist, hard when dry; pH 5.1; gradual boundary; 4 to 8 inches thick.

B21t—19 to 27 inches, yellowish-brown (10YR 5/8) light clay; dark yellowish brown (10YR 4/4) when moist; common, fine, distinct, red mottles; moderate, medium, blocky structure; continuous clay films; very firm when moist, extremely hard when dry; few fine iron concretions; pH 6.0; gradual boundary; 6 to 12 inches thick.

B22t—27 to 36 inches, yellowish-brown (10YR 5/6) light clay; dark yellowish brown (10YR 4/6) when moist; common, medium, faint, grayish-brown (10YR 5/2) mottles; weak, coarse, blocky structure; very firm when moist, extremely hard when dry; continuous clay films; few fine iron concretions; pH 6.0; gradual boundary; 8 to 20 inches thick.

B3—36 to 60 inches +, yellowish-brown (10YR 5/6) clay; dark yellowish brown (10YR 4/6) when moist; common, coarse, distinct, gray (10YR 5/1) mottles; massive; many fine iron concretions; very firm when moist, extremely hard when dry; pH 7.0.

The A horizon ranges from grayish brown to very dark brown, and in a few areas its texture is silt loam. The B2t horizon is dominantly light clay (35 to 50 percent clay) but ranges to clay loam. In this horizon, color varies in detail of mottling; yellowish brown, strong brown, grayish brown, and red are the principal colors. The entire profile ranges from strongly acid to mildly alkaline.

Dennis soils are associated with Parsons, Taloka, Bates, and Eram soils. They do not have an A2 horizon and a dense clay subsoil, both of which are typical of Parsons soils. They have a less friable subsoil than Bates soils, which formed over sandstone. They are deeper than Eram soils. They are similar to Choteau soils, but they have a thinner A horizon and do not have an A2 horizon.

Dennis loam, 1 to 3 percent slopes (DeB).—This soil has the profile described as typical for the series. It occurs as broad, smooth areas throughout the prairies of the county. Included in mapping were small areas of Parsons silt loam and Bates fine sandy loam.

This Dennis soil is well suited to all crops grown in the county. It is subject to moderate erosion if cultivated and not protected. (Capability unit IIe-3; Loamy Prairie range site; no woodland classification)

Dennis loam, 3 to 5 percent slopes (DeC).—This soil occurs on side slopes, below areas of Eram clay loam and areas of the Talihina-Collinsville complex. Included in mapping were small areas of Bates fine sandy loam and Eram clay loam.

This Dennis soil is suitable for cultivation, but it is subject to severe erosion if cultivated and not protected. (Capability unit IIIe-2; Loamy Prairie range site; no woodland classification)

Dennis loam, 2 to 5 percent slopes, eroded (DeC2).—This soil has a thinner surface layer than that described as typical for the series. In many places there are rills and shallow gullies. On about 25 percent of the acreage, erosion has removed part of the original surface layer and tillage has mixed the rest with material from the subsoil. Included in mapping were small areas of Eram clay loam and Bates fine sandy loam.

This Dennis soil is suitable for cultivation, but it is subject to severe erosion if cultivated and not protected. (Capability unit IIIe-5; Loamy Prairie range site; no woodland classification)

Dennis-Dwight complex, 2 to 5 percent slopes, severely eroded (DnC3).—This complex is 50 percent Dennis soils, 30 percent Dwight soils, 15 percent Eram soils, and 5 percent Bates soils. All are severely eroded, clayey soils. Rills, gullies, and clay spots are common.

The surface layer of the Dennis soil is thinner than the corresponding layer in the profile described as typical for the Dennis series. In places the original surface layer has been removed by erosion.

The Dwight soil has a profile similar to that described for the Dwight series.

All the acreage has been cultivated. It is now unsuitable for cultivation. It can be used as tame pasture or native range. (Capability unit VIe-3; no woodland classification. Dennis soil: Eroded Prairie range site; Dwight soil: Slickspot range site)

Dougherty Series

The Dougherty series consists of deep, sandy soils on uplands. These soils are 50 to 200 feet above the flood plain of the South Canadian River. They are well drained and moderately permeable. They formed under timber in slightly acid to mildly alkaline old sandy alluvium. The slope range is 3 to 20 percent.

In a typical profile the surface layer is grayish-brown loamy fine sand about 5 inches thick. The subsurface layer is very pale brown loamy fine sand about 19 inches thick. The subsoil extends to a depth of 66 inches. It is red, friable sandy clay loam. The substratum is light-red, stratified loamy fine sand.

The original vegetation consisted of post oak, blackjack oak, and hickory and an understory of tall grass. Most of the acreage has been cleared for cultivation. Much of it is being planted to bermudagrass.

A typical profile of Dougherty loamy fine sand, 3 to 8 percent slopes, is 1,280 feet west and 800 feet north of the southwest corner of sec. 32, T. 9 N., R. 16 E.

A1—0 to 5 inches, grayish-brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; very friable when moist; pH 6.5; clear boundary; 3 to 8 inches thick.

A2—5 to 24 inches, very pale brown (10YR 8/3) loamy fine sand, very pale brown (10YR 7/3) when moist; single grain; very friable when moist; pH 6.0; clear boundary; 14 to 30 inches thick.

B21t—24 to 55 inches, red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) when moist; strong, coarse, subangular blocky structure; clay films on ped faces and in pores; friable when moist, very hard when dry; pH 5.5; gradual boundary; 20 to 36 inches thick.

B22t—55 to 66 inches, red (2.5YR 4/6) fine sandy loam, dark red (2.5YR 3/6) when moist; moderate, coarse, subangular blocky structure; friable when moist, very hard when dry; clay films bridge sand grains; pH 5.5; gradual boundary; 8 to 15 inches thick.

C—66 to 90 inches, light-red (2.5YR 6/8), stratified loamy fine sand, red (2.5YR 5/8) when moist; thin strata of sandy clay loam; massive; pH 6.5.

The A horizon ranges from 20 to 38 inches in thickness. It is dominantly loamy fine sand. In cultivated areas the A1 horizon is generally pale brown. The B2t horizon ranges from yellowish brown to red. Its texture ranges from heavy sandy loam to sandy clay loam. The clay content is between 18 and 30 percent. The C horizon ranges from loamy fine sand to sandy clay loam. The profile is strongly acid to slightly acid.

Dougherty soils are associated with Eufaula, Konawa, and Stidham soils. They have a more clayey subsoil than Eufaula soils. They have a thicker, more sandy A horizon than Konawa soils. They have a more reddish subsoil than Stidham soils.

Dougherty loamy fine sand, 3 to 8 percent slopes (DoD).—This soil has the profile described as typical for the series. It occurs on side slopes below areas of Stidham soils. Included in mapping were small areas of Stidham and Konawa soils.

This Dougherty soil can be cultivated, but it has very severe limitations that restrict the choice of plants. It requires careful management because the erosion hazard is very severe. It is suitable for post lots. (Capability unit IVe–2; Deep Sand Savannah range site; no woodland classification)

Dougherty-Eufaula complex, 8 to 20 percent slopes (DtE).—This complex is about 60 percent Dougherty soils and about 25 percent Eufaula soils. The rest consists of irregular areas of Stidham loamy fine sand and Konawa fine sandy loam. The Dougherty soil has a profile similar to the one described as typical for the series. The Eufaula soil has a profile similar to the one described for the Eufaula series.

These soils are not suitable for cultivation but are suitable for post lots. They are used for pasture or range. (Capability unit VIe–4; Deep Sand Savannah range site; no woodland classification)

Dwight Series

The Dwight series consists of deep, very gently sloping to gently sloping soils on uplands. These soils are moderately well drained and very slowly permeable. They formed under tall grass in material weathered from shale or clayey alluvium.

In a typical profile the surface layer is light brownish-gray silt loam 6 inches thick. The uppermost part of the subsoil is grayish-brown, firm silty clay 14 inches thick. The middle part is light brownish-gray, firm silty clay mottled with strong brown and yellowish brown. This layer contains numerous salt crystals. It extends to a depth of 56 inches. The lowermost part of the subsoil is light-gray, firm silty clay mottled with yellowish brown and strong brown.

The original vegetation was tall prairie grass. Most of the acreage is used for tame pasture. Many areas are severely eroded.

The Dwight soils in this county are mapped with Dennis and Parsons soils.

A typical profile of Dwight silt loam is 1,800 feet west and 200 feet north of the southeast corner of sec. 22, T. 8 N., R. 14 E.

Ap—0 to 6 inches, light brownish-gray (10YR 6/2) silt loam, grayish-brown (10YR 5/2) when moist; weak, medium, granular structure; friable when moist, hard when dry; pH 6.0; abrupt boundary; 4 to 8 inches thick.

B21t—6 to 20 inches, grayish-brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) when moist; weak, medium, columnar structure that easily breaks to strong medium blocky; extremely firm when moist, extremely hard when dry; continuous clay films; gray silt coatings on ped faces; pH 6.5; gradual boundary; 8 to 16 inches thick.

B22t—20 to 56 inches, light brownish-gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) when moist; few, fine, faint, yellowish-brown and strong-brown mottles; weak, coarse, blocky structure; extremely firm when moist, extremely hard when dry; continuous clay films; gray silt loam in pockets; salt crystals visible; pH 8.0; gradual boundary; 20 to 40 inches thick.

B3—56 to 90 inches, light-gray (5Y 7/1) silty clay, gray (5Y 5/1) when moist; few, fine, faint, yellowish-brown and strong-brown mottles; few small, black concretions; massive; extremely firm when moist, extremely hard when dry; pH 8.0.

The A horizon ranges from light brownish gray to very dark gray. Its texture is silt loam and silty clay cloam. In some areas there is a thin A2 horizon of light-gray silt loam. The B2t horizon ranges from light grayish brown to very dark gray. Its texture ranges from heavy silty clay loam to silty clay. Salt crystals commonly occur in the B2t horizon, and there are generally a few strong-brown and yellowish-brown mottles. The profile ranges from strongly acid to moderately alkaline. It is generally alkaline below a depth of 20 inches.

Dwight soils have a thinner A horizon than Parsons and Dennis soils. They also differ from Dennis soils in having an abrupt boundary between the surface layer and the subsoil.

Enders Series

The Enders series consists of moderately deep soils on uplands. These are the dominant soils in the timbered, stony, hilly part of the county. They are excessively drained and slowly permeable. They formed under timber in material weathered from shale.

In a typical profile the surface layer is light brownish-gray fine sandy loam 2 inches thick. It is underlain by a 2-inch layer of light-gray fine sandy loam. Below this is 5 inches of pale-brown and yellowish-red clay loam. The subsoil is red, firm clay. At a depth of 24 inches is partly weathered, light olive-gray shale.

The original vegetation consisted of post oak, blackjack oak, hickory, and shortleaf pine and an understory of tall grass. The acreage is wooded and is used as range.

The Enders soils in this county are mapped with Hector soils.

A typical profile of Enders fine sandy loam is 1,300 feet west and 50 feet north of the southeast corner of sec. 13, T. 4 N., R. 14 E.

A1—0 to 2 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak fine and medium, granular structure; numerous surface stones 10 to 20 inches in diameter; friable when moist; pH 5.0; clear boundary; 1 to 4 inches thick.

A2—2 to 4 inches, light-gray (10YR 7/2) fine sandy loam, pale brown (10YR 6/3) when moist; weak, fine, granular structure; numerous sandstones; friable when moist; pH 4.5; gradual boundary; 2 to 4 inches thick.

A3—4 to 9 inches, pale-brown (10YR 6/3) and yellowish-red clay loam in ped interstices; moderate, fine, blocky structure; ped faces partly coated with pale-brown fine sandy loam; patchy clay films; few standstones; very firm when moist, extremely hard when dry; pH 4.5; clear boundary; 3 to 7 inches thick.

B2t—9 to 24 inches, red (2.5YR 5/6) clay, red (2.5YR (4/6) when moist; few, distinct, yellowish-brown mottles; strong, medium, blocky structure; continuous clay films; very firm when moist, extremely hard when dry; pH 5.0; gradual, wavy boundary; 8 to 20 inches thick.

R—24 to 36 inches +, partly weathered, light olive-gray shale.

The A1 and A2 horizons range from light gray to dark brown. The texture ranges from fine sandy loam to loam and stony fine sandy loam. The A3 horizon ranges from pale brown to yellowish red. Its texture ranges from loam to clay loam. The B2t horizon is dominantly red or yellowish red but in places is mottled with yellowish brown, gray, and red. Its texture ranges from clay to silty clay. The depth to shale is generally 20 to 35 inches, but there are pockets where it is 50 inches. The profile is strongly acid to very strongly acid.

Enders soils have a more clayey subsoil than Hartsells soils. They are deeper than Hector soils. They differ from both of these soils in overlying shale instead of sandstone.

Enders-Hector complex, 5 to 30 percent slopes (EhE).—This complex is about 60 percent Enders soils and about 35 percent Hector soils. The texture of the surface layer ranges from fine sandy loam to loam and stony fine sandy loam. The rest of the complex consists of Hartsells soil.

The Enders soil has the profile described as typical for the series. The Hector soil has a profile similar to the one described as typical for the Hector series.

These soils are not suitable for cultivation. They are wooded and are used for grazing. (Capability unit VIIs–2; woodland group 5. Enders soil: Sandy Savannah range site; Hector soil: Shallow Savannah range site)

Enders-Hector complex, 30 to 60 percent slopes (EhF).—This complex is about 50 percent Enders soils and about 35 percent Hector soils. The texture of the surface layer ranges from fine sandy loam to loam and stony fine sandy loam. The rest of the complex consists of sandstone and shale outcrops.

The surface layer and the subsoil of the Enders soils are slightly thinner than the corresponding layers in the profile described as typical for the series.

The Hector soil has a profile similar to the one described as typical for the Hector series.

These soils are not suitable for cultivation. They are wooded and are used for grazing. (Capability unit VIIs–4; Savannah Breaks range site; woodland group 5)

Ennis Series

The Ennis series consists of deep, nearly level soils on the flood plains of streams that flow mainly from forested soils. These soils are moderately well drained and moderately slowly permeable.

In a typical profile the surface layer is pale-brown silt loam about 9 inches thick. The subsoil is light yellowish brown, friable silt loam mottled with yellowish brown and grayish brown. It is about 34 inches thick. Below this is light yellowish-brown silt loam. This layer is more prominently mottled than the rest of the profile.

The original vegetation was hardwood forest. Most of the acreage has been cleared for cultivation and is now in bermudagrass pasture.

A typical profile of Ennis silt loam is 400 feet south and 500 feet west of the northeast corner of sec. 12, T. 7 N., R. 18 E.

A1—0 to 9 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 4/3) when moist; weak, medium, granular structure; very friable when moist, slightly hard when dry; pH 6.0; clear boundary; 6 to 14 inches thick.

B—9 to 43 inches, light yellowish-brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) when moist; common, medium, faint mottles of yellowish brown when moist and few, fine, grayish-brown mottles in lower part; weak, medium, subangular blocky structure; few soft iron concretions; diffuse boundary; pH 5.5; 25 to 40 inches thick.

C—43 to 70 inches +, light yellowish-brown (10YR 6/4) silt loam, yellowish brown (10YR 5/4) when moist; many, coarse, distinct mottles of strong brown (7.5YR 5/6) and yellowish brown (10YR 5/4); massive; friable when moist; pH 5.0; diffuse boundary.

The A1 horizon ranges from pale brown to brown. Its texture is dominantly silt loam but is loam in some areas. The yellowish-brown and strong-brown mottling varies in amount; yellowish brown is generally the matrix color below a depth of 14 inches. In many places gray mottles occur below a depth of 36 inches. The B horizon is dominantly silt loam but ranges from loam to light silty clay loam. Below a depth of 43 inches, the texture is generally silt loam, but in some areas there are strata of fine sandy loam or clay loam. The profile ranges from medium acid to very strongly acid.

Ennis soils are similar to Verdigris, Rosebloom, and Ochlockonee soils. They have a lighter colored A horizon and a more acid and prominently mottled B horizon than Verdigris soils. They are better drained than Rosebloom soils and therefore lack the grayish subsoil of those soils. They have a more silty, less stratified profile than Ochlockonee soils.

Ennis silt loam (En).—This soil has the profile described as typical for the series. It occurs as broad, nearly level areas on the flood plains of local streams. It is subject to occasional flooding. Included in mapping were a few small areas of Rosebloom soils and, making up as much as 10 percent of each individual area, tracts of Verdigris soils.

Most of the crops grown in the county are well suited to this soil. Excess water is a moderate limitation. (Capability unit IIw–1; Loamy Bottomland range site; woodland group 1)

Ennis and Verdigris soils, broken (Eo).—This mapping unit consists of nearly level, broken, frequently flooded soils. It includes all of the frequently flooded soils in the county. It is 35 percent Ennis soils, 30 percent Verdigris soils, 15 percent stream channels and banks, 10 percent Rosebloom soils, 5 percent Chastain soils, and 5 percent Ochlockonee soils. These soils occur as long bands along creeks. The width is mostly between 100 and 300 feet but ranges to as much as 800 feet.

The profiles of the Ennis and Verdigris soils in this unit are similar to those described as typical for the respective series. The soils in this unit, however, are subjected to deposition and scouring more frequently than those farther back on the flood plain. The Ennis soil is on flood plains of streams that flow mainly from areas of forested soils, and the Verdigris soil, from areas of prairie soils.

Meandering streams have broken these soils into such small areas that only a very small acreage would be arable even if flooding were controlled. A few areas have been cleared and planted to bermudagrass, but most areas are wooded and are used as pasture. (Capability unit Vw–1; Loamy Bottomland range site; woodland group 1)

Eram Series

The Eram series consists of moderately deep soils on uplands. These soils are moderately well drained and slowly permeable. They formed under tall grass in neutral shale and clay. The slope is dominantly 3 percent but ranges from 2 to 5 percent.

In a typical profile the surface layer is dark grayish-brown clay loam 8 inches thick. The subsoil is about 24 inches thick. The upper part is light olive-brown, very firm clay mottled with red. The lower part is light yellowish-brown, firm clay. It contains a few small, black concretions. At a depth of about 32 inches is hard, olive shale.

Most of the acreage is used as range.

A typical profile of Eram clay loam, 2 to 5 percent slopes, is 500 feet east and 200 feet north of the southwest corner of sec. 1, T. 4 N., R. 15 E.

A1—0 to 8 inches, dark grayish-brown (10YR 4/2) light clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, granular structure; friable when moist, hard when dry; pH 5.5; clear boundary; 6 to 10 inches thick.

B2t—8 to 22 inches, light olive-brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) when moist; many, medium, distinct, red (2.5YR 4/6) mottles; moderate, fine, blocky structure; very firm when moist, extremely hard when dry; continuous clay films; pH 5.5; gradual boundary; 7 to 14 inches thick.

B3—22 to 32 inches, light yellowish-brown (2.5Y 6/4) clay, light olive brown (2.5Y 5/4) when moist; weak, coarse, blocky structure; few, small, black concretions; clay films present; very firm when moist, extremely hard when dry; pH 6.5; gradual boundary; 7 to 16 inches thick.

R—32 to 40 inches +, hard, olive, neutral shale.

The A horizon is dominantly clay loam but ranges to silt loam. Its color ranges from grayish brown to very dark brown. The B2t horizon ranges from light yellowish brown to olive and is generally mottled with red. Shale or firm clay is at a depth ranging from 20 to 40 inches. The profile ranges from strongly acid to slightly acid.

Eram soils are more clayey in the subsoil and are shallower than the associated Dennis soils. They occur near Talihina soils and are deeper than those soils.

Eram clay loam, 2 to 5 percent slopes (ErC).—This soil has the profile described as typical for the series. It is on prairies. Included in mapping were small areas of Talihina and Dennis soils.

This Eram soil is used mainly for native grass production. It can be cultivated, but it is subject to very severe erosion if cultivated and not protected. (Capability unit IVe–1; Loamy Prairie range site; no woodland classification)

Eram clay loam, 2 to 5 percent slopes, eroded (ErC2).—The surface layer of this soil is thinner than the corresponding layer in the profile described as typical for the series. In small areas the surface layer and subsoil have been mixed by tillage, and in some of the more eroded areas the texture of the surface layer is light clay. Rills and shallow gullies have formed. Included in mapping were small areas of Dennis soils.

This Eram soil has been under cultivation but is now used mostly for tame grass pasture. It can be cultivated, but it is subject to very severe erosion if not protected. (Capability unit IVe–4; Loamy Prairie range site; no woodland classification)

Eufaula Series

The Eufaula series consists of deep, undulating, sandy soils on uplands. These soils are somewhat excessively drained and are rapidly permeable. They formed under timber in slightly alkaline, sandy sediments.

In a typical profile the surface layer is pale-brown fine sand 4 inches thick. Beneath this is a 38-inch layer of pink to very pale brown fine sand. The subsoil extends to a depth of 80 inches. It is light-brown loamy fine sand.

The original vegetation consisted of tall grass and scattered stands of hardwoods. Less sloping areas have been used for cultivated crops but are now idle. A few areas are in tame pasture.

A typical profile of Eufaula fine sand, 0 to 3 percent slopes, is 1,700 feet west and 600 feet north of the southeast corner of sec. 11, T. 8 N., R. 14 E.

A1—0 to 4 inches, pale-brown (10YR 6/3) fine sand, brown (10YR 5/3) when moist; single grain; loose when moist and when dry; pH 6.0; clear boundary; 3 to 8 inches thick.

A2—4 to 42 inches, pink (7.5YR 7/4) fine sand, brown (7.5YR 5/4) when moist; single grain; loose when moist and when dry; pH 6.0; gradual, wavy boundary; 20 to 40 inches thick.

B2t—42 to 80 inches, light-brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) when moist; lamellae, ¼ to 1 inch thick and 2 to 6 inches apart, of reddish-brown (5YR 5/4) fine sandy loam, dark reddish brown (5YR 3/4) when moist; lamellae ⅛ inch wide below a depth of 60 inches; single grain; pH 6.0.

The A horizon is dominantly fine sand, but in a few areas it is loamy fine sand. The A1 horizon ranges from very pale brown to brown. Lamellae generally occur in the B2t horizon, below a depth of 40 inches. They are 2 to 6 inches apart, ⅛ inch to 2 inches thick, fine sandy loam or light sandy clay loam in texture, and red, yellowish red, reddish brown, or dark reddish brown in color. The profile ranges from strongly acid to medium acid.

Eufaula soils are associated with Dougherty and Stidham soils. They have a thicker A horizon and a sandier subsoil than those soils.

Eufaula fine sand, 0 to 3 percent slopes (EuB).—This soil occurs mostly in the northern part of the county. Slopes are short and irregular. Included in mapping were small areas of Stidham and Dougherty soils.

This Eufaula soil can be cultivated, but it is very severely limited because of droughtiness. (Capability unit IVs–1; Deep Sand Savannah range site; no woodland classification)

Guin Series

The Guin series consists of sloping to moderately steep soils on uplands. These soils are well drained or excessively drained and moderately to rapidly permeable. They vary considerably, within short distances, in thickness of the surface layer, amount of gravel, and kind of underlying material.

In a typical profile the surface layer is dark grayish-brown gravelly sandy loam about 5 inches thick. The subsurface layer is light brownish-gray gravelly sandy loam about 5 inches thick. The subsoil is yellowish-red, massive gravelly loamy sand. It is about 60 percent gravel. At a depth of about 37 inches is gray shale.

The native vegetation consists of post oak and blackjack oak and an understory of tall grass. All the acreage is used for grazing. Some areas are sources of roadbuilding material.

A typical profile of Guin gravelly sandy loam, 5 to 20 percent slopes, is 255 feet north and 100 feet east of the southwest corner of sec. 7, T. 4 N., R. 15 E.

A1—0 to 5 inches, dark grayish-brown (10YR 4/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) when moist; structureless; approximately 30 percent waterworn gravel; pH 6.0; clear boundary; 1 to 10 inches thick.

A2—5 to 10 inches, light brownish-gray (10YR 6/2) gravelly sandy loam, grayish brown (10YR 5/2) when moist; structureless; approximately 30 percent waterworn gravel; pH 5.5; clear boundary; 4 to 8 inches thick.

B—10 to 37 inches, yellowish-red (5YR 5/6) gravelly loamy sand, yellowish red (5YR 4/6) when moist; massive; approximately 60 percent waterworn gravel; pH 6.0; clear boundary; 10 to 40 inches thick.

R—37 inches +, gray shale.

The surface layer ranges from pale brown to very dark grayish brown. Its texture ranges from gravelly sand to gravelly sandy loam. The A2 horizon ranges from white to pale brown and light brownish gray. The B horizon ranges from red to yellowish red. Its texture ranges from gravelly loamy sand to gravelly sand. The size and content of gravel in this horizon vary within short distances. The gravel content is generally about 60 percent but ranges from 10 to 80 percent.

Guin soils are more gravelly than the associated Dougherty or Stidham soils.

Guin gravelly sandy loam, 5 to 20 percent slopes (GuE).—This soil is in the south-central part of the county, adjacent to Stidham soils. It varies in depth, in texture, and in content of gravel. In some areas there is a subsoil, and in a few areas sandstone or shale is within a depth of 20 inches. The underlying material is shale, sandstone, or gravel. The sandstone and shale are tilted. Consequently, the depth of the solum varies considerably within short distances.

This soil is not suitable for cultivation. It is used for native grass production. There are several large sand and gravel pits. (Capability unit VIs–1; Sandy Savannah range site; woodland group 5)

Hartsells Series

The Hartsells series consists of moderately deep, very gently sloping to sloping soils on uplands. These soils are well drained and moderately permeable. They formed under timber over acid sandstone that in places contains beds of shale.

In a typical profile the surface layer is grayish-brown fine sandy loam about 5 inches thick. Beneath this is a 7-inch layer of pale-brown fine sandy loam. The subsoil extends to a depth of about 34 inches. The upper 4 inches is yellowish-brown, friable fine sandy loam. The lower part is brownish-yellow, friable sandy clay loam mottled with yellowish red. Below this is a 5-inch layer of brownish-yellow fine sandy loam mottled with grayish brown. At a depth of 39 inches is hard sandstone.

The original vegetation consisted of oak and hickory trees interspersed with tall grass. Most of the acreage has been cleared and cultivated, but a considerable acreage is now in bermudagrass pasture.

A typical profile of Hartsells fine sandy loam, 1 to 3 percent slopes, is 1,500 feet east and 100 feet north of the southwest corner of sec. 27, T. 8 N., R. 15 E.

A1—0 to 5 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; very friable; pH 6.0; clear boundary; 4 to 8 inches thick.

A2—5 to 12 inches, pale-brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) when moist; very weak granular structure; very friable; pH 5.5; clear, wavy boundary; 5 to 15 inches thick.

B1—12 to 16 inches, yellowish-brown (10YR 5/6) heavy fine sandy loam; weak, medium, subangular blocky structure; friable; most sand grains coated; pH 5.0; gradual, smooth boundary; 0 to 6 inches thick.

B2t—16 to 34 inches, brownish-yellow (10YR 6/6) sandy clay loam; yellowish-brown (10YR 5/6) when moist; few, medium, distinct, yellowish-red (5YR 5/6) mottles; moderate, medium, subangular blocky structure; friable when moist, very hard when dry; patchy clay films on ped faces and in pores; pH 4.8; gradual, wavy boundary; 10 to 20 inches thick.

C—34 to 39 inches, brownish-yellow (10YR 6/6) fine sandy loam; yellowish brown (10YR 5/6) when moist; many, medium, distinct, grayish-brown (10YR 5/2) mottles; massive; numerous sandstone fragments; pH 5.0.

R—39 inches +, hard sandstone.

In cultivated areas the A1 horizon is dark grayish brown to pale brown. Its texture is dominantly fine sandy loam but ranges to loamy fine sand. The B2t horizon is yellowish brown to strong brown and has varying amounts of brown and yellowish-red mottling. It is dominantly sandy clay loam but ranges from heavy fine sandy loam to light clay loam. The depth to sandstone averages about 39 inches but ranges from 24 to 42 inches. The profile is very strongly acid to medium acid.

Hartsells soils are associated with Bates, Enders, and Hector soils. They differ from Bates soils in having an A2 horizon. They have a more sandy, less reddish subsoil than Enders soils. They are deeper than Hector soils.

Hartsells fine sandy loam, 1 to 3 percent slopes (HaB).—This soil has the profile described as typical for the series. It occurs on broad, smooth hilltops. In a few areas the lowermost part of the subsoil is mottled silty clay. Included in mapping were small areas of Enders and Hector soils.

This Hartsells soil is suited to most crops grown in the county. It is low in fertility and requires a complete fertilizer. It is subject to moderate erosion if cultivated and not protected. (Capability unit IIe–4; Sandy Savannah range site; woodland group 3)

Hartsells fine sandy loam, 3 to 5 percent slopes (HaC).—This soil has a thinner surface layer than that described as typical for the series. It occurs on hilltops and foot slopes throughout the timbered areas of the county. In some areas the lowermost part of the subsoil is mottled silty clay. Included in mapping, and making up as much as 10 percent of any individual area, were areas of Hector soils.

Most of the acreage has been under cultivation but is now used as bermudagrass pasture. The erosion hazard is severe if this soil is cultivated and not protected. (Capability unit IIIe–3; Sandy Savannah range site; woodland group 3)

Hartsells fine sandy loam, 2 to 5 percent slopes, eroded (HaC2).—The surface layer of this soil is thinner than that described as typical for the series. In 25 to 70 percent of the areas, it has been mixed with material from the subsoil. There are rills and gullies 1 to 3 feet deep and 50 to 100 feet apart. Near these, the subsoil is exposed. In some areas the lowermost part of the subsoil is mottled silty clay. Included in mapping were areas of uneroded Hartsells soils and small areas of Enders and Hector soils.

This Hartsells soil is suited to close-growing crops, such as small grain or tame pasture. It is low in fertility and requires a complete fertilizer if sufficient ground cover is to be maintained for protection against erosion The erosion hazard is severe. (Capability unit IIIe–6; Sandy Savannah range site; woodland group 4)

Hector Series

The Hector series consists of shallow soils that formed under timber in material weathered from acid sandstone. These soils are well drained to excessively drained and are moderately rapidly permeable.

In a typical profile the surface layer is brown fine sandy loam about 4 inches thick. The subsurface layer also is brown fine sandy loam about 4 inches thick. The subsoil is reddish-yellow, friable fine sandy loam about 7 inches thick. At a depth of about 15 inches is fractured sandstone.

The native vegetation consists dominantly of post oak and blackjack oak. Some of the less sloping areas have been cleared for cultivation but are used mainly for tame pasture.

The Hector soils in this county are mapped with Hartsells and Enders soils.

A typical profile of Hector fine sandy loam is in the NW¼NW¼ sec. 21, T. 6 N., R. 15 E.

A1—0 to 4 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) when moist; weak, medium, granular structure; numerous sandstone pebbles; friable when moist, slightly hard when dry; pH 6.0; clear boundary; 2 to 5 inches thick.

A2—4 to 8 inches, brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) when moist; weak, medium, granular structure; numerous sandstone pebbles; friable when moist, slightly hard when dry; pH 5.7; clear boundary; 3 to 8 inches thick.

B—8 to 15 inches, reddish-yellow (5YR 6/6) heavy fine sandy loam; yellowish red (5YR 4/6) when moist; weak, medium, subangular blocky structure; friable when moist, hard when dry; numerous sandstone pebbles; pH 5.5; 5 to 10 inches thick.

R—15 inches +, fractured sandstone.

The A1 horizon ranges from grayish brown to brown. Its texture is dominantly fine sandy loam but ranges to stony fine sandy loam. The B horizon ranges from reddish brown to yellowish red, and its texture ranges from fine sandy loam to light sandy clay loam. The depth to sandstone ranges from 10 to 20 inches. The profile ranges from slightly acid to very strongly acid.

Hector soils are similar to Collinsville soils, which formed under grass. They differ from those soils in having an A2 horizon and a lighter colored A1 horizon.

Hector-Hartsells complex, 2 to 5 percent slopes (HhC).—This complex is about 60 percent Hector soils and about 35 percent Hartsells soils. Included in mapping, and making up as much as 5 percent of an individual area, are areas of Enders soils.

The Hector soil has the profile described as typical for the series.

The Hartsells soil has a profile similar to the one described as typical for the Hartsells series but differs in that all horizons are slightly thinner and the depth to sandstone is less than 30 inches.

These soils can be cultivated, but they are subject to very severe erosion if cultivated and not protected. Most of the acreage has been cultivated, but now most of it is used for tame grass pasture. (Capability unit IVe-3; woodland group 4. Hector soil: Shallow Savannah range site; Hartsells soil: Sandy Savannah range site)

Hector-Hartsells complex, 3 to 8 percent slopes, severely eroded (HhD3).—This complex is about 70 percent Hector soils and about 30 percent Hartsells soils.

The profiles of these soils are similar to those described as typical for the respective series. In 25 percent of the acreage most of the original surface layer has been removed through erosion, and in 50 percent of the unit it has been mixed with material from the subsoil through tillage. There are numerous gullies 2 to 4 feet wide and 100 to 200 feet apart.

All of the acreage has been under cultivation but is now idle or is used for tame grass pasture. (Capability unit VIe-2; woodland group 5. Hector soil: Eroded Shallow Savannah range site; Hartsells soil: Eroded Sandy Savannah range site)

Konawa Series

The Konawa series consists of deep, moderately coarse textured soils on uplands. These soils are 50 to 200 feet above the flood plain of the South Canadian River. They are well drained and moderately permeable. They formed under timber in old, sandy, weakly alkaline alluvium.

In a typical profile (fig. 8) the surface layer is pale-brown fine sandy loam about 12 inches thick. The subsoil extends to a depth of 58 inches. The upper 28 inches is reddish-brown, friable sandy clay loam. The lower part is reddish-yellow heavy fine sandy loam mottled with yellowish brown. Below this is reddish-yellow fine sandy loam or loamy fine sand.

The original vegetation consisted of oak, hickory, and elm trees and an understory of tall grass. All but a few small areas have been cleared for cultivation. The principal crops are cotton, small grain, grain sorghum, and soybeans. Some areas are in bermudagrass.

A typical profile of Konawa fine sandy loam, 1 to 3 percent slopes, is 600 feet south and 300 feet east of the northwest corner of sec. 14, T. 8 N., R. 14 E.

A1—0 to 12 inches, pale-brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) when moist; weak, medium, granular structure; very friable when moist; pH 6.0; gradual boundary; 8 to 14 inches thick.

B2t—12 to 40 inches, reddish-brown (5YR 5/4) sandy clay loam, reddish-brown (5YR 4/4) when moist; moderate,

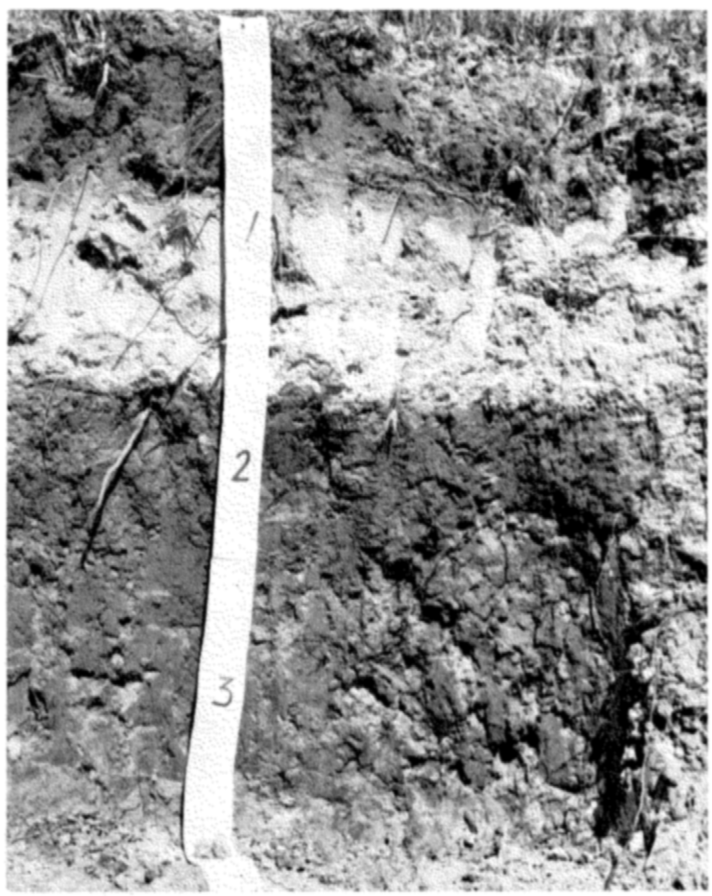

Figure 8.—Profile of Konawa fine sandy loam.

medium, subangular blocky structure; clay films on ped faces; pores coated; friable when moist, hard when dry; pH 6.5; gradual boundary; 25 to 40 inches thick.

B3—40 to 58 inches, reddish-yellow (5YR 6/6) heavy fine sandy loam, yellowish red (5YR 5/6) when moist; weak, medium, subangular blocky structure; many, medium, faint mottles of yellowish brown; clay films in pores; pH 5.5; diffuse boundary; 10 to 25 inches thick.

C—58 to 72 inches, reddish-yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 5/6) when moist; many, fine, distinct, very dark brown mottles; massive; few, small, black concretions; friable when moist; hard when dry; pH 6.5.

The A horizon ranges from pale brown to brown. The texture of the A horizon is dominantly fine sandy loam but ranges from loam to loamy fine sand. In undisturbed areas there is an A2 horizon 2 to 6 inches thick. The A2 horizon ranges from light brown to yellowish brown. Its texture is fine sandy loam. The B2t horizon ranges from reddish brown to red. Its texture is dominantly sandy clay loam. The C horizon ranges from loamy fine sand to light sandy clay loam. The profile ranges from neutral to strongly acid.

Konawa soils are associated with Choteau, Dougherty, and Vanoss soils. They have a redder, sandier subsoil than Choteau and Vanoss soils. They have a much thinner A horizon than Dougherty soils, which have an A2 horizon that extends to a depth of 20 to 38 inches.

Konawa fine sandy loam, 1 to 3 percent slopes (KoB).—This soil has the profile described as typical for the series. It occurs mostly in the northern part of the county, adjacent to the South Canadian River. Included in mapping were areas of Vanoss soils, which make up as much as 8 percent of some areas, and areas of Choteau soils, which make up as much as 5 percent of some areas.

This Konawa soil is well suited to all crops grown in the county, and it is suited to post lots. It is subject to moderate erosion if cultivated and not protected. Most of the acreage is under cultivation. (Capability unit IIe–4; Sandy Savannah range site; no woodland classification)

Konawa soils, 3 to 8 percent slopes, severely eroded (KsD3).—These soils occur mostly in the northern part of the county, adjacent to the South Canadian River. They are dissected by U-shaped gullies 50 to 150 feet apart and 2 to 8 feet or more deep. The surface layer is thinner than that in the profile described as typical for the series. Its texture is dominantly loamy fine sand but ranges to fine sandy loam. Included in mapping were small areas of Dougherty and Stidham soils.

All of the acreage has been under cultivation but is now so eroded and gullied that it is no longer suitable for crops. Most of it is used for tame grass pasture. (Capability unit VIe–1; Sandy Savannah range site; no woodland classification)

Mine Pits and Dumps

Mine pits and dumps (Mp) consists of coal strip pits and mounds of waste from strip pits or shaft mines.

The strip pits are 20 to 40 feet deep and 100 to 200 feet wide. They are usually partly filled with water.

The waste mounds adjacent to the strip pits are 15 to 30 feet high and 100 to 300 feet wide. The soil material, which is removed first, is buried beneath several feet of hard, red, black, or gray, neutral shale.

The waste from the shaft mines consists of red, black, and gray, hard shale.

There is little or no vegetation on the waste mounds. Most of the pits have been stocked with bass and bluegill. (Capability unit VIIIs–1; no range site or woodland classification)

Norwood Series

The Norwood series consists of deep, level, calcareous soils on the flood plain of the South Canadian River.

In a typical profile the surface layer is brown silt loam about 12 inches thick. Below this is brown to reddish-brown, friable silt loam. At a depth of about 32 inches is light-brown very fine sandy loam stratified with fine sandy loam. These soils are well drained and moderately permeable.

The Norwood soils in this county are mapped with Yahola soils.

A typical profile of Norwood silt loam is 600 feet west and 4,000 feet north of the southeast corner of sec. 11, T. 8 N., R. 14 E.

A1—0 to 12 inches, brown (7.5YR 5/2) light silt loam, brown (7.5YR 3/2) when moist; weak, fine, granular structure; friable when moist, hard when dry; calcareous; clear boundary; 10 to 15 inches thick.

AC1—12 to 23 inches, brown (7.5YR 5/3) silt loam, dark brown (7.5YR 4/3) when moist; weak, fine, granular structure; friable when moist, hard when dry; calcareous; diffuse boundary; 10 to 20 inches thick.

AC2—23 to 32 inches, reddish-brown (5YR 5/3) heavy silt loam, reddish brown (5YR 4/3) when moist; massive; friable when moist, hard when dry; calcareous; clear boundary; 6 to 15 inches thick.

C1—32 to 45 inches, light-brown (7.5YR 6/4) very fine sandy loam, brown (7.5YR 4/4) when moist; massive; very friable when moist, slightly hard when dry; stratified with fine sandy loam; calcareous; gradual boundary.

C2—45 to 72 inches +, pink (7.5YR 7/3) loamy very fine sand, light brown (7.5YR 6/3) when moist; massive; loose when moist, soft when dry; calcareous.

The A horizon is dominantly silt loam but ranges from loam to silty clay loam. Its color ranges from reddish brown to dark brown. The profile is dominantly silt loam to a depth of 30 to 40 inches. Below this depth are strata of light-brown to reddish-brown fine sandy loam. The profile is calcareous throughout.

Norwood soils are more silty in the AC horizon and in the upper part of the C horizon than Yahola soils.

Ochlockonee Series

The Ochlockonee series consists of deep, nearly level soils on flood plains. These soils are well drained and moderately rapidly permeable.

In a typical profile the surface layer is pale-brown fine sandy loam about 10 inches thick. The next layer is brown, friable fine sandy loam. Below a depth of about 40 inches is very pale brown, stratified fine sandy loam and loamy fine sand.

The original vegetation was mainly hardwood forest. Most areas have been cultivated but are now used for tame grass pasture.

A typical profile of Ochlockonee fine sandy loam is 600 feet south and 500 feet east of the northwest corner of the SE¼ sec. 21, T. 2 N., R. 17 E.

Ap—0 to 10 inches, pale-brown (10YR 6/3) fine sandy loam, dark brown (10YR 4/3) when moist; weak, fine, granular structure; friable when moist; pH 5.5; clear boundary; 8 to 14 inches thick.

C1—10 to 50 inches, brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) when moist; weak, fine, granular structure; friable when moist, slightly hard when dry; pH 5.0; gradual boundary; 20 to 45 inches thick.

C2—50 to 72 inches, very pale brown (10YR 7/3), stratified fine sandy loam and loamy fine sand, brown (10YR 5/3) when moist; massive; very friable when moist; pH 5.0.

The A horizon ranges from pale brown to dark brown. Its texture is dominantly fine sandy loam. The C horizon ranges from very pale brown to dark grayish brown. Its texture is dominantly fine sandy loam, but there are thin strata of sandy clay loam, loamy fine sand, sand, or gravel. Below the A horizon the profile ranges from very strongly acid to strongly acid.

Ochlockonee soils are similar to Ennis and Yahola soils. They are sandier in the uppermost 40 inches and are better drained than Ennis soils. They differ from Yahola soils in being acid instead of calcareous. Ochlockonee soils are associated with Rosebloom soils. They have a less silty, more brownish profile than those soils, which are poorly drained.

Ochlockonee fine sandy loam (Oc).—This nearly level soil occurs on the flood plains of streams that drain the forested Enders, Hector, and Hartsells soils. It is subject to occasional overflow. Included in mapping, and making up as much as 5 percent of some areas, were areas of Ennis soils.

All crops grown in the county are well suited to this soil. (Capability unit IIw-2; Loamy Bottomland range site; woodland group 2)

Parsons Series

The Parsons series consists of nearly level to very gently sloping soils that are deep over shale. These soils are on upland prairies. They are somewhat poorly drained and very slowly permeable. They formed under tall grass.

In a typical profile (fig. 9) the surface layer is grayish-brown silt loam 7 inches thick. Below this is a layer of light brownish-gray silt loam 5 inches thick. The subsoil extends to a depth of 62 inches or more. The uppermost part is a 12-inch layer of dark grayish-brown, very firm clay mottled with strong brown and reddish brown. The middle part is a 24-inch layer of yellowish-brown, very firm clay mottled with olive brown and grayish brown. The lowermost part is yellowish-brown, very firm clay mottled with light gray and strong brown.

The native vegetation was tall prairie grass. About 60 percent of the acreage has been under cultivation. Tame pasture grass is being planted on many old fields. Only a small acreage is cultivated now.

A typical profile of a Parsons silt loam is in a native grass meadow 1,650 feet west and 600 feet north of the southeast corner of sec. 1, T. 3 N., R. 13 E.

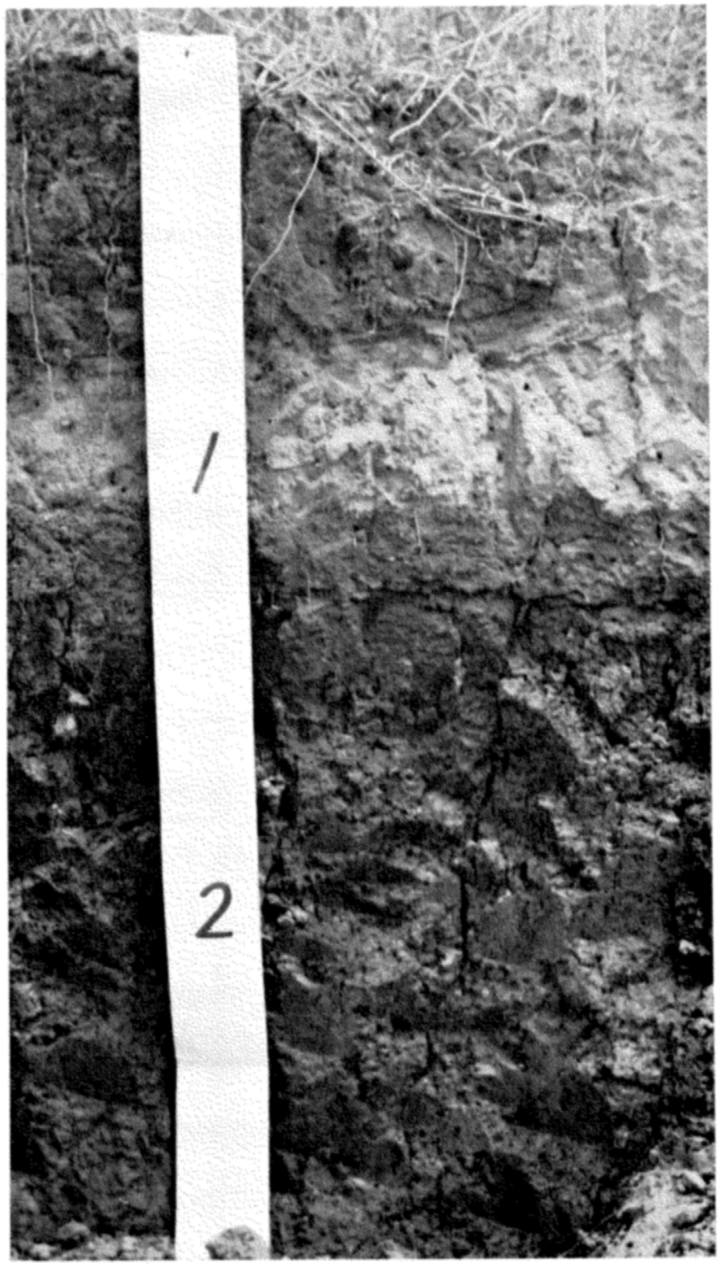

Figure 9.—**Profile of Parsons silt loam.**

A1—0 to 7 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; friable when moist; pH 5.3; clear boundary; 6 to 12 inches thick.

A2—7 to 12 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium, granular structure; few, faint, dark yellowish-brown mottles; friable when moist; pH 5.3; abrupt, wavy boundary; 1 to 6 inches thick.

B21t—12 to 24 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) when moist; many, medium, distinct, strong-brown mottles and few, fine, distinct, reddish-brown mottles; weak, medium, blocky structure; continuous clay films; few fine siltstone fragments; very firm when moist, extremely hard when dry; pH 5.5; gradual boundary; 8 to 16 inches thick.

B22t—24 to 48 inches, yellowish-brown (10YR 5/4) clay, dark grayish brown (10YR 4/2) when moist; few, fine, distinct, olive-brown and grayish-brown mottles; weak, medium, blocky structure; continuous clay films; few fine siltstone fragments; very firm when moist, extremely hard when dry; pH 6.0; gradual boundary; 15 to 30 inches thick.

B3—48 to 62 inches +, yellowish-brown (10YR 5/6) clay, dark yellowish brown (10YR 4/6) when moist; few, medium, faint, light-gray and strong-brown mottles; weak, fine, blocky structure; clay films present; few siltstones; very firm when moist, extremely hard when dry; pH 8.0.

The A1 horizon ranges from grayish brown to very dark grayish brown. The A1 and A2 horizons combined range from 8 to 16 inches in thickness. The B2t horizon is mottled with varying amounts of dark grayish brown, olive brown, strong brown, reddish brown, and yellowish brown. The profile ranges from strongly acid to moderately alkaline.

Parsons soils are similar to Taloka, Woodson, and Wrightsville soils. They have a thinner surface layer and subsoil than Taloka soils. They have a light-colored subsurface layer, which Woodson soils lack. Parsons soils are associated with Ennis and Bates soils. They are more poorly drained and have a more clayey subsoil than those soils.

Parsons silt loam, 0 to 1 percent slopes (PaA).—This soil has the profile described as typical for the series. Included in mapping were areas of Taloka soils that make up as much as 10 percent of some areas, and also small areas of Woodson soils.

Droughtiness is a limitation. Only drought-resistant or cool-season crops should be selected for planting. (Capability unit IIs–1; Claypan Prairie range site; no woodland classification)

Parsons silt loam, 1 to 3 percent slopes (PaB).—Included with this soil in mapping were small areas of Taloka, Dennis, and Eram soils.

This Parsons soil is subject to severe erosion if cultivated and not protected. Because of droughtiness, it is limited to drought-resistant or cool-season crops. About 80 percent of the acreage has been under cultivation, but most of it is now used for tame grass pasture. (Capability unit IIIe–1; Claypan Prairie range site; no woodland classification)

Parsons-Dwight complex, 1 to 3 percent slopes, eroded (PdB2).—This complex is 40 percent Parsons soils and 25 percent Dwight soils. Included in mapping, and making up about 15 percent of an individual area, were areas of a soil intergrading between Parsons and Dwight soils. Dennis loam and Choteau loam each make up about 10 percent of an area.

Erosion has cut rills and has removed most of the surface layer from small areas of these soils. Otherwise, the profiles of the Parsons and Dwight soils in this complex are similar to those described as typical for the respective series.

Most of the acreage has been under cultivation but is now unsuitable for crops. The acreage is used mainly for tame grass pasture or native range. (Capability unit VIe–5; no woodland classification. Parsons soil: Claypan Prairie range site; Dwight soil: Slickspot range site)

Rosebloom Series

The Rosebloom series consists of deep, level to slightly depressed soils on flood plains. These soils are poorly drained and very slowly permeable.

In a typical profile the surface layer is light brownish-gray silt loam about 10 inches thick. The subsoil, about 23 inches thick, is gray, friable silt loam mottled with yellowish brown. Below this is light-gray, firm silty clay loam mottled with grayish brown and yellowish brown.

The original vegetation consisted of hardwoods. Most of the acreage has been cleared and is used for tame grass pasture.

A typical profile of Rosebloom silt loam is 1,600 feet south and 1,320 feet east of the northwest corner of sec. 2, T. 4 N., R. 15 E.

A1—0 to 10 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; few, fine, faint, yellowish-brown mottles when moist; weak, fine, granular structure; friable when moist, very hard when dry; pH 5.0; clear boundary; 5 to 15 inches thick.

B—10 to 33 inches, gray (10YR 6/1) silt loam, dark gray (10YR 4/1) when moist; many, fine, faint, yellowish-brown mottles when moist; weak, coarse, subangular blocky structure; patchy clay films; friable when moist, extremely hard when dry; few soft iron concretions; pH 4.5; diffuse boundary; 15 to 25 inches thick.

C1g—33 to 53 inches, light-gray (10YR 6/1) light silty clay loam, dark gray (10YR 4/1) when moist; few, fine, faint, grayish-brown and yellowish-brown mottles; weak, coarse, subangular blocky structure; thin clay films; firm when moist, extremely hard when dry; numerous soft iron concretions; pH 5.0; diffuse boundary; 15 to 25 inches thick.

C2g—53 to 96 inches, light-gray (10YR 6/1) silty clay loam, gray (10YR 5/1) when moist; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; massive; numerous, small, soft iron concretions; pH 6.0.

The A1 horizon is dominantly silt loam; in a few small areas it is silty clay loam or loam. It ranges from light brownish gray to dark grayish brown and is generally faintly mottled with yellow and brown. Some areas have an A2 horizon of white to light-gray silt loam. The B and C horizons range from silt loam to silty clay loam. The profile ranges from very strongly acid to slightly acid.

Rosebloom soils are similar to Chastain, Ennis, and Verdigris soils. They have a less clayey B horizon than Chastain soils. They have a grayer B horizon than Ennis and Verdigris soils.

Rosebloom silt loam (Rs).—This level to slightly depressed soil occurs along streams that flow from forested soils. It is subject to occasional flooding. Included in mapping were areas of Chastain soils, which make up as much as 5 percent of an individual area, and areas of Ennis soils, which make up as much as 3 percent of an area.

This Rosebloom soil can be cultivated but generally needs a drainage system. Excess water severely limits the choice of plants. (Capability unit IIIw–1; Heavy Bottomland range site; woodland group 1)

Stidham Series

The Stidham series consists of deep, nearly level to very gently sloping, sandy soils on uplands. These soils are well drained and moderately permeable. They formed in neutral to mildly alkaline, old sandy alluvium.

In a typical profile the surface layer is pale-brown loamy fine sand 7 inches thick. The subsurface layer is white loamy fine sand 19 inches thick. To a depth of 55 inches, the subsoil is brownish-yellow, friable sandy clay loam mottled with very pale brown and strong brown. Below this is a layer of mottled fine sandy loam. At a depth of 68 inches is light-gray loamy fine sand.

The original vegetation consisted mainly of post oak, blackjack oak, hickory, and elm and an understory of tall grass. Most of the acreage has been cleared for cultivation. About half of the acreage is now used for tame pasture.

A typical profile of Stidham loamy fine sand, 0 to 3 percent slopes, is 500 feet east and 100 feet south of the intersection of U.S. Highway 69 and Hardy Springs road in sec. 18, T. 5 N., R. 15 E.

Ap—0 to 7 inches, pale-brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) when moist; weak, very fine, granular structure or single grain; loose when moist or dry; pH 6.5; clear boundary; 3 to 9 inches thick.

A2—7 to 26 inches, white (10YR 8/2) loamy fine sand, pale brown (10YR 6/3) when moist; single grain; loose when moist or dry; pH 6.5; clear, wavy boundary; 13 to 30 inches thick.

B21t—26 to 38 inches, brownish-yellow (10YR 6/8) sandy clay loam, yellowish brown (10YR 5/8) when moist; many, coarse, faint, very pale brown and strong-brown mottles; moderate, medium, subangular blocky structure;

friable when moist, hard when dry; continuous clay films; pH 6.0; diffuse boundary; 8 to 18 inches thick.

B22t—38 to 55 inches, brownish-yellow (10YR 6/8) sandy clay loam, yellowish brown (10YR 5/8) when moist; common, medium, distinct, strong-brown (7.5YR 5/6) and very pale brown mottles; weak, medium, subangular blocky structure; friable when moist, very hard when dry; clay films on ped faces; pores coated; pH 5.0; diffuse boundary; 8 to 18 inches thick.

B3—55 to 68 inches, coarsely mottled brownish-yellow (10YR 6/8) and very pale brown (10YR 7/3) heavy fine sandy loam, yellowish brown (10YR 5/8) and pale brown (10YR 6/3) when moist; massive; sand grains coated; pH 5.0; diffuse boundary; 16 to 20 inches thick.

C—68 to 75 inches +, light-gray (10YR 7/2) loamy fine sand; brown (10YR 5/3) when moist; common, coarse, distinct, yellowish-brown (10YR 5/6) mottles; massive; pH 6.0.

The A horizon ranges from 20 to 36 inches in thickness. Its texture is dominantly loamy fine sand. The A1 horizon ranges from very pale brown to grayish brown. The B horizon ranges from sandy clay loam to heavy fine sandy loam. Mottles in this horizon are strong brown, yellowish brown, brownish yellow, very pale brown, and reddish yellow. In some areas the B3 horizon has light-gray mottles. The C horizon ranges from loamy fine sand to fine sandy loam. In places below a depth of 5 feet, the profile is neutral or mildly alkaline.

Stidham soils are associated with and are similar to Dougherty and Konawa soils. Their subsoil is not so red as that of those soils. They have a thicker A2 horizon than Konawa soils. Stidham soils are also associated with Eufaula soils. They have a less sandy subsoil than those soils.

Stidham loamy fine sand, 0 to 3 percent slopes (StB).—This soil occurs as broad, smooth areas in the central and northern parts of the county. Included in mapping were small areas of Eufaula and Dougherty soils.

This Stidham soil is subject to severe wind and water erosion if cultivated and not protected. Most of the acreage has been cleared for cultivation. About half the acreage is used for tame grass pasture. (Capability unit IIIe-4; Deep Sand Savannah range site; no woodland classification)

Summit Series

The Summit series consists of deep, very gently sloping soils on uplands. These soils are moderately well drained and slowly permeable. They formed under tall grass in material weathered from limestone and calcareous shale. In many areas they occur on colluvial foot slopes that are separated from the higher, more sloping Talpa-Rock outcrop complex by Eram soils. They grade to the less sloping Woodson soils at slightly lower elevations.

In a typical profile the surface layer is dark-gray or very dark gray silty clay loam 13 inches thick. The subsoil is very firm silty clay. The upper part is dark gray and the lower part is dark grayish brown. At a depth of 54 inches is a 6-inch layer of gray silty clay. Limestone and calcareous shale occur at a depth of about 60 inches.

The original vegetation was tall prairie grass. Most of the acreage has been under cultivation. About half the acreage is now in tame grass pasture.

A typical profile of Summit silty clay loam, 1 to 3 percent slopes, is 900 feet south and 200 feet east of the northeast corner of SW¼ sec. 28, T. 3 N., R. 14 E.

Ap—0 to 7 inches, dark-gray (10YR 4/1) silty clay loam, black (10YR 2/1) when moist; moderate, fine, granular structure; friable when moist, hard when dry; pH 6.0; clear boundary; 4 to 8 inches thick.

A1—7 to 13 inches, very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) when moist; strong, medium, granular structure; hard when dry, friable when moist; pH 6.2; gradual boundary; 4 to 10 inches thick.

B2t—13 to 35 inches, dark-gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) when moist; moderate, medium, blocky structure; very firm wnen moist, extremely hard when dry; continuous clay films; pH 6.5; diffuse boundary; 15 to 30 inches thick.

B3—35 to 54 inches, dark grayish-brown (2.5Y 4/2) silty clay, very dark grayish brown (2.5YR 3/2) when moist; weak, coarse, blocky structure; common, fine, faint, olive mottles; few fine, black concretions and few small limestone and siltstone fragments; very firm when moist, extremely hard when dry; pH 7.2; diffuse boundary; 10 to 24 inches thick.

C—54 to 60 inches gray (5Y 5/1) silty clay, dark gray (5Y 4/1) when moist; common, medium, olive (5Y 5/4) mottles; massive; gray soft shale or siltstone fragments occurring in seams in lower part; pH 7.5; 4 to more than 20 inches thick.

R—60 inches +, limestone and calcareous shale.

The A1 horizon is dominantly silty clay loam, but in some small areas it is clay loam and silt loam. In a few areas it contains limestone gravel. Its color ranges from gray to black. The B2t horizon ranges from gray to very dark brown. The B2t and B3 horizons range from silty clay to clay. The C horizon is clay or silty clay and in many places contains fragments of shale, siltstone, or limestone. The profile ranges from medium acid to moderately alkaline.

Summit soils have stronger structure in the B horizon and a more gradual boundary between the surface layer and subsoil than Woodson and Parsons soils. They have a darker colored surface layer than Parsons soils. They are deeper than Eram and Talpa soils.

Summit silty clay loam, 1 to 3 percent slopes (SuB).—This soil has the profile described as typical for the series. It occurs on foot slopes, below areas of Talpa soils.

This soil is subject to moderate erosion if cultivated and not protected. Most of the acreage is under cultivation. (Capability unit IIe-3; Loamy Prairie range site; no woodland classification)

Talihina Series

The Talihina series consists of shallow upland soils that formed under tall grass in material weathered from shale. These soils are excessively drained and slowly permeable.

In a typical profile (fig. 10) the surface layer is grayish-brown stony clay loam 6 inches thick. The subsoil is brown, firm clay 9 inches thick. At a depth of about 15 inches is olive shale.

In this county Talihina soils are mapped with Collinsville soils.

A typical profile of Talihina stony clay loam is 1,600 feet west and 200 feet north of the southeast corner of sec. 2, T. 4 N., R. 15 E.

A1—0 to 6 inches, grayish-brown (10YR 5/2) stony clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, subangular blocky structure; firm when moist, hard when dry; numerous large and small sandstone fragments; pH 6.0; clear boundary; 4 to 8 inches thick.

B—6 to 15 inches, brown (10YR 5/3) clay, dark brown (10YR 4/3) when moist; few, fine, distinct, dark reddish-brown mottles; weak, medium, blocky structure; continuous clay films; very firm when moist, extremely hard when dry; numerous small siltstone and sandstone fragments; pH 5.2; gradual boundary; 4 to 10 inches thick.

R—15 to 25 inches +, olive shale.

The A1 horizon is dominantly stony clay loam but ranges to silt loam. Its color ranges from grayish brown to very dark brown. The B horizon ranges from brown and yellowish brown

Figure 10.—**Profile of Talihina stony clay loam.**

to olive and is mottled with various shades of red. The depth to shale ranges from 8 to 20 inches. The profile ranges from very strongly acid to medium acid.

Talihina soils are similar to Talpa, Collinsville, and Hector soils, but they formed over shale, whereas Talpa soils formed over limestone and Collinsville and Hector soils formed over sandstone. Talihina soils are not so deep as Eram soils.

Talihina-Collinsville complex, 5 to 20 percent slopes (TcE).—This complex is 45 percent Talihina soils, 20 percent Collinsville soils, 20 percent Eram soils, and 15 percent soils intergrading between Talihina and Eram soils. The profiles of the Talihina and Collinsville soils in this complex are similar to those described for the respective series. This complex occurs on stony ridges on prairie. It is used for native range. (Capability unit VIIs–1; Shallow Prairie range site; no woodland classification)

Taloka Series

The Taloka series consists of deep, nearly level to very gently sloping soils on uplands. These soils are somewhat poorly drained and very slowly permeable. They formed under tall grass in old clayey alluvium or in material weathered from shale.

In a typical profile (fig. 11) the surface layer is grayish-brown silt loam 12 inches thick. The subsurface layer is light-gray silt loam 12 inches thick. The subsoil, to a depth of about 46 inches, grayish-brown, very firm silty clay mottled with reddish brown and yellowish brown. The lower part is light olive-brown silty clay. It extends to a depth of 6 feet or more.

The original vegetation was tall prairie grass. Most of the acreage is in tame pasture. There are a few native grass meadows.

A typical profile of Taloka silt loam, 0 to 1 percent slopes, is 2,200 feet west and 100 feet north of the southeast corner of sec. 5, T. 3 N., R. 14 E.

A1—0 to 12 inches, grayish-brown (10YR 5/2) light silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; friable when moist, slightly hard when dry; pH 5.5; clear boundary; 8 to 16 inches thick.

A2—12 to 24 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; few, medium, faint, yellowish-brown mottles; very weak granular structure to massive; friable when moist, slightly hard when dry; pH 5.0; abrupt, wavy boundary; 8 to 16 inches thick.

B21t—24 to 32 inches, grayish-brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) when moist; few, fine, distinct, reddish-brown mottles and common, medium, faint, dark yellowish-brown mottles; strong, medium, blocky structure; continuous clay films; very firm when moist, extremely hard when dry; pH 5.5; diffuse boundary; 6 to 14 inches thick.

B22t—32 to 46 inches, grayish-brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) when moist; many, medium, faint, yellowish-brown mottles; moderate, medium, blocky structure; continuous clay films; very firm when moist, extremely hard when dry; pH 6.0; diffuse boundary; 16 to 20 inches thick.

B3—46 to 72 inches, light olive-brown (2.5YR 5/4) silty clay, olive brown (2.5YR 4/4) when moist; many, medium, faint, grayish-brown mottles; weak, coarse, blocky structure; continuous clay films; very firm when moist, extremely hard when dry; few, soft, black concretions; pH 7.0.

The A1 horizon is dominantly silt loam but ranges to loam. Its color ranges from grayish brown to very dark grayish brown. The A2 horizon ranges from light gray to brown. The boundary between the A2 and B2t horizons is abrupt, but in places peds in the topmost 3 inches of the B2t horizon are coated with silt from the A2 horizon. The B2t horizon ranges from silty clay to clay. Its color ranges from grayish brown to brown, and mottles range from red to olive brown. The profile ranges from very strongly acid to neutral.

Taloka soils are similar to Parsons, Choteau, and Dennis soils. They have a thicker A1 horizon and A2 horizon than Parsons soils. They have a more clayey subsoil than Choteau soils. They differ from Dennis soils in having an A2 horizon.

Taloka silt loam, 0 to 1 percent slopes (TkA).—This soil has the profile described as typical for the series. It occurs as broad, smooth areas. Included in mapping, and making up as much as 10 percent of an individual area, were areas of Parsons or Dennis soils.

Most of the acreage has been cultivated. About half the acreage is now used for tame grass pasture. Droughtiness is a limitation. For best production, drought-resistant or cool-season crops should be grown. (Capability unit IIs–2; Loamy Prairie range site; no woodland classification)

Taloka silt loam, 1 to 3 percent slopes (TkB).—This soil occurs on prairies. Included in mapping were small areas of Parsons and Dennis soils.

This Taloka soil is used mostly for tame grass pasture. It is subject to moderate erosion if cultivated and not protected. (Capability unit IIe–3; Loamy Prairie range site; no woodland classification)

Talpa Series

The Talpa series consists of very shallow upland soils that formed under grass in material weathered from limestone. These soils are moderately well drained to excessively drained. They commonly occur along limestone ridges near the Choctaw Fault. The ridges are generally

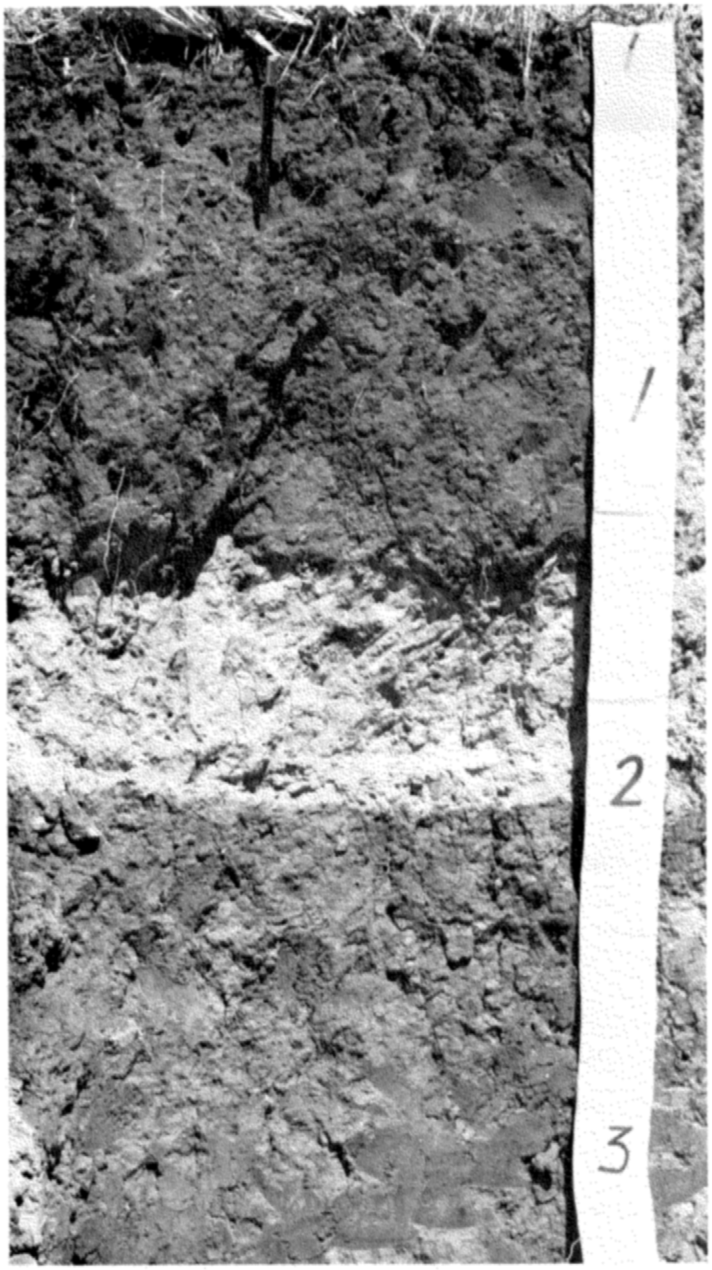

Figure 11.—**Profile of Taloka silt loam.**

less than one-fourth mile wide but range from about 400 feet to one-half mile. The slope gradient is generally about 15 percent but ranges from approximately 5 percent on ridgetops to 30 percent on side slopes.

In a typical profile the surface layer is very dark gray stony clay loam 8 inches thick. About 30 percent of the surface is covered with limestone rocks. Hard, fractured limestone is at a depth of 8 inches.

In most areas the vegetation consists of tall prairie grass and winged elm, haw, and persimmon trees.

The Talpa soils in this county are mapped with areas of Rock outcrop.

A typical profile of Talpa stony clay loam is north of the road in the southeast corner of the NE¼ sec. 10, T. 3 N., R. 15 E.

A1—0 to 8 inches, very dark gray (10YR 3/1) stony clay loam, black (10YR 2/1) when moist; strong, medium, granular structure; friable when moist, hard when dry; 30 percent of surface is covered with limestone rock; pH 6.5; 4 to 15 inches thick.

R—8 inches +, hard, fractured limestone.

This soil ranges from grayish brown to black. Its texture ranges from heavy silt loam to stony clay loam. The profile ranges from slightly acid to moderately alkaline.

Talpa soils are similar to Hector, Collinsville, and Talihina soils. They are darker colored than those soils and they are underlain by limestone, whereas those soils are underlain by acid sandstone or shale. Talpa soils are shallower than the associated Summit, Woodson, and Eram soils.

Talpa-Rock outcrop complex, 5 to 30 percent slopes (TrE).—This complex is approximately 40 percent Talpa stony clay loam, 30 percent rock outcrops, 10 percent Eram clay loam, 10 percent Summit silty clay loam, and 10 percent Enders soils. It occurs along limestone ridges in the southern part of the county.

The Talpa soil has the profile described as typical for the series. The rock outcrop is limestone.

This complex is not suitable for cultivation. It is used for native range. (Capability unit VIIs–3; Edgerock range site; no woodland classification)

Vanoss Series

The Vanoss series consists of deep, nearly level to very gently sloping soils that formed under tall grass in old, loamy, weakly alkaline alluvium. These soils are well drained and moderately permeable. They occur in the northern part of the county.

In a typical profile the surface layer is brown and grayish-brown loam 18 inches thick. The subsoil is brown and yellowish-brown, friable to firm clay loam. At a depth of 54 inches is yellowish-brown, firm sandy clay loam.

The original vegetation was tall native grass. Almost all the acreage is under cultivation.

A typical profile of Vanoss loam, 0 to 1 percent slopes, is 800 feet south and 1,000 feet west of the northeast corner of sec. 24, T. 8 N., R. 14 E.

Ap—0 to 10 inches, brown (10YR 5/3) light loam, dark brown (10YR 3/3) when moist; weak, fine, granular structure; friable when moist; pH 6.7; abrupt boundary; 7 to 12 inches thick.

A1—10 to 18 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, granular structure; friable when moist; pH 7.0; gradual boundary; 4 to 10 inches thick.

B21t—18 to 32 inches, brown (10YR 5/3) light clay loam, dark brown (10YR 3/3) when moist; moderate, medium, subangular blocky structure; patchy clay films on ped faces, continuous clay films in pores; friable when moist, very hard when dry; pH 6.0; gradual boundary; 10 to 20 inches thick.

B22t—32 to 54 inches, yellowish-brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) when moist; moderate, medium, subangular blocky structure; patchy clay films on ped faces, continuous clay films in pores; firm when moist, very hard when dry; few large sand grains; pH 5.5; gradual boundary; 15 to 25 inches thick.

B3—54 to 80 inches +, yellowish-brown (10YR 5/4) light sandy clay loam, dark yellowish brown (10YR 4/4) when moist; few, medium, faint, brownish-yellow (10YR 6/8) mottles, yellowish brown (10YR 5/8) when moist; very weak, coarse, subangular blocky structure or massive; firm when moist, very hard when dry; pH 5.5; gradual boundary.

The A horizon is dominantly loam but ranges to very fine sandy loam. Its color ranges from brown to very dark grayish brown, and its thickness ranges from 12 to 20 inches. Generally there are no mottles above a depth of 50 inches. In some areas, the texture below a depth of 50 inches is fine sandy loam. The profile ranges from strongly acid to mildly alkaline.

Vanoss soils are similar to Choteau, Konawa, and Bates soils. They have a more friable B horizon than Choteau soils and do not have the mottling in this layer that is typical of Choteau soils. They are not so sandy in the A and B horizons as Konawa soils. They are deeper than Bates soils.

Vanoss loam, 0 to 1 percent slopes (VaA).—This soil has the profile described as typical for the series. It occurs as broad, smooth areas in the northern part of the county. Included in mapping, and making up as much as 10 percent of an individual area, are areas of Choteau loam.

This Vanoss soil is well suited to all crops grown in the county. It is also suited to post lots. It has no major limitations. Most of the acreage is under cultivation. (Capability unit I–2; Loamy Prairie range site; no woodland classification)

Vanoss loam, 1 to 3 percent slopes (VaB).—This soil occurs in the northern part of the county. Included in mapping, and making up as much as 10 percent of an individual area, were areas of Choteau loam.

This Vanoss soil is well suited to all crops grown in the county. It is also suited to post lots. It is subject to moderate erosion if cultivated and not protected. Most of the acreage is under cultivation. (Capability unit IIe–2; Loamy Prairie range site; no woodland classification)

Verdigris Series

The Verdigris series consists of deep soils on flood plains. These soils are moderately well drained and moderately slowly permeable. They are not seasonally wet. They formed in alluvium.

In a typical profile the surface layer is grayish-brown or dark grayish-brown silt loam 15 inches thick. The subsoil is grayish-brown, friable silt loam about 15 inches thick. Below this, and extending to a depth of about 90 inches, is light brownish-gray heavy silt loam.

The original vegetation consisted of hardwoods and a grass understory. Almost all the acreage has been cleared for cultivation. A considerable acreage is now used for tame pasture.

A typical profile of Verdigris silt loam is 1,500 feet west and 2,640 feet south of the northeast corner of sec. 13, T. 8 N., R. 15 E.

Ap—0 to 7 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; friable when moist; pH 5.6; clear boundary; 5 to 10 inches thick.

A1—7 to 15 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; friable when moist, hard when dry; pH 6.2; gradual boundary; 6 to 10 inches thick.

B—15 to 30 inches, grayish-brown (10YR 5/2) heavy silt loam, very dark grayish brown (10YR 3/2) when moist; weak granular structure; friable when moist, very hard when dry; pH 5.8; gradual boundary; 10 to 30 inches thick.

C1—30 to 90 inches +, light brownish-gray (10YR 6/2) heavy silt loam, dark grayish brown (10YR 4/2) when moist; few, fine, faint, yellowish-brown mottles when moist; massive; friable when moist, very hard when dry; pH 5.7; gradual boundary.

The A1 horizon is dominantly silt loam but ranges to loam. Its color ranges from grayish brown to very dark grayish brown. In the lower part of the profile, the texture ranges from silt loam to clay loam. In many areas there are yellowish-brown mottles below a depth of 30 inches. There are some gray mottles below a depth of 50 inches. The profile ranges from medium acid to slightly acid.

Verdigris soils are similar to Ennis, Rosebloom, and Chastain soils. They have a darker colored, less acid subsoil than Ennis and Rosebloom soils. They are darker colored and less clayey below the surface layer than Chastain soils.

Verdigris silt loam (Vg).—This soil occurs as nearly level areas on flood plains of streams that flow mainly from prairie soils. It is subject to occasional flooding. Included in mapping were small areas of Ennis or Chastain soils.

All crops grown in the county are well suited to this soil. Most of the acreage is under cultivation. Excess water is a moderate limitation. (Capability unit IIw–1; Loamy Bottomland range site; woodland group 1)

Woodson Series

The Woodson series consists of deep, nearly level soils on uplands. These soils are somewhat poorly drained and are very slowly permeable in the subsoil. They formed under tall grass in clay or in material weathered from calcareous shale. They are adjacent to or between the limestone ridges of the Choctaw Fault.

In a typical profile the surface layer is dark-gray silt loam 10 inches thick. The subsoil is dark-gray to light-gray, very firm silty clay. At a depth of 37 inches is pale-olive silty clay.

The original vegetation was tall prairie grass. Most of the acreage has been cultivated. Tame pasture is grown in some areas.

A typical profile of Woodson silt loam, 0 to 1 percent slopes, is 1,730 feet north and 2,150 feet west of the southeast corner of sec. 9, T. 4 N., R. 17 E.

Ap—0 to 10 inches, dark-gray (10YR 4/1) heavy silt loam, very dark gray (10YR 3/1) when moist; moderate, medium, granular structure; friable when moist; pH 6.0; clear boundary; 8 to 14 inches thick.

B21t—10 to 30 inches, dark-gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) when moist; few, fine, distinct, olive mottles in lower part; weak, fine and medium, blocky structure; continuous clay films; very firm when moist, extremely hard when dry; pH 6.5 in upper part grading to pH 7.5; diffuse boundary; 10 to 22 inches thick.

B22t—30 to 37 inches, light-gray (10YR 6/1) silty clay, gray (10YR 5/1) when moist; weak, coarse, blocky structure; clay films present; few small limestone pebbles; very firm when moist, extremely hard when dry; pH 7.5; diffuse boundary; 7 to 14 inches thick.

B3—37 to 65 inches +, pale-olive (5Y 6/4) silty clay, olive (5Y 5/4) when moist; weak, medium, blocky structure; very firm when moist, extremely hard when dry; few, fine, black concretions and limestone fragments; pH 8.0.

The A horizon is dominantly silt loam, but in a few areas it is clay loam or silty clay loam. Its color ranges from dark gray to black. The upper part of the B horizon ranges from dark gray to black. In texture it ranges from silty clay to clay. At a depth of 25 to 40 inches, the B horizon changes from light gray to pale olive. The profile ranges from medium acid to moderately alkaline.

Woodson soils are similar to Summit and Parsons soils. They lack the light-colored A2 horizon that is typical of Parsons soils. They have a more abrupt boundary between the surface layer and subsoil than Summit soils do.

Woodson silt loam (Wo).—This soil occurs as nearly level areas in the southern part of the county. It is adjacent to Talpa soils. Included in mapping, and making up as much as 10 percent of an individual area, are areas of Summit soils.

Most of the acreage has been under cultivation. Now about half the acreage is used for tame grass pasture. Droughtiness is a limitation. Only cool-season or drought-resistant crops should be grown. (Capability unit IIs–1; Claypan Prairie range site; no woodland classification)

Wrightsville Series

The Wrightsville series consists of deep, nearly level to slightly depressed soils on uplands. These soils are poorly drained and very slowly permeable. They formed under forest in old, clayey alluvium.

In a typical profile the surface layer is light-brownish gray silt loam 4 inches thick. The subsurface layer is very pale brown silt loam 9 inches thick. The subsoil is light-gray, very firm clay mottled with olive brown, yellowish brown, and yellowish red. At a depth of 40 inches is light olive-gray extremely firm clay.

The original vegetation consisted of hardwoods and an understory of tall grass. Several areas have been cleared and cultivated but are now in tame pasture.

A typical profile of Wrightsville silt loam, 0 to 1 percent slopes, is 800 feet south and 100 feet west of the northeast corner of the NW¼ sec. 32, T. 8 N., R. 15 E.

A1—0 to 4 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; few, fine, faint, strong-brown mottles; weak, medium, granular structure; friable when moist, hard when dry; pH 5.0; clear, wavy boundary; 2 to 6 inches thick.

A2—4 to 13 inches, very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) when moist; peds coated with light gray; streaks of light gray; weak, medium, subangular blocky structure; friable when moist, very hard when dry; pH 4.5; abrupt, wavy boundary; 4 to 10 inches thick.

B2g—13 to 27 inches, light-gray (10YR 6/1) clay, gray (10YR 5/1) when moist; common, medium, distinct, olive-brown mottles and common, fine, distinct, yellowish-red mottles; moderate, medium, blocky structure; material from A2 horizon in cracks and on vertical ped faces; continuous clay films; very firm when moist, extremely hard when dry; pH 6.0; gradual, wavy boundary; 10 to 20 inches thick.

B3g—27 to 40 inches, light-gray (5Y 6/1) clay, gray (5Y 5/1) when moist; common, fine, faint, olive-brown and yellowish-brown mottles when moist; weak, coarse, blocky structure; continuous clay films; very firm when moist, extremely hard when dry; numerous soft iron concretions; pH 7.2; diffuse boundary; 10 to 20 inches thick.

Cg—40 to 72 inches +, light olive-gray (5Y 6/2) clay, olive gray (5Y 5/2) when moist; many, medium, faint, olive mottles and few, fine, faint, strong-brown mottles when moist; massive; extremely firm when moist, extremely hard when dry; few soft iron concretions; pH 8.0.

The A1 horizon is dominantly silt loam but ranges to fine sandy loam. Its color ranges from light gray to dark grayish brown. The A2 horizon ranges from white to very pale brown with white coatings. The B2g horizon ranges from clay to silty clay. Its color ranges from light gray to dark grayish brown. This soil generally becomes alkaline below a depth of 20 to 50 inches.

Wrightsville soils are similar to Counts, Parsons, and Dwight soils. They have a grayer, less mottled subsoil than Counts soils. They have a thicker, lighter colored surface layer than Parsons soils. They have a thicker surface layer than Dwight soils.

Wrightsville silt loam (Wr).—This soil occurs as level to slightly depressed areas, mostly in the northern part of the county. Included in mapping were small areas of Dwight and Parsons soils.

Most of the acreage is used for pasture. Excess water is a very severe limitation. (Capability unit IVw–1; Loamy Savannah range site; woodland group 3)

Yahola Series

The Yahola series consists of deep, nearly level, calcareous soils on flood plains. These soils are well drained and moderately rapidly permeable. They formed in recent alluvium.

In a typical profile the surface layer is brown very fine sandy loam 12 inches thick. Below this is light-brown, friable fine sandy loam. At a depth of 24 inches is brown very fine sandy loam.

The original vegetation consisted of hardwoods and a grass understory. Most areas have been cleared. A large acreage is in tame pasture.

In this county Yahola soils are mapped with Norwood soils.

A typical profile of Yahola very fine sandy loam is 600 feet east and 50 feet north of the southwest corner of sec. 21, T. 8 N., R. 13 E.

A1—0 to 12 inches, brown (7.5YR 5/4) light very fine sandy loam, dark brown (7.5YR 3/4) when moist; weak, fine, granular structure; friable when moist, slightly hard when dry; pH 6.5; clear boundary; 10 to 20 inches thick.

AC—12 to 24 inches, light-brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 4/4) when moist; very weak, fine, granular structure; friable when moist, slightly hard when dry; calcareous; gradual boundary; 10 to 30 inches thick.

C1—24 to 48 inches, brown (7.5YR 5/4) very fine sandy loam, dark brown (7.5YR 3/4) when moist; massive; friable when moist, hard when dry; calcareous; gradual boundary; 0 to 30 inches thick.

C2—48 to 96 inches, brown (10YR 5/3) silt loam, dark brown (10YR 3/3) when moist; massive; friable when moist, hard when dry; calcareous.

The A1 horizon is dominantly light very fine sandy loam but ranges to fine sandy loam or silt loam. Its color ranges from light brown to dark brown. The AC and C1 horizons are dominantly fine sandy loam or very fine sandy loam but have thin strata that range in texture from loamy fine sand to heavy loam. Below a depth of 40 inches is stratified material that ranges from fine sandy loam to heavy silt loam and from brown to dark reddish brown. The A1 horizon ranges from slightly acid to neutral. The rest of the profile is calcareous.

Except for being calcareous, Yahola soils are similar to Ochlockonee soils.

Yahola-Norwood complex (Yn).—This complex is about 65 percent Yahola very fine sandy loam, 30 percent Norwood silt loam, and 5 percent soils similar to Yahola soils except that they are lighter colored and sandier. All of these soils are on the flood plain of the South Canadian River, in the northern part of the county. They are well drained and are rarely flooded. Included in mapping were a few small, slightly depressed areas.

The Yahola soil has the profile described as typical for the series. The Norwood soil has the profile described as typical for the Norwood series.

All crops grown in the county are well suited to these soils. There are few limitations. Most of the acreage is under cultivation. (Capability unit I–1; Loamy Bottomland range site; woodland group 2)

Use and Management of the Soils

About 5 percent of the soils in Pittsburg County are used for cultivated crops and 10 percent for tame pasture. This section explains how the soils can be managed for these purposes. It defines the capability classification used by the Soil Conservation Service, in which the soils are grouped according to their suitability for crops, and describes use and management of the soils by capability units. It also shows predicted yields per acre of specified crops, under two levels of management, on the soils suitable for cultivation.

Management of the Soils for Cultivated Crops [8]

Grain sorghum, soybeans, peanuts, corn, cotton, and alfalfa are the main crops grown in Pittsburg County. Small grain-legume mixtures are grown for temporary pasture.

Cultivated soils, such as Vanoss loam, need management that conserves water, maintains fertility, controls erosion, and preserves tilth.

A cropping system is needed that insures adequate growth of crops and provides protection against wind and water erosion. Large amounts of residue are needed periodically on such soils as Bates fine sandy loam, not only for erosion control but also for maintenance of tilth and fertility. Peanuts and other low-residue crops should be followed by a cover crop, rye or vetch, for example. Alfalfa, which is included in the cropping system used on Vanoss soils, helps in maintaining the productivity and the physical condition of the soils.

Leaving plant residue on the surface or working it partly into the soil is an important factor in the management of a soil like Choteau loam. When large amounts of residue from small grain or other nonlegume crops are used, nitrogen fertilizer is desirable for the following crop.

Minimum tillage reduces soil crusting and increases water intake. Excessive tillage destroys soil structure, causes compaction, and increases the hazard of erosion. Excessive tillage on Woodson soils, for example, causes both compaction and surface crusting, both of which inhibit emergence of seedlings. Tillage should be limited to seedbed preparation and weed control. On many soils, excessive compaction can be prevented by avoiding trampling by livestock after a heavy rain.

Fertilizer is needed on most soils. The kind and amount to be applied is best determined through soil tests. Some soils, like the Yahola and Norwood soils on bottom land, are naturally fertile but still need specific kinds of fertilizer. Other soils, like the Hartsells soils of the forested uplands, are low in plant nutrients and respond to a complete fertilizer. Some soils respond to large amounts of fertilizer; others do not. Lime is essential if a crop like alfalfa is grown on an acid soil, such as Ennis silt loam.

Management of the Soils for Tame Pasture

Approximately 10 percent of Pittsburg County is tame pasture. Most of this acreage consists of arable soils, such as Bates, Dennis, Vanoss, and Verdigris soils.

[8] By Ernest O. Hill.

The general trend in this county has been to convert cropland to pasture. Tame pasture crops provide an excellent cover and reduce the erosion hazard on such upland soils as Bates and Dennis.

Bermudagrass, which is widely grown on many soils of the county, provides abundant pasture on Bates, Dennis, Vanoss, and Verdigris soils. It is usually grown with a legume, such as Kobe lespedeza, Ladino clover, or big yellow hop clover. Large amounts of forage are obtained by growing fescue and other cool-season, perennial grasses and legumes on the fertile Verdigris soils. Other legumes, such as sericea lespedeza, are used for hay and pasture on Choteau, Dennis, Vanoss, and Summit soils. Rye and oats are temporary cool-season annual grasses that are well suited to Taloka soils. Sudangrass is grown on Vanoss, Bates, Konawa, Norwood, and many other productive soils for summer pasture and hay.

Control of grazing is essential for optimum forage production. Brush control, which reduces plant competition and encourages vigorous growth of tame pasture grasses, is likely to be needed on forested soils, such as Hartsells soils. Weed control is needed for maximum forage production on prairie soils, such as Taloka soils. Weed control and an adequate supply of water promote uniform distribution of grazing, increase the amount of forage, and prolong the life of the pasture. Fertilizer is generally needed.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, all kinds of soils are grouped at three levels: the capability class, the subclass, and the unit. These are discussed in the following paragraphs.

Capability Classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

- Class I soils have few limitations that restrict their use.
- Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.
- Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

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

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture or range, woodland, or wildlife habitat.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife habitat.

Class VIII soils and landforms have limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife habitat, or water supply, or to esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated 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* shows that water in or on the soil interferes 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 United States but not in Pittsburg County, shows 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 limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife habitat, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are 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 designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraphs; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages the capability units in Pittsburg County are described, and suggestions for the use and management of the soils are given. The names of soil series represented are mentioned in the description of each unit, but this does not mean that all the soils of a given series are in the unit. The capability unit designation for each soil in the county can be found in the "Guide to Mapping Units."

Capability unit I-1

This unit consists of the Yahola-Norwood complex. This complex is on bottom land. The soils are deep, nearly level, and loamy. They are well drained, slightly acid to calcareous, and moderate to high in content of organic matter and supply of plant nutrients.

All crops grown in the county are well suited to these soils. A soil-conserving cropping system and management of crop residue are important factors in preserving structure and maintaining fertility.

Capability unit I-2

This unit consists of deep, nearly level, loamy soils of the Choteau and Vanoss series. These soils are on uplands. They are well drained to moderately well drained and mildly alkaline to strongly acid.

All crops commonly grown in the county are well suited to these soils. Bermudagrass and forage sorghum are the most common tame pasture grasses. Overseeding bermudagrass with a suitable legume increases the amount of forage and the length of the grazing season.

Preserving soil structure and replenishing the supply of plant nutrients are important considerations in management.

Capability unit IIe-1

The one soil in this unit, Bates fine sandy loam, 1 to 3 percent slopes, is moderately deep, well drained, and medium acid to slightly acid. It is on uplands.

Most crops generally grown in the county are well suited to this soil. Alfalfa is only moderately well suited because of the limited storage capacity for water and plant nutrients, but it can be grown if sufficient lime and phosphate are applied.

Controlling erosion, preserving structure, and maintaining fertility are important practices in management. If row crops are grown, terracing and contour farming are needed for control of erosion. Planting grain sorghum and incorporating large amounts of residue into the soil help in preserving structure and maintaining fertility.

Capability unit IIe-2

This unit consists of deep, nearly level to very gently sloping, loamy soils of the Choteau and Vanoss series. These soils are on uplands. They are well drained or moderately well drained and strongly acid to mildly alkaline.

All crops commonly grown in the county are well suited to these soils (fig. 12). Bermudagrass and forage sorghum are the most common tame pasture crops. Overseeding bermudagrass with a suitable legume increases the amount of forage and the length of the grazing season.

Controlling erosion, preserving structure, and maintaining fertility are the main concerns in management. When row crops are grown, terraces and contour tillage are needed for control of erosion. When small grain is grown and management is generally good, terraces are not likely to be needed. A cover crop following a low-residue crop, such as cotton, helps in maintaining fertility. A mixture of small grain and a legume is a common cover crop.

Capability unit IIe-3

This unit consists of deep, very gently sloping, loamy soils of the Dennis, Summit, and Taloka series. These soils are on uplands. They are slowly or very slowly permeable.

All crops commonly grown in the county can be grown on these soils. Lime and phosphate are generally needed for alfalfa and other legumes.

Controlling erosion, preserving structure, and maintaining fertility are the main considerations in management. If row crops are grown, terraces are needed for control of erosion. If close-growing crops or perennial pasture plants are grown year after year, terraces are not needed. Utilizing large amounts of residue is essential and helps in preserving structure, maintaining fertility, and reducing the hazard of erosion.

Capability unit IIe-4

This unit consists of deep and moderately deep, moderately coarse textured to medium-textured soils of the Counts, Hartsells, and Konawa series. These soils are on uplands. They are low in fertility.

Most crops grown in the county can be grown on these soils. Peanuts, soybeans, and grain sorghum are the main crops. A bermudagrass-legume mixture grows well. The response to fertilizer is good.

The main consideration in management is controlling erosion. Other major considerations are preserving soil structure and replenishing the supply of plant nutrients in all of the soils and overcoming droughtiness in Counts loam, which has a clay subsoil.

Small grain year after year is a good cropping system if the residue is utilized. Legumes are beneficial in any cropping system. Terracing and contour farming ordinarily are needed if row crops are grown. A cover crop, for example, a small grain and a legume, following a low-residue crop is generally helpful.

Capability unit IIw-1

This unit consists of deep, nearly level, moderately well drained, loamy soils of the Ennis and Verdigris series. These soils are on bottom lands. They are high or moderately high in natural fertility and available water capacity. Some areas are flooded occasionally, but crops are seldom damaged.

All crops commonly grown in the county are well suited to these soils.

Disposing of excess water, preserving structure, and maintaining fertility are the main considerations in management.

A high-residue crop, such as grain sorghum, fertilized with nitrogen or supplemented with a legume, is a satisfactory cropping system. Utilizing crop residue is important. Surface drainage is needed in some areas.

Capability unit IIw-2

The one soil in this unit, Ochlockonee fine sandy loam, is a deep, nearly level, well-drained, moderately coarse textured soil on bottom lands. It is medium in natural fertility and moderate in available water capacity. It is occasionally flooded.

All crops commonly grown in the county are well suited to this soil.

Controlling overflow, preserving structure, and maintaining fertility are the main concerns in management. Oats or another small grain year after year is a satisfactory cropping system if the residue is utilized.

Capability unit IIs-1

This unit consists of deep, nearly level to slightly depressional soils of the Parsons and Woodson series. These soils are on uplands. They have a loamy surface layer and a clayey subsoil. They are somewhat poorly drained, very slowly permeable, and strongly acid to moderately alkaline. They are low in natural fertility and are in poor tilth.

The choice of crops is limited. Small grain, grain sorghum, and tame pasture are well suited to these soils. Fescue is better suited to Woodson soils than to Parsons soils.

Surface crusting, slow intake of water, and seasonal wetness and droughtiness are the main limitations. Preserving structure is an important consideration in management.

Small grain year after year is a suitable cropping system if the residue is utilized. Minimum tillage and fertilization are needed. Surface drainage is needed occasionally. When row crops are grown, row direction is usually needed for adequate drainage.

Capability unit IIs-2

The one soil in this unit, Taloka silt loam, 0 to 1 percent slopes, is deep and very slowly permeable.

This soil is suited to crops that mature early, when the supply of moisture is most abundant. Droughtiness limits production of late-maturing crops, such as cotton. Grain sorghum, small grain, and bermudagrass-legume pasture do well if well managed. Most of the other crops grown in the county can be grown on this soil.

Overcoming droughtiness, maintaining structure, and supplying plant nutrients are important practices in management.

A high-residue nonlegume fertilized with nitrogen or supplemented with legumes is a suitable cropping system. Proper row direction improves drainage.

Capability unit IIIe-1

The one soil in this unit, Parsons silt loam, 1 to 3 percent slopes, is a deep soil on uplands. It has a dense clay subsoil.

Small grain, grain sorghum, and tame pasture grasses are the crops commonly grown on this soil. The choice of cultivated crops is limited to drought-resistant or cool-season varieties.

The main considerations in management are controlling erosion, preventing crusts from forming on the surface, preserving soil structure, maintaining fertility, and overcoming droughtiness.

Terraces, contour farming, a soil-conserving cropping system, and residue management are needed if this soil is cultivated.

Capability unit IIIe-2

This unit consists of deep or moderately deep, gently sloping, well drained and moderately well drained soils of the Bates and Dennis series. These soils are on uplands.

Most crops grown in the county can be grown on these soils. Grain sorghum, soybeans, cotton, and peanuts are the chief crops. Bermudagrass-legume pasture does well. Alfalfa and corn are not well suited.

Figure 12.—Peanuts on Choteau very fine sandy loam, 0 to 3 percent slopes.

Controlling erosion, preserving structure, and maintaining fertility are important practices in management.

Grain sorghum year after year is a good cropping system if the residue is utilized. Legumes in the cropping system are beneficial. Terracing and contour farming are essential in controlling erosion.

Capability unit IIIe-3

The one soil in this unit, Hartsells fine sandy loam, 3 to 5 percent slopes, is moderately deep and well drained. It is low in natural fertility, but the response to fertilizer is good.

Peanuts and grain sorghum are the crops commonly grown on this soil.

Controlling erosion and maintaining fertility are the main concerns in management. Controlling soil blowing and preserving structure are also important.

Peanuts followed by a high-residue crop is an example of a soil-conserving cropping system. A cover crop each year following the harvest of peanuts reduces the erosion hazard. Terracing and contour farming are needed to reduce the erosion hazard.

Capability unit IIIe-4

The one soil in this unit, Stidham loamy fine sand, 0 to 3 percent slopes, is deep, light colored, well drained, and coarse textured.

Peanuts, grain sorghum, and truck crops are the chief crops grown on this soil. If well managed, bermudagrass pasture does well.

Controlling wind and water erosion and maintaining fertility are important concerns in management. Low available water capacity is a limitation.

Small grain and vetch following peanuts or watermelons is an example of a suitable cropping system. The vetch and small grain can be plowed under in spring, thus serving as both a cover crop and a green-manure crop. Legumes in the cropping system are beneficial. Residue management is needed for control of wind and water erosion and for conserving moisture. Cover crops are needed if low-residue crops are grown.

Capability unit IIIe-5

This unit consists of deep or moderately deep, very gently sloping to gently sloping, well drained and moderately well drained, eroded soils of the Bates and Dennis series. Erosion has removed much of the original surface layer from these soils. Production is low to moderate.

Sorghum crops and bermudagrass (fig. 13) are the crops best suited to these soils. Peanuts, grain sorghum, cotton, and other row crops are suited, but they increase the erosion hazard.

Maintaining fertility, preserving structure, and controlling erosion are the main considerations in management. Fertilization, cover crops, and crop-residue management are effective in preserving tilth and maintaining fertility. Terraces and contour farming are needed for control of erosion. Residue management reduces the hazard of erosion. Applications of lime and fertilizer increase the amount of residue.

Capability unit IIIe-6

The one soil in this unit, Hartsells fine sandy loam, 2 to 5 percent slopes, eroded, is moderately deep and well drained. It is low in natural fertility.

Bermudagrass pasture (fig. 14), peanuts, and grain sorghum are the most suitable crops. Corn and cotton can be grown, but yields are low.

Controlling erosion, reducing the risk of surface crusting, maintaining fertility, and preserving structure are the chief concerns in management.

Sudangrass harvested for forage and followed by grain sorghum is a suitable cropping system if sufficient residue is utilized. Terracing and contour farming are needed for

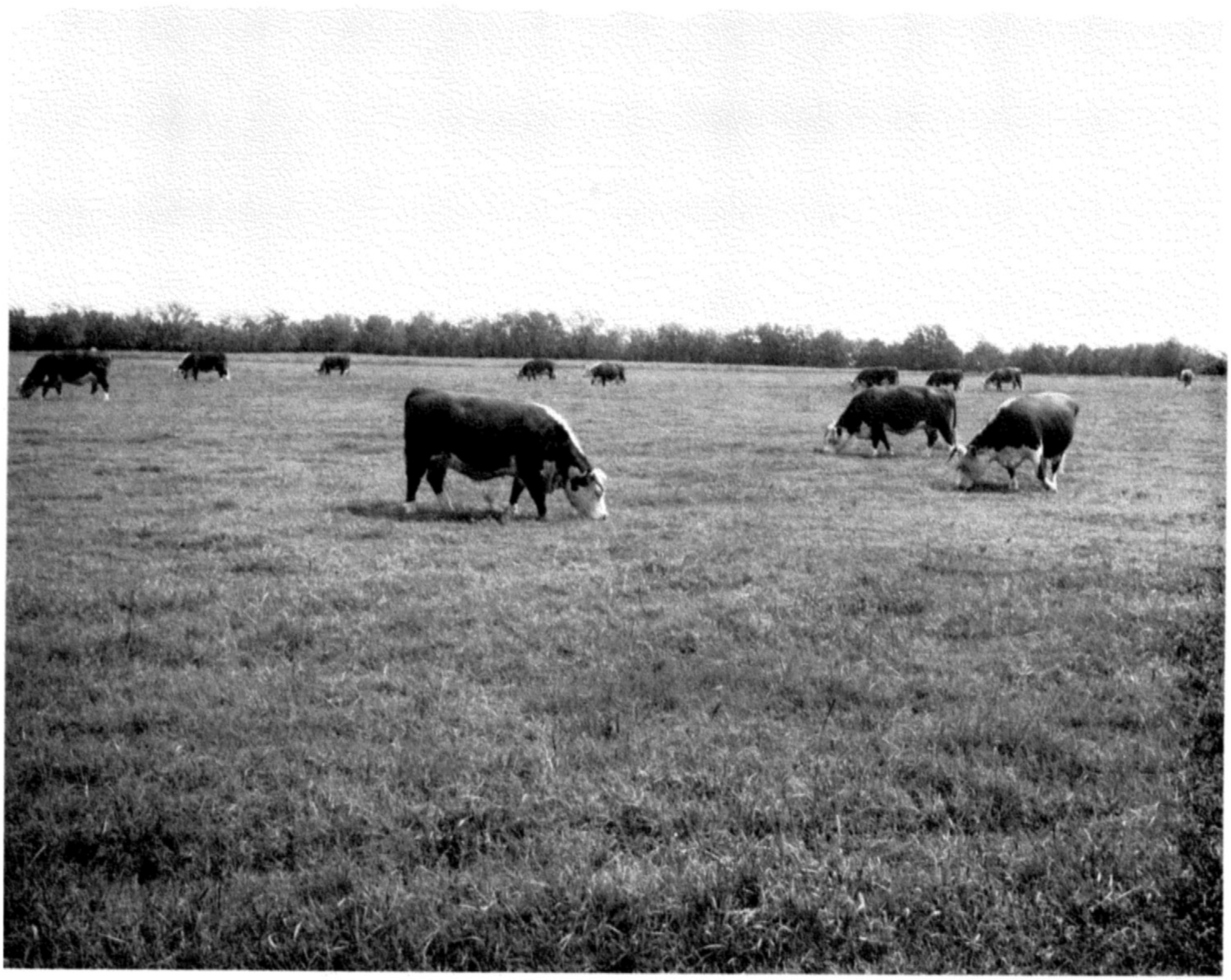

***Figure 13.*—Excellent stand of bermudagrass on Dennis loam, 2 to 5 percent slopes, eroded.**

control of erosion. Residue or a cover crop reduces the hazard of soil blowing. Fertilization increases the amount of residue.

Capability unit IIIw-1

This unit consists of deep, level to slightly depressed, poorly drained soils of the Chastain and Rosebloom series. These soils are on flood plains.

Grain sorghum is the main crop. Sudangrass, a fescue-legume mixture, and a bermudagrass-legume mixture are the most commonly grown pasture plants. Alfalfa and corn are not well suited.

Controlling overflow, disposing of excess surface water, preserving structure, and maintaining fertility are the main considerations in management.

Grain sorghum year after year is a good cropping system if the residue is utilized to improve the soil and to overcome droughtiness. Row direction and a surface drainage system are needed for disposal of excess surface water.

Capability unit IVe-1

The one soil in this unit, Eram clay loam, 2 to 5 percent slopes, is moderately deep, has a clay subsoil, and is slowly permeable. It is on uplands.

Oats and other small grain, sown grain sorghum, and bermudagrass-legume pasture all grow well on this soil.

Controlling erosion, improving water intake, preserving structure, and maintaining fertility are the chief concerns in management.

The severe erosion hazard limits the use of row crops. Terraces and contour farming are needed in all areas farmed to annual crops. Fertilization helps in establishing a good protective cover that reduces the hazard of erosion.

Capability unit IVe-2

The one soil in this unit, Dougherty loamy fine sand, 3 to 8 percent slopes, is deep and well drained. It is on uplands.

Figure 14.—**Winter pasture of bermudagrass and Elbon rye on Hartsells fine sandy loam, 2 to 5 percent slopes, eroded.**

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Winter rye in combination with vetch, bermudagrass-legume pasture, and sown or broadcast sorghum are the main crops suited to this soil. Row crops increase the erosion hazard.

Controlling erosion and maintaining fertility are the chief concerns in management.

Annual crops need to be managed so that the surface of the soil is protected by a growing crop or by crop residue much of the time. Winter rye year after year is a good cropping system if it is adequately fertilized and the residue is utilized. Applications of lime and fertilizer are needed in order to maintain vigorous growth that provides a good protective cover.

Capability unit IVe-3

This unit consists of Hector-Hartsells complex, 2 to 5 percent slopes. This complex is on uplands. The soils are moderately deep and shallow and well drained. They are low in fertility.

Bermudagrass-legume pasture and sudangrass-sorghum pasture are the main crops grown in these soils.

Controlling erosion, preserving structure, and maintaining fertility are the chief concerns in management. The complex mixing of the shallow, droughty Hector soils and the moderately deep Hartsells soils makes management difficult.

Sown sudangrass year after year is a good cropping system if the residue is utilized. Row crops are not suitable. Terraces and contour farming are important if close-growing, soil-depleting, sown crops are grown in rotation with high-residue sown crops. Applications of lime and fertilizer help in establishing healthy plants that provide good protective cover and leave an adequate amount of residue.

Capability unit IVe-4

The one soil in this unit, Eram clay loam, 2 to 5 percent slopes, eroded, is a moderately deep soil on uplands. It has a clay subsoil.

The erosion hazard and the clay subsoil limit the choice of crops. Sudangrass and small grain are well suited. Bermudagrass pasture is one of the best uses for this soil.

Controlling erosion, increasing the water-intake rate, preserving soil structure, and improving fertility are the main concerns in managing this soil.

Small grain year after year is a good cropping system if the residue is utilized. Fertilization increases the amount of residue. Terraces and contour farming are needed for erosion control.

Capability unit IVe-5

This unit consists of Bates-Collinsville fine sandy loams, 2 to 5 percent slopes. These are moderately deep and shallow soils on uplands.

Bermudagrass-legume pasture and sudangrass-sorghum pasture are the main crops grown on these soils.

Controlling erosion, preserving structure, and maintaining fertility are the main considerations in management.

Much of the acreage is under perennial vegetation. The severe erosion hazard prohibits the use of these soils for row crops. Terraces and contour farming help in controlling erosion.

Capability unit IVw-1

The one soil in this unit, Wrightsville silt loam, is deep, nearly level, and poorly drained. It has a very slowly permeable subsoil.

Grain sorghum and soybeans are the main crops grown on this soil. Bermudagrass-legume pasture does well. Droughtiness or extreme wetness often lowers production.

Controlling surface wetness, preserving structure, and maintaining fertility are the most important concerns in management.

Grain sorghum year after year is a good cropping system if the residue is utilized. Legumes in cropping systems are beneficial. The available moisture capacity can be increased through management of crop residue, and surface drainage can be improved by row direction.

Capability unit IVs-1

The one soil in this unit, Eufaula fine sand, 0 to 3 percent slopes, is a deep soil on uplands. It is low in fertility.

Sudangrass and bermudagrass-legume mixture are the main crops grown on this soil.

Low available water capacity is a serious limitation. Controlling erosion and maintaining fertility are important practices in management.

Sudangrass or another high-residue crop year after year is an example of a good cropping system. Weeping lovegrass or other perennial vegetation is another example.

Capability unit Vw-1

This unit consists of Ennis and Verdigris soils, broken. These soils are adjacent to stream channels and are flooded several times each year.

Most of the acreage is covered with native trees and grass and is used for pasture. The frequency of flooding generally prevents the use of these soils for cultivated crops. The pasture crop best suited is bermudagrass or fescue overseeded with a suitable clover and annual lespedeza.

Weed control, proper stocking, and fertilization are needed to maintain production.

Capability unit VIe-1

This unit consists of Konawa soils, 3 to 8 percent slopes, severely eroded. These are deep, light-colored, upland soils that formed in old sandy alluvium. Many deep, U-shaped gullies have formed.

These soils are so severely eroded that they are not suited to cultivated crops. All of the acreage has been under cultivation and needs revegetation. Shaping gullies and planting bermudagrass are among the management practices needed. Overseeding bermudagrass with a suitable legume and applying adequate fertilizer will increase the amount of forage and the length of the grazing season.

Capability unit VIe-2

This unit consists of Hector-Hartsells complex, 3 to 8 percent slopes, severely eroded. This complex is on uplands. The soils are light colored, shallow and moderately deep over sandstone, and low in fertility.

All of the acreage has been under cultivation. Now the soils are so severely eroded that they are no longer suitable for cultivation. Establishing a cover of vegetation is the most important factor in management. Shaping gullies and planting bermudagrass and then overseeding with a suitable legume will help in protecting these soils from further erosion. Proper fertilization is required for successful establishment of grasses.

Capability unit VIe-3

This unit consists of Dennis-Dwight complex, 2 to 5 percent slopes, severely eroded. This complex is on uplands. The soils are dark colored and are deep over shale.

These soils have been under cultivation but are now so severely eroded that they are not suitable for cultivated crops. They are suitable for native grass or bermudagrass and wildlife plantings. Overseeding bermudagrass with a suitable legume increases the amount of forage and the length of the grazing season. Fertilization is needed.

Capability unit VIe-4

This unit consists of Dougherty-Eufaula complex, 8 to 20 percent slopes. This complex is on uplands. The soils are deep, light colored, and sandy. They formed in old sandy alluvium.

Most areas are wooded and are used for grazing. Because of moderately steep slopes, droughtiness, and low fertility, these soils are not suited to cultivation. They are suited to bermudagrass. Overseeding bermudagrass with a suitable legume increases the amount of forage and the length of the grazing season. Fertilization is needed. Brush control is needed for increased native grass production.

Capability unit VIe-5

This unit consists of Parsons-Dwight complex, 1 to 3 percent slopes, eroded. This complex is on uplands. The soils are deep, dark colored, and very slowly permeable.

These soils have been under cultivation but are now unsuitable for cultivated crops because of erosion and slickspots. They are suited to native grass or bermudagrass and wildlife plantings. Overseeding bermudagrass with a suitable legume increases the amount of forage and the length of the grazing season. Fertilization is needed.

Severe surface crusting in slickspot areas makes it difficult to obtain a stand of grass. Extra amounts of organic matter reduce the hazard of surface crusting.

Capability unit VIs-1

The one soil in this unit, Guin gravelly sandy loam, 5 to 20 percent slopes, is light colored and moderately deep.

Because of moderately steep slopes, droughtiness, and low fertility, this soil is not suitable for cultivation. Most areas are wooded and are used for grazing. It is not practical to plant bermudagrass on this soil. Brush control increases the amount of native grass forage.

Capability unit VIIs-1

This unit consists of Talihina-Collinsville complex, 5 to 20 percent slopes. This complex is one of stony prairie soils that are very shallow to shallow over acid sandstone and shale.

Most areas are used as native range. Some of the less stony areas are used as native hay meadow. None are suited to cultivation or to woodland use.

Capability unit VIIs-2

This unit consists of Enders-Hector complex, 5 to 30 percent slopes. This complex is one of stony forested soils that are shallow to moderately deep over acid sandstone and shale.

Most areas are used for grazing. Some are commercial woodland. None are suited to cultivation. Brush control is needed for both range and woodland.

Capability unit VIIs-3

This unit consists of Talpa-Rock outcrop complex, 5 to 30 percent slopes. This complex is one of very shallow, dark-colored, stony soils that formed in material weathered from limestone.

Under good range management, these soils produce fair yields of native grasses. They are not suited to cultivation or to woodland use.

Capability unit VIIs-4

This unit consists of Enders-Hector complex, 30 to 60 percent slopes (fig. 15). This complex is one of stony forested soils that formed over acid sandstone and shale.

These soils are not suited to cultivation. They are used mostly for grazing. Grass production is low, even under proper range management.

Capability unit VIIIs-1

This unit consists of Mine pits and dumps. The material is a mixture of rock, shale, and soil material from coal mines, both shaft mines and strip pits. The strip pits can be used for fish production.

Predicted Yields

The predicted average yields per acre of the principal crops grown in Pittsburg County, under two levels of management, are given in table 4.

The yields given in columns A are those that can be expected under common management, that is, management practiced by a substantial number of farmers in the county. Common management ordinarily includes (1) proper seeding rates, proper dates of planting, and efficient harvesting methods; (2) adequate control of weeds, insects, and plant diseases to insure good growth of plants; (3) terracing and contour farming where needed; (4) small applications of fertilizer and lime to cash crops; and (5) early plowing where practicable.

The yields given in columns B are those that can be expected under improved management. Improved management includes (1) proper seeding rates, proper dates of planting, and efficient harvesting methods; (2) adequate control of weeds, insects, and plant diseases to insure good growth of plants; (3) applications of the kinds and amounts of fertilizer and the amounts of lime indicated by soil tests; (4) crop-residue management and tillage that control erosion, maintain soil structure, increase infiltration of water, and promote the emergence of seedlings; (5) surface drainage where needed; (6) use of suitable and improved varieties of crops and pasture plants; (7) cover crops or stripcropping on sandy soils that tend to blow; and (8) good management of livestock grazing winter small grain.

Figure 15.—**Stony Enders-Hector complex in background; associated Hartsells soils in foreground.**

If the yields for bermudagrass listed in table 4 are to be obtained, special attention must be given to the distribution of salt and water and the use of fences for rotation grazing. Also, brush and weed control is needed.

Use of the Soils for Range [4]

About 60 percent of Pittsburg County is used as range. This acreage consists of the steep, the shallow, and the stony soils. The deep, smooth soils are generally used for cropland and tame pasture.

Much of the rangeland is in small livestock farms, but there are several large ranches. The major livestock enterprise consists of raising beef cattle and marketing weaner calves and feeder steers. The range is commonly grazed the year around, and the forage is supplemented with protein cubes and hay or with tame pasture grasses.

[4] By NEAL STIDHAM and DAVID ANKLE, range conservationists, Soil Conservation Service.

Range Sites and Condition Classes

Effective range management requires knowledge of the capabilities of the different kinds of soils and the kinds and amounts of herbage that can be produced. It also requires the ability to evaluate the present condition of the range vegetation in relation to its potential for production.

For the purpose of classifying range resources, soils are placed in groups called range sites. Each site has a distinctive potential plant community, the composition of which depends upon a combination of environmental conditions, mainly the combined effects of soil and climate. The potential plant community, or climax vegetation, reproduces itself so long as the environmental conditions remain the same.

The plants on a given range site are grouped, according to their response to grazing, as decreasers, increasers, and invaders. Decreasers are plants in the potential plant community that tend to die out if they are heavily grazed for long periods. They are generally the most palatable and the most productive perennials. Increasers are plants in the potential plant community that become more abundant as the decreasers decline. These plants are generally shorter, less productive, and less palatable than the decreasers. Under prolonged heavy grazing of the range, the increasers become dominant. Invaders are plants that are not part of the potential plant community but that become established if both the decreasers and the increasers decline. They may originate in an adjoining site or at a great distance.

Range condition refers to the composition of the existing vegetation on a given site in relation to what the site is capable of producing. It is expressed in terms of condition classes. The condition class represents the degree to which the existing plant community differs from that of the potential plant community. It is described as excellent, good, fair, or poor.

A range site is in excellent condition if 76 to 100 percent of the present vegetation is of the same kind as the potential plant community for the site. 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 25 or less.

TABLE 4.—*Predicted yields per acre of major crops under two levels of management*

[Figures in columns A indicate yields under common management; figures in columns B indicate yields under improved management. Absence of figure indicates the crop is not commonly grown on the soil specified]

Soil	Peanuts		Corn		Cotton (lint)		Soybeans		Alfalfa		Grain sorghum		Bermudagrass		Native hay	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Lb.*	*Lb.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Bu.*	*Bu.*	*A.U.M.*[1]	*A.U.M.*[1]	*Tons*	*Tons*
Bates fine sandy loam, 1 to 3 percent slopes	20	38	32	44	250	400	15	22	1. 7	2. 7	32	48	4. 0	5. 5	1. 3	1. 7
Bates fine sandy loam, 3 to 5 percent slopes	17	35	22	35	175	300	12	20			24	42	3. 9	5. 3	1. 3	1. 7
Bates fine sandy loam, 2 to 5 percent slopes, eroded	15	24			140	250					20	30	3. 2	4. 5		
Bates-Collinsville fine sandy loams, 2 to 5 percent slopes					120	180					16	26	2. 6	4. 4	1. 1	1. 4
Chastain silty clay loam					190	290					18	30	2. 9	4. 5	. 9	1. 2
Choteau loam, 0 to 1 percent slopes	28	50	36	58	300	450	22	32	2. 6	3. 6	40	55	4. 6	6. 0	1. 5	2. 0
Choteau loam, 1 to 3 percent slopes	26	46	33	48	280	430	20	30	2. 4	3. 3	38	52	4. 2	5. 8	1. 5	2. 0
Choteau very fine sandy loam, 0 to 3 percent slopes	34	58	30	48	270	420	18	28	2. 1	3. 0	36	52	4. 0	5. 3	1. 4	1. 8
Counts loam, 0 to 2 percent slopes			20	32	180	280	13	22			22	32	3. 1	5. 0		
Dennis loam, 1 to 3 percent slopes	22	40	32	46	240	400	16	24	2. 0	3. 0	36	50	4. 1	5. 6	1. 4	1. 8
Dennis loam, 3 to 5 percent slopes	20	36	22	35	190	330	12	20			32	44	4. 0	5. 5	1. 3	1. 7
Dennis loam, 2 to 5 percent slopes, eroded	15	25			150	275	10	16			20	30	3. 5	4. 6		
Dennis-Dwight complex, 2 to 5 percent slopes, severely eroded													1. 4	3. 0		
Dougherty loamy fine sand, 3 to 8 percent slopes	16	30	20	32	175	275					20	32	3. 4	5. 0		
Dougherty-Eufaula complex, 8 to 20 percent slopes													3. 0	4. 2		
Enders-Hector complex, 5 to 30 percent slopes																
Enders-Hector complex, 30 to 60 percent slopes																
Ennis silt loam	25	38	35	55	280	425	22	32	2. 5	3. 5	40	65	5. 0	7. 0		
Ennis and Verdigris soils, broken													4. 5	6. 0		
Eram clay loam, 2 to 5 percent slopes											18	30	2. 0	3. 5	1. 3	1. 7
Eram clay loam, 2 to 5 percent slopes, eroded											14	22	1. 8	3. 2		
Eufaula fine sand, 0 to 3 percent slopes	12	18											1. 7	3. 3		
Guin gravelly sandy loam, 5 to 20 percent slopes																
Hartsells fine sandy loam, 1 to 3 percent slopes	25	40	30	45	250	400	16	24			32	46	3. 9	5. 0	1. 0	1. 4
Hartsells fine sandy loam, 3 to 5 percent slopes	20	35	20	38	200	350	12	20			24	40	3. 4	4. 8	. 9	1. 3
Hartsells fine sandy loam, 2 to 5 percent slopes, eroded	16	30			150	300					20	35	3. 0	4. 5		
Hector-Hartsells complex, 2 to 5 percent slopes	10	18									10	20	2. 1	3. 8	. 8	1. 1
Hector-Hartsells complex, 3 to 8 percent slopes, severely eroded													1. 7	3. 4		
Konawa fine sandy loam, 1 to 3 percent slopes	32	55	30	50	230	400	18	28	2. 0	2. 9	35	48	4. 0	5. 3		
Konawa soils, 3 to 8 percent slopes, severely eroded													2. 3	4. 0		

See footnote at end of table

TABLE 4.—*Predicted yields per acre of major crops under two levels of management*—Continued

Soil	Peanuts		Corn		Cotton (lint)		Soybeans		Alfalfa		Grain sorghum		Bermudagrass		Native hay	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Lb.*	*Lb.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Bu.*	*Bu.*	*A.U.M.*[1]	*A.U.M.*[1]	*Tons*	*Tons*
Mine pits and dumps	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Ochlockonee fine sandy loam	25	50	45	60	280	425	----	----	2. 2	3. 2	46	62	5. 0	7. 0	----	----
Parsons silt loam, 0 to 1 percent slopes	14	22	22	37	250	310	13	22	----	----	27	44	2. 9	4. 5	1. 2	1. 6
Parsons silt loam, 1 to 3 percent slopes	----	----	26	36	200	300	11	19	----	----	24	37	2. 3	4. 0	1. 2	1. 6
Parsons-Dwight complex, 1 to 3 percent slopes, eroded	----	----	----	----	----	----	----	----	----	----	----	----	1. 5	3. 0	----	----
Rosebloom silt loam	----	----	----	----	----	----	----	----	----	----	24	40	3. 4	4. 8	----	----
Stidham loamy fine sand, 0 to 3 percent slopes	25	45	25	40	250	325	----	----	----	----	28	48	4. 0	5. 2	1. 2	1. 6
Summit silty clay loam, 1 to 3 percent slopes	----	----	24	38	240	375	14	20	2. 2	3. 2	28	43	4. 0	5. 4	1. 1	1. 5
Talihina-Collinsville complex, 5 to 20 percent slopes	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1. 0	1. 3
Taloka silt loam, 0 to 1 percent slopes	24	44	32	50	245	400	17	25	2. 0	3. 1	37	56	3. 5	5. 0	1. 4	1. 8
Taloka silt loam, 1 to 3 percent slopes	24	44	30	45	250	375	14	20	1. 8	3. 0	36	49	3. 0	4. 5	1. 4	1. 8
Talpa-Rock outcrop complex, 5 to 30 percent slopes	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Vanoss loam, 0 to 1 percent slopes	32	55	50	70	325	475	25	35	3. 0	4. 0	45	60	5. 0	7. 0	1. 5	2. 0
Vanoss loam, 1 to 3 percent slopes	30	50	45	65	300	450	22	32	2. 7	3. 7	40	55	4. 8	6. 7	1. 5	2. 0
Verdigris silt loam	30	45	52	74	350	500	26	34	3. 0	4. 0	50	70	5. 0	7. 0	1. 7	2. 2
Woodson silt loam	----	----	----	----	225	300	10	16	----	----	25	40	3. 0	4. 5	1. 1	1. 5
Wrightsville silt loam	----	----	----	----	----	----	10	15	----	----	20	34	2. 0	3. 5	----	----
Yahola-Norwood complex	35	60	55	75	400	550	28	36	3. 5	4. 5	55	75	5. 5	7. 5	----	----

[1] Animal-unit-month is a term used to express the carrying capacity of pasture. It is the number of animal units carried per acre, multiplied by the number of months the pasture is grazed during a single grazing season without injury to the sod. An acre of pasture that provides 2 months of grazing for 2 cows has a carrying capacity of 4 animal-unit-months.

A range site in excellent condition (fig. 16) is at or near its maximum productivity. It has a plant cover that adequately protects the soil, encourages intake or moisture, and helps in maintaining fertility. A site in good condition has lost a few decreaser plants, but it is still productive and can be maintained and improved by good management. A site in fair condition has a severely altered plant community in which increasers are dominant and invaders are becoming prominent. Generally the litter is inadequate for protection against compaction and erosion. The exclusion of livestock for an entire season is usually necessary to bring about rapid improvement in condition of the range. A site in poor condition has lost almost all of the desirable forage plants. Few, if any, of the original range plants are left, and invaders are numerous.

Trends in Range Condition

Potential forage production depends on the range site. Current forage production depends on range condition and current moisture conditions.

One of the main objectives of good range management is to keep the range in excellent condition, or at least in good condition. Range that is kept in excellent condition provides optimum forage yields and is protected against erosion and loss of water.

One of the major considerations in management is recognizing important changes in the plant cover. The changes are so gradual that they are often overlooked or misunderstood. The lush growth after heavy rainfall, for example, may be mistaken for an upward trend in condition. Actually, this type of cover is generally weedy and the trend is downward, toward poorer condition and lower forage production. Conversely, some rangeland that is closely grazed and appears to be deteriorating is under careful management and is actually in excellent condition.

Range condition classifies the existing vegetation on the site, but it does not indicate whether the range is improving or deteriorating.

Plant vigor is one of the factors that indicate trend in condition. It is reflected mainly in the size of the plant in relation to its age and the environment in which it is growing. Increased vigor of decreaser plants indicates that range condition is improving.

An abundance of seedlings of the species most palatable to livestock is another sign of an upward trend in condition.

A change in plant composition also indicates the trend in condition. An increase in the number of decreasers shows that the range is improving. The weakening or dying out of some of the decreasers shows that the range is declining. Generally, the invasion of plants not native to the site indicates that a decline has already taken place.

An accumulation of plant residue indicates an upward trend in range condition. Residue reduces the severity of erosion caused by raindrops and makes the surface of the soil more favorable for seedlings and for the intake and conservation of moisture.

The condition of the soil surface affects both the trend in condition and the rate of recovery. An increase in the amount of bare ground, surface crusting, erosion, and compaction from trampling indicates a downward trend in range condition.

Figure 16.—**Sandy Savannah range site in excellent condition. The soil is Hartsells fine sandy loam.**

Descriptions of the Range Sites

Fifteen range sites are recognized in Pittsburg County. Some are on prairies, some are on savannahs, and some are on bottom lands. These sites are described in the pages that follow.

The estimates of herbage yields given in each site description are based on annual growth of herbage clipped at ground level and air dried. For sites on prairies and bottom lands, the yields are of total herbage, not usable or grazable forage. For sites on savannahs, the yields are of grasses and forbs and do not include the leaf, flower or fruit, and stem of woody plants.

The Guide to Mapping Units shows the range site classification for each soil in the county.

Claypan Prairie site

This site consists of nearly level to very gently sloping soils that have a dense clayey subsoil.

Production is moderate. If this site is in excellent condition, decreaser plants make up about 70 percent of the vegetation. These plants are little bluestem, big bluestem, indiangrass, switchgrass, purpletop, gayfeather, sunflower, and black sampson. A mixture of meadow dropseed, Scribner panicum, wild indigo, slimflower scurf-pea, and goldenrod makes up the other 30 percent.

After prolonged use of this site, invaders become abundant. These plants are broomsedge, three-awn, narrowleaf sumpweed, lanceleaf ragweed, bitter sneezeweed, persimmon, and hawthorn.

The estimated annual yield of herbage per acre is about 5,000 pounds in favorable years and about 2,500 pounds in unfavorable years.

Edgerock site

The one mapping unit in this site, Talpa-Rock outcrop complex, 5 to 30 percent slopes, occurs along limestone ridges of the Choctaw Fault. There are many limestone rocks on the surface. On either side of the ridges are long narrow bands of deeper soils. Runoff is excessive. Droughtiness is a limitation.

Production is low. If this site is in excellent condition, decreases make up about 70 percent of the plant community, and increasers about 30 percent. The principal decreasers are big bluestem, little bluestem, switchgrass, indiangrass, and beaked panicum. Common increasers are side-oats grama, hairy grama, dropseed, and purpletop.

As range condition declines, woody plants, such as winged elm, persimmon, bois-d'arc, post oak, blackjack oak, and hackberry, become abundant. Careful management is needed if this site is to be maintained in excellent condition.

The estimated annual yield of herbage per acre is about 2,000 pounds in favorable years and about 1,000 pounds in unfavorable years.

Eroded Prairie site

This site consists of the Dennis soils in Dennis-Dwight complex, 2 to 5 percent slopes, severely eroded. These soils have lost most of their original surface layer through sheet erosion, and in many places they are gullied. Crusts form on the soil material that is left and limit moisture intake and plant growth.

In excellent condition, this site produces a mixture of indiangrass, big bluestem, and little bluestem. Maximum production is between 40 and 50 percent lower than that on the Loamy Prairie range site. Deferment of grazing throughout the growing season accelerates the reestablishment of grass.

The estimated annual yield of herbage per acre is about 3,000 pounds in favorable years and about 1,500 pounds in unfavorable years.

Loamy Prairie site

This site consists of nearly level to gently sloping soils that have a loamy surface layer. The texture and the depth of these soils are such that moisture relations are favorable for the growth of tall grasses.

This is the most productive of the upland range sites. If it is in excellent condition, about 80 percent of the vegetation is a mixture of big bluestem, little bluestem, indiangrass, and switchgrass. All are decreasers. About 15 percent is made up of increasers, such as tall dropseed, tridens, purpletop, wild indigo, goldenrod, and heath aster. The other 5 percent is made up of legumes and such forbs as tickclover, leadplant, gayfeather, and black sampson. Sumac is a common woody increaser.

Common invaders are broomsedge, three-awn, splitbeard bluestem, showy partridgepea, ragweed, common broomweed, bitter sneezeweed, elm, persimmon, and hawthorn.

The estimated annual yield of herbage per acre is about 7,000 pounds in favorable years and about 3,500 pounds in unfavorable years.

Shallow Prairie site

This site consists of sloping to moderately steep (fig. 17), medium-textured soils that are shallow to very shallow over sandstone and shale. On much of this site there are sandstones on or near the surface.

This is a moderately productive site. It produces about the same kind of vegetation as the Loamy Prairie range site, which was previously described, but potential production is about 25 percent lower. About 70 percent of the climax vegetation is made up of decreaser plants, such as big bluestem, little bluestem, switchgrass, indiangrass, wildrye, Virginia tephrosia, catclaw sensitivebrier, and perennial sunflower. If this site is in excellent condition, increaser plants make up 30 percent of the vegetation. Important increasers are silver bluestem, meadow dropseed, side-oats grama, winged elm, hawthorn, and persimmon.

Prolonged heavy grazing thins out the decreasers and allows increasers and invaders to become abundant. Some common invaders are annual brome, three-awn, splitbeard bluestem, broomsedge, ragweed, common broomweed, and bitter sneezeweed.

The estimated annual yield of herbage per acre is about 5,000 pounds in favorable years and about 2,500 pounds in unfavorable years.

Slickspot site

This site is on uplands. The soils have a hard surface crust, a low moisture-storage capacity, and a slow rate of absorption. As a result of a concentration of salts and a subsoil of compact clay, the vegetation is limited to plants that are both salt tolerant and drought resistant.

Significant decreaser plants are little bluestem, switchgrass, and wildrye. These plants make up about 65 percent of the vegetation if the site is in excellent condition. Increaser plants, which make up 35 percent of the potential plant community, are longspike tridens, meadow dropseed, Scribner panicum, sedges, and rushes.

Characteristic invaders are lanceleaf ragweed, narrowleaf sumpweed, bitter sneezeweed, croton, and three-awn.

The estimated annual yield of herbage per acre is about 2,000 pounds in favorable years and about 1,000 pounds in unfavorable years.

Deep Sand Savannah site

This site consists of deep sands on uplands. These soils are potentially productive of oak trees and tall grasses.

When this site is in excellent condition, about 60 percent of the climax vegetation is a mixture of grasses and forbs and about 40 percent is made up of woody species. Herbaceous decreasers are little bluestem, big bluestem, indiagrass, switchgrass, and beaked panicum. Increasers include purpletop, tall dropseed, Scribner panicum, sand lovegrass, and Texas bullnettle.

Following prolonged heavy grazing, or heavy use after fire, the better plants are weakened and such invaders as broomsedge, splitbeard bluestem, annual three-awn, showy partridgepea, ragweed, marestail, and white snake root become prominent.

The estimated annual yield of herbage per acre is 4,500 pounds in favorable years and about 2,250 pounds in unfavorable years.

Eroded Sandy Savannah site

This site consists of the Hartsells soil in Hector-Hartsells complex, 3 to 8 percent slopes, severely eroded. This soil is moderately deep and loamy and is underlain by partly weathered sandstone. It was formerly culti-

Figure 17.—Shallow Prairie range site (Talihina-Collinsville complex, 5 to 20 percent slopes) in background. Loamy Prairie range site (Eram soils) in foreground.

vated. Range seeding is required in establishing the better grasses. Gullies are numerous.

Trees make up about 35 percent of the climax vegetation. These are mainly post oak, blackjack oak, red oak, and hickory. Grasses and forbs make up about 65 percent of the potential plant cover. Common decreaser grasses are big bluestem, little bluestem, and indiangrass. Common cool-season forage plants are Canada wildrye, low panicum, and carex.

The principal invaders on this site are broomsedge, splitbeard bluestem, three-awn, and ragweed.

The estimated annual yield of herbage per acre is about 2,500 pounds in favorable years and about 1,250 pounds in unfavorable years.

Eroded Shallow Savannah site

This site consists of Hector soils in Hector-Hartsells complex, 3 to 8 percent slopes, severely eroded. These soils are shallow and loamy and are underlain by partly weathered sandstone. They were formerly cultivated. The shallowness and the gullies limit plant production.

This site produces the same kind of climax vegetation as the Shallow Savannah site, but potential production is lower. Common decreaser grasses are big bluestem, little bluestem, and indiangrass.

The principal invaders on this site are broomsedge, splitbeard bluestem, three-awn, and ragweed. Range seeding is required in establishing the better grasses.

The estimated annual yield of herbage per acre is about 2,000 pounds in favorable years and about 1,000 pounds in unfavorable years.

Loamy Savannah site

This site consists of moderately productive soils on uplands. Originally these soils supported an open stand of trees in natural grassland. They are very slowly permeable and have a limited amount of water available for plant use.

In excellent condition, this site supports a cover of tall grasses and an open stand of post oak and blackjack oak. Woody species make up about 40 percent of climax vegetation. Decreaser grasses and forbs make up about 40 percent, and increasers about 20 percent. The principal decreasers are big bluestem, little bluestem, switchgrass, indiangrass, beaked panicum, broadleaf uniola, and tick-clover. Some common increasers are low panicum, purple-

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top, heath aster, goldenrod, hickory, and winged elm.

Overgrazing allows broomsedge, annual three-awn, greenbrier, post oak, blackjack oak, and winged elm to become abundant. The estimated annual yield of herbage per acre is about 5,000 pounds in favorable years and about 2,500 pounds in unfavorable years.

Sandy Savannah site

This site consists of deep to moderately deep, very gently sloping to moderately steep, sandy soils on uplands. These soils support a cover of tall grasses mixed with oak, hickory, and pine trees (fig. 18).

Trees make up about 35 percent of the climax vegetation. These are mainly post oak, blackjack oak, red oak, and hickory. Pine occurs in the southeastern part of the county. Grasses and forbs make up about 65 percent of the potential plant cover. The principal decreaser grasses are big bluestem, little bluestem, indiangrass, and switchgrass. The principal cool-season forage plants are Canada wildrye, low panicum, and carex.

In poor condition, this site appears to be a solid stand of post oak and blackjack oak in which occur a weak stand of broomsedge and a few decreaser plants.

The estimated annual yield of herbage per acre is about 5,000 pounds in favorable years and about 2,000 pounds in unfavorable years.

Savannah Breaks site

The one mapping unit in this site is Enders-Hector complex, 30 to 60 percent slopes. These soils are stony and are moderately deep to very shallow over shale and sandstone. Rapid runoff is common during periods of heavy rainfall or during prolonged rainy periods.

When this site is in excellent condition, about 60 percent of the vegetation consists of grasses, legumes, and other forbs, and 40 percent consists of woody plants. The principal forage plants are little bluestem, big bluestem,

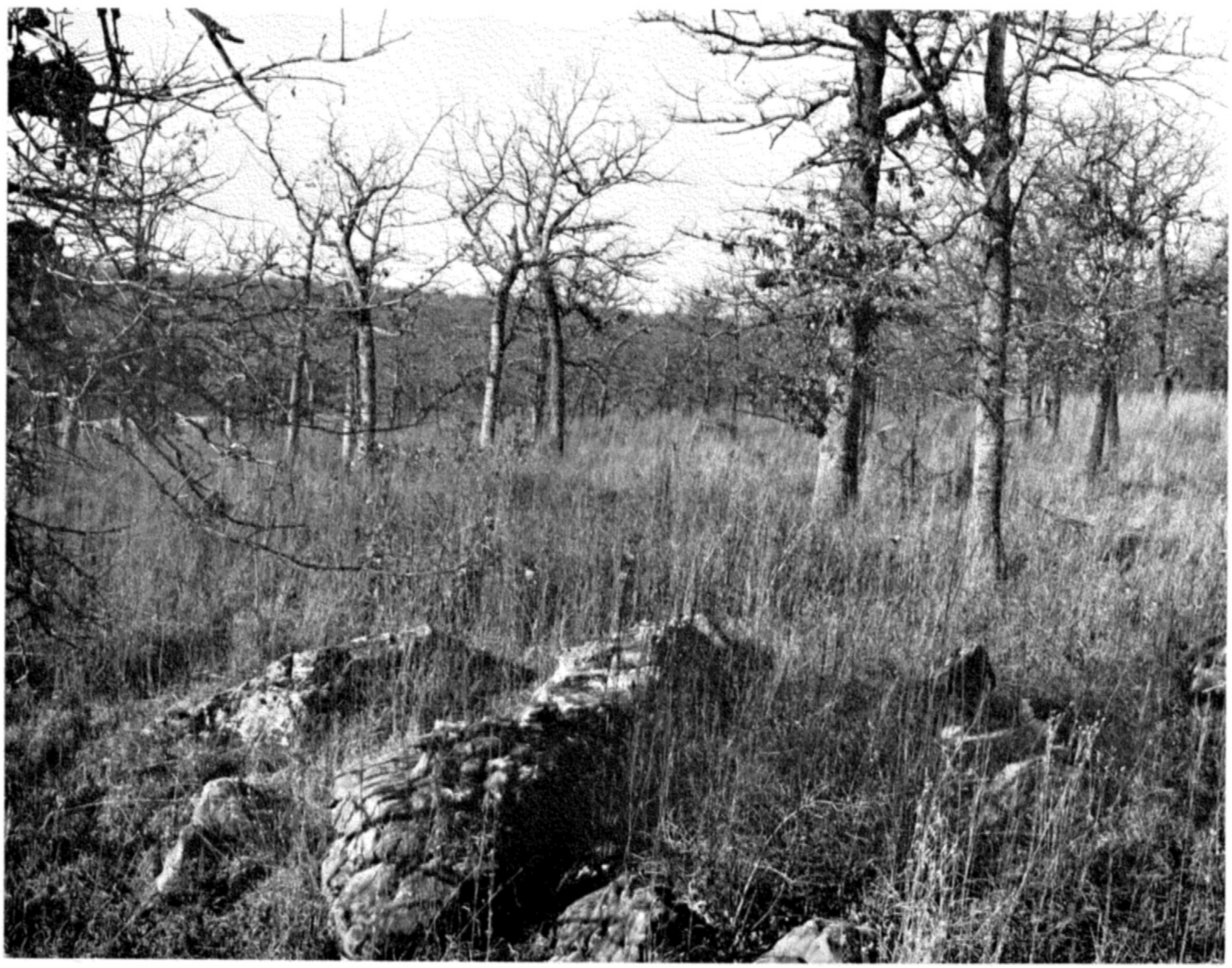

Figure 18.—Sandy Savannah site and Shallow Savannah site in excellent condition. Both are lightly grazed. The soil is the Enders part of Enders-Hector complex.

Figure 19.—**Shallow Savannah site in poor condition. The soil is the Hector part of the Enders-Hector complex.**

indiangrass, and switchgrass. The principal trees are post oak, blackjack oak, and shortleaf pine.

Prolonged heavy grazing or fire and heavy use have thinned out the grasses and released space for sprouts. Where this has occurred, range condition has declined to poor and the plant cover is almost a solid stand of scrubby post oak, blackjack oak, elm, hawthorn, and persimmon. This overstory of woody plants shades the grasses and contributes to the development of a thin, weak stand of little bluestem, broomsedge, annual three-awn, poverty oatgrass, ragweed, and croton.

The estimated annual yield of herbage per acre is about 3,000 pounds in favorable years and about 1,500 pounds in unfavorable years.

Shallow Savannah site

This site consists of stony, shallow to very shallow soils on uplands. The vegetative cover is a grass understory mixed with blackjack oak, post oak, and associated woody vegetation. Excessive runoff, shallowness, and stoniness limit the available water capacity and the forage production.

When this site is in excellent condition, the vegetation is about 70 percent grasses and forbs and 30 percent an open stand of post oak, blackjack oak, and a few hickory. Common decreasers are big bluestem, little bluestem, switchgrass, indiangrass, tephrosia, slender lespedeza, prairie clover, and black sampson. Increasers, such as purpletop, tall dropseed, Scribner panicum, sunflower, heath aster, post oak, blackjack oak, and winged elm, become abundant as range condition declines.

As range condition declines to poor (fig. 19), trees become abundant. In poor condition the site is a dense stand of post oak and blackjack oak. The grass cover can be restored by chemical spraying, deferred grazing, and proper range use.

The estimated annual yield of herbage per acre is about 4,750 pounds in favorable years and about 2,350 pounds in unfavorable years.

Heavy Bottomland site

This site is made up of deep, poorly drained, very slowly permeable soils that formed in alluvium. These soils are subject to flooding. They have a surface layer of silt loam or silty clay loam. Their subsoil is very slowly permeable.

Hardwoods make up 30 to 40 percent of the climax vegetation, and grasses and forbs 60 to 70. The principal decreasers are big bluestem, indiangrass, switchgrass, eastern gamagrass, broadleaf uniola, and prairie cordgrass. Under the more shaded canopy of American elm, ash, and oak, the dominant grasses are wildrye, broadleaf uniola, sedges, and rushes.

When this site is in poor condition, there is an abundance of sumpweed, ironweed, ragweed, windmillgrass, hawthorn, elm, persimmon, ash, and trumpetvine.

The estimated annual yield of herbage per acre is about 7,000 pounds in favorable years and about 3,500 pounds in unfavorable years.

Loamy Bottomland site

This site consists of nearly level, deep, loamy soils that are highly fertile. Because of position and depth, these soils receive and store more moisture than do other soils in the area.

This site has the highest potential production of any site in the county. In excellent condition it supports a mixture of tall grasses and woody plants. The principal grasses are prairie cordgrass, eastern gamagrass, big bluestem, switchgrass, broadleaf uniola, switch cane, and wildrye. The woody plants are mainly walnut, pecan, indigobush, and trumpetvine. Grasses and forbs make up 55 percent of the vegetation, and woody plants about 45 percent. Hardwoods suited to this site are American elm, green ash, pecan, walnut, and red oak.

In areas that have been cultivated and abandoned or that are in poor condition, this site is a jungle of greenbrier, hawthorn, post oak, blackjack oak, pecan sprouts, winged elm, sumpweed, ironweed, and ragweed mixed with broomsedge, johnsongrass, or bermudagrass.

Most of this site is either in cultivated crops or in tame pasture, but it could be returned to highly productive native grass. The estimated annual yield of herbage per acre is 8,500 pounds in favorable years and about 4,250 pounds in unfavorable years.

Use of the Soils for Woodland [5]

Soils suitable for producing wood crops make up about 25 percent of Pittsburg County. All soils in the southeastern quarter of the county and on bottom land in the rest of the county are capable of producing wood crops. The tree growth that appears on most other areas is not true forest.

Forestry operations are, and usually have been, temporary in nature. Forested areas have been considered mostly in terms of grazing value. Under good management, many areas, for example, wooded areas in the southeastern part of the county, could be used for both range and woodland. For the hardwood forests on bottom land, however, good management would preclude grazing.

[5] By CHARLES P. BURKE, woodland conservationist, Soil Conservation Service.

Forest Cover Types

Mixed bottom-land hardwoods, oak-hickory, and oak-pine are the major forest cover types in the county.

The bottom-land hardwood mixture occurs on soil associations 1 and 4 (see general soil map). It consists mainly of cottonwood, willow, sycamore, ash, elm, hackberry, pecan, and some flood-tolerant oaks.

The upland oak, hickory, and pine represented in the other two cover types occur in mountainous areas, largely on soil association 3. The trees are mainly post oak, red oak, white oak, blackjack oak, hickory, and shortleaf pine.

The proportion of the more valuable species and the better individual trees in the forest stands has declined through overgrazing, lack of fire control, and inattention to proper cutting practices. The original species composition is not evident in many parts of the county.

Woodland Groups

The soils of Pittsburg County that are suitable for producing wood crops have been placed in five woodland groups. Each group consists of soils that are suited to the same kind of trees, that have about the same potential productivity, and that require about the same management.

The kinds of trees suitable for post-lot plantings, the kinds to be favored in natural stands, and the kinds suitable for woodland plantings are all mentioned in the description of each woodland group.

Potential productivity is described in terms of site index and average annual growth.

Site index indicates potential productivity of a soil for a given species. It is the expected height, in feet, of the dominant trees of a given species in an even-aged stand at 50 years of age, except for cottonwood. In cottonwood stands it is the average height of the dominant trees at 30 years of age. Well-stocked, even-aged forest stands of more than 30 years are measured for present height and age, in order to determine the correct site index.

Available data on the average annual growth of representative trees, in board feet per acre, according to the Doyle scale, are also given in the descriptions of the woodland groups.

The site indexes and annual growth rates shown in each description are averages for the group; no one of them represents a specific soil.

The soils of each group have, in varying degrees, limitations that affect management. The limitations considered are equipment limitation, seedling mortality, plant competition, and erosion hazard. The degrees of limitation are described as slight, moderate, and severe.

The use of equipment is affected by wetness, stoniness, slope, and, especially in coarse-textured soils, dryness. The severity of the limitation varies according to the type of equipment used in planting, tending, and harvesting the forest crops. The limitation is slight if there is little or no restriction on the type of equipment that can be used or on the time of year that equipment can be used. The limitation is moderate if the use of equipment is limited by slope or seasonal wetness. It is severe if the use of equipment is limited by slope, rocks, texture, instability of the soils, or seasonal wetness.

Seedling mortality refers to the expected loss of seedlings or saplings. It applies to both naturally regenerated seedlings and planted stock. Mortality is slight if trees regenerate naturally in areas where there is enough seed, or if not more than 25 percent of the planted seedlings die. It is moderate if trees ordinarily do not regenerate in numbers that will restock the stands naturally, or if 25 to 50 percent of planted seedlings die. It is severe if trees do not reseed naturally, even where there are enough seeds, or if 50 percent or more of planted seedlings die.

Plant competition refers to invasion by undesirable species of trees or shrubs that compete with desirable species for moisture and plant nutrients. It also refers to the return of such invaders after control measures have been applied. Plant competition is slight if unwanted plants do not prevent adequate natural regeneration or do not interfere with the early growth and adequate development of planted seedlings. It is moderate if unwanted plants delay natural regeneration but do not retard the eventual development of a fully stocked stand. It is severe if unwanted plants prevent adequate restocking, without intensive preparation of the site and without special maintenance practices.

The erosion hazard referred to in the description of the woodland groups is based on an estimate of the degree of erosion to be expected under customary management. Erosion damages the quality of the soils of a site, obstructs roads and trails that are necessary for access and fire protection, and interferes with harvesting. The erosion hazard is slight if only a small loss of soil is likely. It is moderate if uncontrolled runoff and inadequate plant cover can be expected to result in a moderate loss of soil. It is severe if steepness, uncontrolled runoff, and slow infiltration and permeability can be expected to result in loss of considerable soil material.

Descriptions of the woodland groups in Pittsburg County follow. The names of the soil series represented are mentioned in the description of each group, but this does not mean that all the soils of a given series are in the group. The woodland designation for each soil in the county can be found in the "Guide to Mapping Units."

Woodland group 1

This group consists of soils of the Ennis, Rosebloom, and Verdigris series. These soils are on flood plains and are subject to overflow. They are loamy, deep, nearly level, moderately well drained to poorly drained, and neutral to very strongly acid.

Osage-orange, catalpa, and black locust are suitable for post-lot plantings. Red oak, sycamore, cottonwood, and pecan are the preferred kinds of trees in natural stands. Cottonwood is suitable for woodland plantings.

The average site index is 69 for upland oak and 80 for cottonwood. The average expected annual growth is 120 board feet per acre for upland oak and 235 board feet for cottonwood.

The equipment limitation is moderate to severe. Seedling mortality is slight to moderate. Plant competition is slight to moderate. Controlling erosion is a minor problem.

Woodland group 2

This group consists of soils of the Ochlockonee, Norwood, and Yahola series. These soils are on flood plains. All are loamy, deep, nearly level, well drained, and moderately alkaline to very strongly acid. Ochlockonee soils are subject to overflow. Yahola and Norwood soils are seldom flooded.

Catalpa and black locust are suitable for post-lot plantings. Cottonwood, sycamore, red oak, white oak, and black walnut are among the preferred kinds of trees in native stands.

The average site index is 65 for upland oak and 87 for cottonwood. The average annual growth is 105 board feet per acre for oak and 385 board feet for cottonwood.

The equipment limitation is slight, and seedling mortality is slight. Plant competition is slight to moderate. The erosion hazard is slight.

Woodland group 3

This group consists of soils of the Counts, Hartsells, and Wrightsville series. These soils are on uplands. They are deep to moderately deep, gently sloping, light colored, and medium acid to very strongly acid.

Black locust is the only species suitable for post-lot plantings. Shortleaf pine, red oak, white oak, and redcedar are preferred kinds of trees in native stands. Shortleaf pine, loblolly pine, and eastern redcedar are suitable for woodland plantings.

The average site index is 58 for shortleaf pine and 63 for upland oak. The expected annual growth is 110 board feet per acre for pine and 95 board feet for upland oak.

The equipment limitation is slight, and seedling mortality is slight. Plant competition is sometimes severe. The erosion hazard is slight.

Woodland group 4

This group consists of Hartsells and Hector soils. These soils are on uplands. They are moderately deep to shallow, very gently sloping to gently sloping, light colored, and medium acid to very strongly acid.

These soils are too shallow or too eroded to be suitable for post-lot plantings. Shortleaf pine, red oak, and eastern redcedar are preferred kinds of trees in native stands. Shortleaf pine and eastern redcedar are suitable for woodland plantings.

The average site index is 49 for shortleaf pine and 54 for oak. The average annual growth is 50 board feet for pine and 70 board feet for oak.

The limitations that affect management are moderate to severe except for erosion, which is slight to moderate.

Woodland group 5

This group consists of soils of the Enders, Guin, Hartsells, and Hector series. These soils are moderately deep to very shallow and gently sloping to steep. Enders and Hector soils are stony. Hartsells and Hector soils are severely eroded.

These soils are not suitable for post-lot plantings. Shortleaf pine, red oak, and eastern redcedar are preferred kinds of trees in native stands.

The average site index is 40 for shortleaf pine and 43 for oak. Rocks and steep slopes make all limitations severe.

Post Lots

Durable, attractive fenceposts grown in the shortest possible time is the objective in establishing a post lot. The trees in Oklahoma most suitable for post-lot plantings are black locust, catalpa, and Osage-orange. Most of the native species are unsatisfactory.

In general, the most satisfactory post lots are those established on soils that are productive of field crops or tame pasture, or that generally support a stand of native grass. In addition to the soils mentioned in woodland groups 1, 2, and 3, some soils of the Choteau, Dennis, Dougherty, Konawa, and Vanoss series are suitable for post-lot plantings (fig 20). These soils are designated in the "Guide to Mapping Units."

Some dump areas of coal strip mines can be used for black locust. Conditions vary within short sections of these waste piles. Some of this material is toxic to plant growth. The more weathered material is generally the more suitable. A forester or soil scientist should be consulted before post lots are planted in any of these areas.

Use of the Soils for Wildlife[6]

The dominant wildlife areas in Pittsburg County are the timbered bottom lands, the timbered uplands, and the prairies. The timbered bottom lands are along the larger streams throughout the county and along the South Canadian River in the extreme northern part. The timbered uplands and the prairies are well distributed throughout the county, in tracts of varying sizes.

[6] By JEROME SYKORA, biologist, Soil Conservation Service.

***Figure 20.*—Black locust post lot on Choteau loam.**

The important kinds of wildlife are bobwhite quail, mourning dove, deer, fox squirrel, gray squirrel, cottontail rabbits, raccoon, mink, opossum, skunk, muskrat, and beaver. Predatory animals, such as coyote, bobcat, red fox, and gray fox, are numerous. Fairly large numbers of waterfowl and shore birds use the farm ponds and lakes as resting places while migrating. There are several species of hawks and owls, many species of songbirds, and, in the southeastern part of the country, a small remnant flock of eastern wild turkey.

Soil association 1 (see general soil map) makes up less than 1 percent of the county. The soils in this association are productive of crops, such as alfalfa, corn, grain sorghum, and soybeans, that provide a valuable supplement to the natural wildlife food supply, and they are well suited to tree and shrub plantings that supplement existing habitat plantings. The dense stands of cottonwood, willow, and tamarisk that invade these bottom-land forests must be thinned out in order to provide the best kind of wildlife habitat.

Soil association 2 makes up less than 6 percent of the county. Up to 80 percent of this association had been cleared of a mixed oak forest and cultivated. Now, as a result of low fertility and erosion, less than 30 percent of this acreage is cropland. The rest has been converted to tame pasture. Peanuts, rye, vetch, grain sorghum, and truck crops are the chief crops. The soils in this association are well suited to annuals, perennials, woody plants, and weeds that provide food for wildlife.

Soil association 3 occurs as fairly large areas throughout the county and makes up a little more than half the total acreage. About 85 percent of this association has a post oak-blackjack oak cover. The rest, which was once cleared and cultivated, has been converted to native grass and tame pasture. The present vegetative cover provides fair- to moderate-quality habitat for deer, squirrel, and wild turkey, but poor-quality habitat for quail. Providing small openings in heavily wooded areas, through the use of mechanical equipment or herbicides, would increase the supply of food and edge vegetation for all wildlife species. The lack of diversity and abundance of natural and cultivated food-producing plants is the most serious limiting factor in establishing suitable wildlife habitat on this association.

Soil association 4 occurs as long, narrow strips along major streams. It makes up about 8 percent of the county. At one time about 40 percent of this association was cultivated. At present, only about 10 percent of it is cultivated and the rest is in permanent pasture. There are small acreages of corn, cotton, alfalfa, and grain sorghum. Uncleared areas support a desirable woody cover of ash, elm, oak, hackberry, honey locust, willow, cottonwood, persimmon, Osage-orange, sycamore, box elder, and greenbrier. This bottom-land habitat is most desirable for deer, turkeys, furbearing animals, and songbirds. The soils are deep and have good potential for supplemental plantings that increase the wildlife carrying capacity.

Soil association 5 occurs as fairly large areas distributed throughout the county. It makes up about 19 percent of the total acreage. At one time about half of this association was cultivated. At present, only about 10 percent is in crops. The rest is in tame pasture. All of the soils in this association have good potential for supplemental habitat plantings. Considerable sumac and Osage-orange grow on Collinsville and Talihina soils, which are minor soils in the association. Along meadow edges and wooded drainageways, this cover provides moderate- to good-quality habitat for quail, rabbits, deer, turkeys, furbearers, and songbirds.

Soil association 6, which makes up about 11 percent of the county, occurs mostly as steep slopes and ridges. It provides considerable protection for wildlife because it is nearly inaccessible to humans. The largest tracts are in the southeastern part of the county. The soils are stony and are moderately deep to shallow. The acreage of tillable soils that would support plantings beneficial to wildlife is limited. Proper range use is the most important practice in maintaining wildlife food and cover.

Soil association 7 makes up only 2 percent of the county. About 90 percent of it is under cultivation. The chief crops are grain sorghum, soybeans, peanuts, cotton, and alfalfa. Waste grain from these crops provides needed supplemental wildlife food. The soils are deep, nearly level to very gently sloping, and highly productive. The potential is good for improving wildlife habitat, for example, by establishing hedgerow and field border plantings and by protecting and encouraging native plants along drainageways and rights of way and in odd areas.

Most of the fishing in this county is done in Lake McAlester, Lake Eufaula, the larger streams, and the better quality farm ponds. Fish in the larger streams include channel, bullhead, and flathead catfish, black bass, white bass, crappie, carp, buffalo, numerous kinds of minnows, and various species of small sunfish.

Numerous farm ponds have been built for livestock water and for recreational purposes. If drainage to these ponds is from a well-vegetated watershed, and the water is clear and fertile and can be maintained at a reasonably stable level, the potential is moderate to good for production of bass, bluegill, and channel cat.

A water level constant enough for fish production generally cannot be maintained in ponds built in permeable or excessively drained soils, such as those in soil associations 1 and 2. Turbidity is a significant limitation in ponds built in soils that are dispersed or are high in fine clay, as are some of the soils in associations 5 and 6. Turbidity severely limits fish production. It is tolerated to some degree by channel cat and bullheads, but, at best, only very low production can be expected.

Use of the Soils in Engineering[7]

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. Among the properties most important to engineers are permeability, shear strength, compaction characteristics, soil drainage, shrink-swell characteristics, grain size, and plasticity. The depth to bedrock and the topography also are important.

Information in this publication can be used to—

[7] Prepared by WALTER MARTIN, agricultural engineer, and WILLIAM E. HARDESTY, civil engineer, Soil Conservation Service.

1. Make studies that will aid in selecting and developing industrial, commercial, residential, and recreational sites.
2. Make preliminary estimates of the engineering properties of soils in planning agricultural drainage systems, farm ponds, irrigation systems, diversion terraces, and other structures for conservation of soil and water.
3. Make studies that will aid in selecting locations for highways, airports, pipelines, and underground cables, and in planning detailed investigations at the selected locations.
4. Locate probable sources of sand and gravel and other construction material.
5. Correlate performance with soil mapping units to develop information that will be useful in planning engineering practices and in designing and maintaining structures.
6. Determine the suitability of soils for cross-country movement of vehicles and construction equipment.
7. Supplement other publications, such as maps, reports, and aerial photographs, that are used in preparation of engineering reports for a specific area.
8. Develop other preliminary estimates for construction purposes.

The engineering interpretations reported in tables 5, 6, and 7 do not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads and excavations deeper than the depths of layers here reported. Even in these situations, however, the soil map is useful in planning more detailed field investigations and in indicating the kinds of problems that may be expected.

Some of the terms used by soil scientists have special meanings in soil science that may not be familiar to engineers. These terms are defined in the Glossary.

TABLE 5.—*Estimated*

[Depth to water table is not shown because it is

Soil series and map symbols	Hydrologic soil group	Permeability	Depth to bedrock	Depth from surface	Classification
					USDA texture
		Inches per hour	*Inches*	*Inches*	
Bates: BaB, BaC, BaC2, BcC (For Collinsville part of BcC, see Collinsville series.)	B	0.63–2.0	20–48	0–25	Fine sandy loam
				25–39	Sandy clay loam
				39	Partly weathered sandstone.
Chastain: Ca	D	<0.63	>72	0–17	Silty clay loam
				17–96	Clay
Choteau: ChA, ChB, CoB	C	0.2–0.63	>72	0–22	Loam or very fine sandy loam
				22–72	Clay loam
Collinsville	C	2.0–6.3	4–20	0–11	Fine sandy loam
				11	Sandstone.
Counts: CuA	C	<0.06	>60	0–10	Loam
				10–64	Clay
Dennis: DeB, DeC, DeC2, DnC3 (For Dwight part of DnC3, see Dwight series.)	C	0.06–0.20	>60	0–13	Loam
				13–19	Clay loam
				19–60	Clay
Dougherty: DoD, DtE (For Eufaula part of DtE, see Eufaula series.)	B	0.63–2.0	>72	0–24	Loamy fine sand
				24–66	Sandy clay loam
				66–90	Loamy fine sand
Dwight	D	<0.06	>72	0–6	Silt loam
				6–90	Silty clay
Enders: EhE, EhF (For Hector part of EhE and EhF, see Hector series.)	C	0.06–0.20	20–50	0–4	Fine sandy loam
				4–9	Clay loam
				9–24	Clay
				24	Shale.
Ennis: En, Eo (For Verdigris part of Eo, see Verdigris series.)	B	0.20–0.63	>72	0–70	Silt loam
Eram: ErC, ErC2	D	0.06–0.20	20–40	0–8	Clay loam
				8–32	Clay
				32	Shale.
Eufaula: EuB	A	6.3–20.0	>72	0–42	Fine sand
				42–80	Loamy fine sand

See footnote at end of table.

Engineering Classifications

The two systems most commonly used in classifying soils for engineering are the systems approved by the American Association of State Highway Officials (AASHO) and the Unified system.

The AASHO system (*1*) is used to classify soils according to those properties that affect use in highway construction. In this system all soil material is classified in seven principal groups. The groups range from A–1, which consists of soils that have the highest bearing strength and are the best soils for subgrade, to A–7, which consists of soils that have the lowest strength when wet. Within each group, the relative engineering value of the soil material is indicated by a group index number. The numbers range from 0, for the best material, to 20, for the poorest. The group index number is shown in parentheses following the soil group symbol.

In the Unified system (*7*) soils are identified according to particle-size distribution, plasticity, liquid limit, and organic-matter content. There are eight classes of coarse-grained soils, which are gravels (G) and sands (S); six classes of fine-grained soils, which are silts (M) and clays (C); and one class of highly organic soils (O). In this system, SW and SP are clean sands; SM and SC are sands that include fines of silt and clay; ML and CL are silts and clays that have a low liquid limit; and MH and CH are silts and clays that have a high liquid limit.

Soil scientists use the USDA textural classification (*5*). In this, the texture of the soil is determined according to the proportion of soil particles smaller than 2 millimeters in diameter, that is, the proportion of sand, silt, and clay.

Table 7 shows the AASHO and Unified classification of specified soils in the county, as determined by laboratory tests. Table 5 shows the estimated classification of

engineering properties

more than 72 inches for all soils in the county]

Classification—Continued		Percentage passing sieve—			Available water capacity	Reaction	Shrink-swell potential
Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)			
					Inches per inch of soil	*pH*	
SM, ML	A–2, A–4	----------	100	30–60	0. 14	5. 6–6. 5	Low.
SC, CL	A–4	----------	100	40–60	. 14	5. 6–6. 5	Low.
CL	A–4, A–6	----------	100	85–95	. 17	4. 5–5. 5	Moderate.
CL, CH	A–7	----------	100	90–100	. 17	4. 5–6. 0	Moderate to high.
ML, CL	A–4	----------	100	55–85	. 14	5. 1–6. 5	Low.
CL	A–6, A–7	----------	100	75–95	. 17	5. 6–7. 3	Moderate.
SM, ML	A–2, A–4	70	70	30–60	. 12	5. 6–6. 5	Low.
CL, ML	A–4	----------	100	55–85	. 14	4. 5–5. 5	Low.
CL, CH	A–6, A–7	----------	100	75–90	. 17	4. 5–7. 3	Moderate to high.
CL, ML	A–4	----------	100	55–85	. 14	5. 1–6. 5	Low.
CL	A–4, A–6	----------	100	75–95	. 17	5. 1–6. 5	Moderate.
CL, CH	A–7	----------	100	85–95	. 17	5. 6–7. 3	High.
SM	A–4	----------	100	36–50	. 09	5. 6–6. 5	Low.
SC, CL	A–4	----------	100	45–65	. 17	5. 1–6. 0	Moderate.
SM	A–2, A–4	----------	100	30–50	. 09	5. 6–6. 5	Low.
ML	A–4	----------	100	75–90	. 14	5. 6–6. 5	Low.
CL, CH	A–7	----------	100	90–98	. 17	6. 1–8. 4	High.
SM, ML	A–4	60	60	45–65	. 14	4. 5–5. 5	Low.
CL	A–6	----------	100	75–95	. 17	4. 5–5. 5	Moderate.
MH, CH	A–7	----------	100	90–98	. 17	4. 5–5. 5	Moderate to high.
ML, CL	A–4	----------	100	75–95	. 14	4. 5–6. 5	Low.
ML, CL	A–6, A–4	----------	100	75–95	. 17	5. 1–6. 0	Moderate.
CH	A–7	----------	100	90–98	. 17	5. 1–6. 5	High.
SM, SP	A–3	----------	100	5–10	. 05	5. 1–6. 0	Low.
SM	A–2	----------	100	15–35	. 07	5. 1–6. 0	Low.

TABLE 5.—*Estimated*

Soil series and map symbols	Hydrologic soil group	Permeability	Depth to bedrock	Depth from surface	Classification: USDA texture
		Inches per hour	*Inches*	*Inches*	
Guin: GuE.[1]					
Hartsells: HaB, HaC, HaC2	B	0. 63–2. 0	24–42	0–16	Fine sandy loam
				16–34	Sandy clay loam
				34–39	Fine sandy loam
				39	Sandstone.
Hector: HhC, HhD3 (For Hartsells part of HhC and HhD3, see Hartsells series.)	B	2. 0–6. 3	10–20	0–15	Fine sandy loam
				15	Weathered sandstone.
Konawa: KoB, KsD3	B	0. 63–2. 0	>72	0–12	Fine sandy loam
				12–40	Sandy clay loam
				40–72	Fine sandy loam
Mine pits and dumps: Mp.[1]					
Norwood	B	0. 63–2. 0	>72	0–32	Silt loam
				32–45	Very fine sandy loam
				45–72	Loamy very fine sand
Ochlockonee: Oc	B	2. 0–6. 3	>72	0–72	Fine sandy loam
Parsons: PaA, PaB, PdB2 (For Dwight part of PdB2, see Dwight series.)	D	<0. 06	>60	0–12	Silt loam
				12–62	Clay
Rosebloom: Rs	D	<0. 06	>72	0–33	Silt loam
				33–96	Silty clay loam
Stidham: StB	B	0. 63–2. 0	>72	0–26	Loamy fine sand
				26–55	Sandy clay loam
				55–68	Fine sandy loam
				68–75	Loamy fine sand
Summit: SuB	C	0. 06–0. 20	60	0–13	Silty clay loam
				13–60	Silty clay
				60	Shale and limestone.
Talihina: TcE (For Collinsville part of TcE, see Collinsville series.)	D	0. 06–0. 20	>24	0–6	Stony clay loam
				6–15	Clay
				15–25	Shale.
Taloka: TkA, TkB	D	<0. 06	>72	0–24	Silt loam
				24–72	Silty clay
Talpa: TrE (Properties not estimated for Rock outcrop part of TrE.)	D	0. 20–0. 63	6–18	0–8	Stony clay loam
				8	Hard limestone.
Vanoss: VaA, VaB	B	0. 63–2. 0	>72	0–18	Loam
				18–54	Clay loam
				54–80	Sandy clay loam
Verdigris: Vg	B	02. 0–0. 63	>72	0–90	Silt loam
Woodson: Wo	D	<0. 06	>72	0–10	Silt loam
				10–65	Silty clay
Wrightsville: Wr	D	<0. 06	>72	0–13	Silt loam
				13–72	Clay
Yahola: Yn (For Norwood part of Yn, see Norwood series.)	B	2. 0–6. 3	>72	0–48	Very fine sandy loam or fine sandy loam.
				48–96	Silt loam

[1] Widely variable material.

engineering properties—Continued

Classification—Continued		Percentage passing sieve—			Available water capacity	Reaction	Shrink-swell potential
Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)			
					Inches per inch of soil	*pH*	
SM, ML	A-2, A-4	------------	100	30-60	.12	5.1-6.0	Low.
SC, CL	A-4	------------	100	40-60	.14	4.5-5.5	Low.
SM, ML	A-2, A-4	------------	100	30-60	.12	4.5-5.5	Low.
SM	A-2, A-4	------------	100	25-45	.12	4.5-6.0	Low.
SM, ML	A-2, A-4	------------	100	30-60	.14	5.6-6.5	Low.
SC, CL	A-4	------------	100	40-60	.14	5.6-6.5	Low.
SM, ML	A-2, A-4	------------	100	30-60	.14	5.5-6.5	Low.
ML	A-4	------------	100	75-90	.14	7.4-8.4	Low.
ML	A-4	------------	100	60-80	.14	7.4-8.4	Low.
SM	A-2, A-4	------------	100	30-50	.07	7.4-8.4	Low.
SM, ML	A-2, A-4	------------	100	30-60	.14	4.5-5.5	Low.
ML	A-4	------------	100	75-90	.14	5.1-6.0	Low.
CL, CH	A-7	------------	100	90-98	.17	5.1-8.4	High.
ML	A-4	------------	100	75-90	.14	4.5-5.5	Low.
ML, CL	A-4, A-6	------------	100	85-95	.14	4.5-6.0	Low.
SM	A-2	------------	100	15-35	.07	6.1-6.5	Low.
SC, CL	A-4	------------	100	40-60	.14	4.5-6.5	Low.
SM, ML	A-2, A-4	------------	100	30-60	.14	4.5-7.8	Low.
SM	A-2	------------	100	15-35	.07	5.6-7.8	Low.
ML, CL	A-4, A-6	------------	100	85-95	.17	5.6-6.5	High.
CL, CH	A-7	------------	100	90-98	.17	6.1-7.8	High.
ML, CL	A-6, A-7	80	80	55-75	.17	5.6-6.5	Moderate.
MH, CH	A-7	------------	100	90-98	.17	5.1-6.0	High.
ML	A-4	------------	100	75-90	.14	4.5-6.0	Low.
CL, CH	A-7	------------	100	90-98	.17	5.1-7.3	High.
CL	A-6	------------	100	75-95	.17	6.1-7.3	Moderate.
ML, CL	A-4	------------	100	55-85	.14	6.1-7.3	Low.
CL	A-6	------------	100	75-95	.17	5.1-6.5	Moderate.
CL	A-4, A-6	------------	100	75-90	.14	5.1-6.0	Low.
ML	A-4	------------	100	75-90	.14	5.6-6.5	Low.
ML	A-4	------------	100	75-90	.14	5.6-6.5	Low.
CL, CH	A-7	------------	100	90-98	.17	6.1-8.4	High.
ML	A-4	------------	100	75-90	.14	4.5-5.5	Low.
CL, CH	A-7	------------	100	90-98	.17	5.6-8.4	High.
ML	A-4	------------	100	60-80	.14	6.6-8.4	Low.
ML	A-4	------------	100	75-90	.14	7.4-8.4	Low.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of— Topsoil	Select grading material	Subgrade	Soil features affecting— Highway location	Farm ponds: Reservoir area
Bates: BaB, BaC, BaC2	Fair to poor: easily eroded on steep slopes.	Good	Good if slopes are stabilized.	Lateral internal seepage; depth to rock about 20 to 40 inches.	Depth to rock about 20 to 40 inches.
Bates-Collinsville fine sandy loams: BcC.	Fair to poor: limited quantity; easily eroded.	Good: limited quantity.	Good	Depth to rock about 4 to 30 inches; lateral seepage.	Depth to rock about 4 to 30 inches.
Chastain: Ca	Surface layer good.	Unsuitable: too clayey.	Poor: subsoil highly plastic.	Occasional flooding; moderate to high shrink-swell potential in subsoil.	No limiting features.
Choteau: ChA, ChB, CoB.	Good to fair: large quantity.	Fair to good	Good to fair: requires close moisture control.	Soil unstable when saturated.	No limiting features.
Counts: CuA	Fair to poor: shallow over clay.	Surface layer fair; subsoil too clayey.	Surface layer good; limited quantity.	Moderate to high shrink-swell potential in subsoil.	No limiting features.
Dennis: DeB, DeC, DeC2.	Good	Surface layer fair to poor; subsoil too plastic.	Fair to poor: requires close moisture control; subsoil too clayey.	Plastic clayey subsoil; moderate to high shrink-swell potential.	No limiting features.
Dennis-Dwight complex: DnC3.	Poor: severely eroded.	Unsuitable	Poor: too clayey	Moderate to high shrink-swell potential.	No limiting features.
Dougherty: DoD, DtE (For Eufaula part of DtE, see Eufaula series.)	Poor: too sandy	Good	Good if slopes are stabilized.	Cuts subject to erosion.	Sandy material below a depth of 5 feet; seepage.
Enders-Hector complex: EhE, EhF.	Unsuitable: stony.	Unsuitable: stony.	Fair to poor: 10 to 50 inches over bedrock or clay.	Hilly topography; Hector soils 10 to 20 inches over rock.	10 to 50 inches over bedrock; steep slopes.
Ennis: En	Good	Poor: unstable when wet.	Poor: low density; difficult to compact.	Flood hazard; unstable silty soils.	No limiting features.
Ennis and Verdigris soils: Eo.	Good	Poor: unstable when wet.	Poor: low density; difficult to compact.	Frequent flooding	Frequent flooding; high siltation rate.
Eram: ErC, ErC2	Fair to poor: clay at a depth of 1 foot.	Unsuitable	Poor: unstable when wet.	Moderate to high shrink-swell potential; shale at a depth of 20 to 40 inches.	Depth to shale 20 to 40 inches.
Eufaula: EuB	Unsuitable: too sandy.	Fair: must have binder added.	Good if confined and if slopes are stabilized.	Cuts subject to to erosion.	Very rapid seepage.

See footnote at end of table.

interpretations

Soil features affecting—Continued: Farm ponds—Con.: Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Degree and kind of limitation for septic tank filter fields
No limiting features.	Good drainage	Sloping topography; limited soil depth.	No limiting features.	No limiting features.	Severe: depth to rock about 20 to 40 inches.
Limited borrow material.	Good drainage	Limited soil depth; sloping topography.	Limited soil depth.	Limited soil depth; droughtiness.	Severe: depth to rock about 4 to 30 inches.
Moderate to high shrink-swell potential; dispersed soils in a few areas.	Flood hazard; seasonal high water table; depressed areas.	Very slow permeability; crusting and cracking; occasional flooding.	Level topography	No limiting features.	Severe: very slow permeability; occasional flooding.
Dispersed soils in a few areas.	A few depressed areas.	No limiting features.	No limiting features.	No limiting features.	Severe: moderately slow permeability.
Moderate to high shrink-swell potential.	Mounds in some areas; poor internal drainage.	Very slow permeability.	Mounds in some areas.	No limiting features.	Severe: very slow permeability.
Moderate to high shrink-swell potential.	Good drainage	Slow permeability	No limiting features.	No limiting features.	Severe: slow permeability.
Dispersed soils in a few areas; moderate to high shrink-swell potential.	Nonarable	Nonarable	Nonarable	Vegetation difficult to establish; a few slick spots.	Severe: slow or very slow permeability.
Erosion hazard	Good drainage	High intake rate; limited to sprinkler irrigation.	Sandy texture	Hazard of gully erosion.	Slight.
Limited borrow material.	Nonarable	Nonarable	Nonarable	Stones; 10 to 50 inches over bedrock.	Severe: steep slopes; Hector soils 10 to 20 inches over bedrock.
Difficult to compact	Occasional flooding	Occasional flooding	Nearly level topography.	Nearly level topography.	Severe: occasional flooding.
Variable seepage; stratified.	Nonarable; frequent flooding.	Nonarable	Nonarable	Frequent flooding	Severe: frequent flooding.
Moderate to high shrink-swell potential; limited borrow material.	Good drainage	Slow permeability; sloping topography; depth to bedrock 20 to 40 inches.	No limiting features.	No limiting features.	Severe: slow permeability; depth to shale 20 to 40 inches.
Very rapid seepage; erosion hazard.	Good drainage	Low water-holding capacity; rapid intake rate.	Sandy texture	Severe erosion hazard; droughtiness.	Slight: rapid permeability; water contamination is a hazard.

See footnote at end of table.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Select grading material	Subgrade	Highway location	Farm ponds: Reservoir area
Guin: GuE	Unsuitable: variable material.	Good to poor: variable material.	Good if binder is added.	Steep slopes; springs and seepy areas.	Steep slopes; rapid seepage.
Hartsells: HaB, HaC, HaC2.	Fair to poor: easily eroded.	Good	Good	Lateral internal seepage; depth to rock about 24 to 42 inches.	Depth to rock about 24 to 42 inches.
Hector-Hartsells complex: HhC, HhD3.	Fair to poor: easily eroded; limited quantity.	Good: limited quantity.	Good if slopes are stabilized.	Depth to rock 10 to 30 inches; lateral seepage.	Depth to rock 10 to 30 inches.
Konawa: KoB, KsD3	Fair to poor: easily eroded on steep slopes.	Good	Good if slopes are stabilized.	Cuts subject to erosion.	Sandy material below a depth of 5 feet; seepage.
Mine pits and dumps: Mp.[1]					
Ochlockonee: Oc	Good	Good	Good	Occasional flooding	Possible rapid seepage.
Parsons: PaA, PaB	Poor: shallow surface layer, easily eroded.	Poor: surface layer unstable; subsoil too clayey.	Poor: surface layer unstable when wet; subsoil too clayey.	Highly plastic subsoil; poor internal drainage; high shrink-swell potential in subsoil.	No limiting features.
Parsons-Dwight complex: PdB2.	Poor: clay at a depth of 1 foot.	Poor: surface layer unstable; subsoil too clayey.	Poor: surface layer unstable when wet; subsoil too clayey.	Highly plastic subsoil; poor internal drainage; high shrink-swell potential in subsoil.	Dispersion hazard
Rosebloom: Rs	Good	Poor: unstable when wet.	Fair to poor: difficult to compact.	Occasional flooding; poor surface drainage.	No limiting features.
Stidham: StB	Poor: easily eroded on steep slopes.	Good	Good if slopes are stabilized.	Cuts subject to erosion.	Rapid seepage below a depth of 5 feet.
Summit: SuB	Surface layer good; subsoil too clayey.	Unsuitable: too clayey.	Poor: too plastic	Highly plastic subsoil.	No limiting features.
Talihina-Collinsville complex: TcE.	Poor: stony; depth to bedrock about 4 to 20 inches.	Unsuitable: stony.	Fair to poor: depth to sandstone or shale about 4 to 20 inches.	Depth to sandstone or shale about 4 to 20 inches; moderately steep slopes.	Depth to sandstone or shale about 4 to 20 inches.
Taloka: TkA, TkB	Fair: easily eroded on steep slopes; unsuitable below a depth of 24 inches; too clayey.	Poor: surface layer too elastic; subsoil too clayey.	Poor: surface layer has low density and is difficult to compact; subsoil has high shrink-swell potential.	Perched water table; poor internal drainage; high shrink-swell potential.	No limiting features.

interpretations—Continued

Soil features affecting—Continued					Degree and kind of limitation for septic tank filter fields
Farm ponds—Con. Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	
Rapid seepage	Nonarable	Nonarable	Nonarable	Severe erosion hazard; droughtiness.	Severe: steep slopes; variable material.
No limiting features	Good drainage	Sloping topography; limited soil depth.	No limiting features.	No limiting features	Severe: depth to rock about 24 to 42 inches.
Limited borrow material; erosion hazard.	Good drainage	Sloping topography; limited soil depth; limited water-holding capacity.	Depth to rock 10 to 30 inches.	Limited soil depth; droughtiness.	Severe: depth to rock 10 to 30 inches.
Erosion hazard	Good drainage	Moderate to high intake rate.	Hazard of gully erosion.	Hazard of gully erosion.	Slight.
Possible rapid seepage; erosion hazard.	Good drainage	Occasional flooding	Nearly level topography.	Nearly level topography.	Severe: occasional flooding.
High shrink-swell potential.	Depressed areas; poor internal drainage.	Very slow intake rate.	No limiting features.	Droughtiness; difficult to establish vegetation.	Severe: very slow permeability.
High shrink-swell potential.	Nonarable	Nonarable	Nonarable	Severe erosion hazard; droughtiness.	Severe: very slow permeability.
Low density; difficult to compact.	Occasional flooding; slightly depressed topography.	Very slow intake rate; occasional flooding.	Nearly level topography.	Nearly level topography.	Severe: occasional flooding; slow percolation rate.
Erosion hazard	Good drainage	High intake rate; limited to sprinkler irrigation.	Sandy texture; not applicable.	Sandy texture; erosion hazard.	Slight.
Low shear strength	Good drainage	Low intake rate; sticky when wet.	No limiting features.	No limiting features.	Severe: slow permeability.
Limited borrow material.	Nonarable	Nonarable	Nonarable	Stones; limited soil depth.	Severe: depth to sandstone or shale about 4 to 20 inches.
Low shear strength	Perched water table; very slow permeability; dense clay at a depth of about 24 inches.	Very slow intake rate below a depth of 24 inches.	No limiting features.	No limiting features.	Severe: very slow permeability.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of— Topsoil	Select grading material	Subgrade	Soil features affecting— Highway location	Farm ponds: Reservoir area
Talpa-Rock outcrop complex: TrE.	Poor: limestone at a depth of 2 to 15 inches.	Unsuitable: stony.	Fair to poor: shallow over limestone.	Limited depth to limestone.	Limited depth to limestone.
Vanoss: VaA, VaB	Good	Fair	Good to fair	No limiting features.	No limiting features.
Verdigris: Vg	Good	Poor: too elastic.	Poor: low density; difficult to compact.	Occasional flooding	No limiting features.
Woodson: Wo	Poor: surface layer shallow over clayey subsoil.	Poor: surface layer too elastic; subsoil too clayey.	Poor: surface layer unstable when wet; subsoil too clayey.	Highly plastic subsoil; poor internal drainage; high shrink-swell potential in subsoil.	No limiting features.
Wrightsville: Wr	Fair to poor: surface layer shallow over clay.	Poor: surface layer too elastic; subsoil too clayey.	Poor: surface layer unstable when wet; subsoil too clayey.	Highly plastic subsoil; poor internal drainage; high shrink-swell potential in subsoil.	No limiting features.
Yahola-Norwood complex: Yn.	Good	Fair to good: stratified.	Fair to good: low density; difficult to compact.	Water table at a depth of about 6 feet.	Stratified material; possible seepage.

[1] Widely variable material.

all the soils in the county according to all three systems of classification.

Estimated Properties of the Soils

Estimates of soil properties that are significant in engineering are listed in table 5. These estimates are based on available test data for modal, or typical, profiles. Estimates of properties of soils not tested are based on test data for similar soils in this county and in other counties and on past experience in engineering construction. Since the estimates are for modal soils, considerable variation from the values given in table 5 should be anticipated. More information on the range of properties of the soils and complete profile descriptions are given in the section "Descriptions of the Soils."

The first column in table 5 shows the classification of the soils into four hydrologic soil groups. The entire soil profile is considered, to the greatest depth shown in the column headed "Depth from surface." The soils are classified on the basis of intake of water at the end of a long duration storm that occurs after prior wetting and opportunity for swelling and without the protection of vegetation. Group A consists mostly of sandy soils that have the lowest runoff potential. Group D consists mostly of clays that have the highest runoff potential.

The column headed "Permeability" indicates the rate at which water moves downward through undisturbed soil material. The permeability of the soil is estimated as it occurs in place. The estimates are based on soil structure and porosity. Mechanically developed features, such as plowpans and surface crusts, have not been considered.

The column headed "Available water capacity" gives estimates of the amount of capillary water in soil that is wet to field capacity. If soil moisture is at the wilting point for plants, this amount of water will wet the soil material described to a depth of 1 inch without deeper percolation.

The column headed "Shrink-swell potential" indicates the volume change to be expected of the soil material with a change in moisture content. This potential is based on volume-change tests or on observance of other physical properties or characteristics of the soil. For example, soil material from the A horizon of Summit soils is very sticky when wet and develops extensive shrinkage cracks when dry; hence, it has a high shrink-swell potential. Conversely, material from the A horizon of Eufaula soils is structureless and nonplastic, and it therefore has a low shrink-swell potential.

Interpretations of Engineering Properties

Table 6 lists for each soil in Pittsburg County, interpretations of specific properties that are likely to affect the suitability of the soils for various engineering purposes. These interpretations are based on the information in table 5, on test data, and on field experience and performance.

Normally, only the surface layer of a soil is rated for topsoil. The suitability of this layer depends largely on *interpretations*—Continued

Soil features affecting—Continued					Degree and kind of limitation for septic tank filter fields
Farm ponds—Con. Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	
Limited borrow material.	Nonarable	Nonarable	Nonarable	Stones; limited soil depth.	Severe: shallow over limestone.
No limiting features	Good drainage	No limiting features	No limiting features.	No limiting features	Slight.
Difficult to compact; low density.	No limiting features	No limiting features	Nearly level topography.	No limiting features	Severe: occasional flooding.
High shrink-swell potential.	Depressed areas; poor internal drainage.	Very slow intake rate.	Nearly level topography.	Droughtiness	Severe: very slow permeability.
High shrink-swell potential.	Depressed areas; poor internal drainage.	Very slow intake rate.	Nearly level topography.	Droughtiness; low fertility.	Severe: very slow permeability.
Stratified material; erosion hazard.	Localized wet spots	Variable intake rate	Nearly level topography.	Nearly level topography; flooding.	Severe: flooding.

its texture and depth. Topsoil material must be capable of being worked into a good seedbed for seeding or sodding, yet be clayey enough to resist erosion on steep slopes. The depth of suitable material determines whether or not it is economical or wise to remove it.

The suitability rating for select grading material depends mainly on the grain size and the amount of silt and clay. Soils that are predominantly sand are good if a binder is added for cohesion. Clay soils compress under load and rebound when unloaded; thus, they are rated unsuitable.

Some soils, such as sandy clays and sandy clay loams, offer few problems in placement or compaction. Clays with a high shrink-swell potential require special compaction techniques and close moisture control both during and after construction. Sands compact well but are difficult to confine in a fill. The rating reflects the ease with which these problems can be overcome.

The degree of limitation of the soils for use as septic tank filter fields depends on the percolation rate, permeability, flood hazard, slope, and depth to bedrock or other impervious material. The information given in table 6 applies to isolated systems in rural or rural-fringe areas. Percolation requirements are most restrictive on small urban sites.

Engineering Test Data for Soils

Table 7 contains test data for soil samples collected during the soil survey of the county and tested by the State Highway Department. Samples were collected only from selected soils. Test data for some of the other soils may be found in other published surveys.

Formation and Classification of the Soils

This section describes the major factors of soil formation and tells how these factors have affected the soils of Pittsburg County. It also defines the current classification system and shows the classification of the soils by series and higher categories.

Factors of Soil Formation

Soil forms through the interaction of the five major soil-forming factors—climate, living organisms, parent material, relief, and time. Differences in one or more of these factors result in the formation of different kinds of soils. The five factors of soil formation as they occur in Pittsburg County are described in the paragraphs that follow.

Climate

Pittsburg County has a warm, subhumid, essentially uniform climate. Rainfall has been adequate for leaching the soils and for plant growth. Although climate has influenced soil formation in the county, it is not the chief cause of the wide differences among the soils.

TABLE 7.—*Engineering*

[Tests performed by Oklahoma Department of Highways in accordance with standard

Soil name and location	Parent material	Oklahoma report no. SO–	Depth	Shrinkage		
				Limit	Ratio	Volume change
Choteau loam:			*In.*	*Pct.*		*Pct.*
2,100 feet east and 50 feet north of southwest corner of sec. 15, T. 8 N., R. 14 E.	Old alluvium.	4870	9–18	18	1. 76	18
		4871	30–41	15	1. 85	15
		4872	41–59	14	1. 92	38
		4873	59–78	13	1. 92	37
Dennis loam:						
590 feet west and 150 feet south of northeast corner of sec. 18, T. 3 N., R. 14 E.	Sandstone and siltstone.	4859	0–7	18	1. 78	8
		4860	19–27	11	2. 00	76
		4861	36–60	8	2. 07	59
Enders fine sandy loam:						
1,300 feet west of southeast corner of sec. 13, T. 4 N., R. 14 E.	Shale.	4865	2–4	19	1. 81	3
		4866	9–24	13	1. 87	79
		4867	24–36	12	1. 94	26
Ennis silt loam:						
660 feet west and 700 feet south of northeast corner of sec. 12, T. 7 N., R. 18 E.	Alluvium.	4879	0–9	17	1. 82	7
		4880	9–43	15	1. 87	15
		4881	59–72	15	1. 89	15
Eram clay loam:						
150 feet west and 50 feet north of southeast corner of sec. 4, T. 4 N., R. 14 E.	Shale.	4862	0–12	19	1. 76	11
		4863	12–25	12	1. 92	79
		4864	25–43	10	2. 03	55
Hector fine sandy loam:						
650 feet south and 900 feet west of northeast corner of sec. 6, T. 7 N., R. 16 E.	Sandstone.	4877	0–4	[3] NP	NP	NP
		4878	4–12	NP	NP	NP
Rosebloom silt loam:						
500 feet south and 2,350 feet east of northwest corner of sec. 3, T. 4 N., R. 14 E.	Alluvium.	4853	0–7	19	1. 68	16
		4854	21–36	12	1. 94	22
		4855	47–65	11	1. 98	32
Talihina clay loam:						
400 feet south of center of sec 20, T. 5 N., R. 15 E	Shale.	4868	0–2	14	1. 83	25
		4869	2–9	13	1. 93	39

[1] Mechanical analysis according to AASHO Designation: T 88–57. Results by this procedure may 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

test data

procedures of the American Association of State Highway Officials (AASHO)]

Mechanical analysis [1]									Liquid limit	Plasticity index	Classification	
Percentage passing sieve—						Percentage smaller than—					AASHO	Unified [2]
1-in.	¾-in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.005 mm.	0.002 mm.				
									Pct.			
------	------	------	100	99	83	67	20	17	28	6	A-4(8)	ML-CL
------	------	------	100	99	87	73	28	25	36	16	A-6(10)	CL
------	------	------	100	99	84	70	33	30	46	27	A-7-6(16)	CL
------	------	------	100	99	84	70	35	32	48	30	A-7-6(18)	CL
------	------	------	100	97	74	60	15	12	23	3	A-4(8)	ML
------	------	------	100	98	87	87	52	48	63	32	A-7-5(20)	MH-CH
------	------	------	100	96	83	72	44	40	54	31	A-7-6(19)	CH
100	99	95	93	87	63	55	17	12	19	2	A-4(6)	ML
------	------	------	------	100	97	92	70	62	85	43	A-7-5(20)	MH
------	------	------	100	95	91	90	47	33	40	16	A-6(10)	ML-CL
------	------	------	------	100	85	64	18	13	24	4	A-4(8)	ML-CL
------	------	------	------	100	92	73	24	19	26	6	A-4(8)	ML-CL
------	------	------	------	100	96	85	35	22	28	8	A-4(8)	CL
------	------	100	96	90	72	56	21	15	33	9	A-4(7)	ML-CL
------	------	------	100	98	92	85	62	56	65	30	A-7-5(20)	MH
------	------	------	100	99	93	84	53	44	57	34	A-7-6(19)	CH
------	------	------	100	99	45	30	7	4	NP	NP	A-4(2)	SM
------	------	------	100	99	32	17	4	1	NP	NP	A-2-3(0)	SM
------	------	------	100	99	87	79	23	17	29	5	A-4(8)	ML-CL
------	------	------	100	99	87	80	37	30	33	16	A-6(10)	CL
------	------	------	100	99	76	65	30	27	33	16	A-6(10)	CL
------	------	------	100	94	85	78	38	29	35	9	A-4(8)	ML-CL
------	------	------	100	99	97	93	60	46	53	23	A-7-5(16)	MH-CH

than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analysis data used in this table are not suitable for naming textural classes for soils.

[2] SCS and BPR have agreed to consider that all soils having plasticity indexes within 2 points of the A-line are to be given a borderline classification. Examples of borderline classification obtained by this use are ML-CL and MH-CH.

[3] NP=Nonplastic.

Living organisms

Plants, animals, insects, bacteria, and fungi are important in the formation of soils. The addition of plant and animal residues and their decomposition by microorganisms increase the supply of plant nutrients and organic matter and change the structure, porosity, and color of the soils.

Vegetation has affected soil formation in Pittsburg County more than other living organisms have. Soils that formed under prairie vegetation, Dennis soils, for example, are moderately high in organic-matter content and have a dark-colored surface layer. Soils that formed under forest vegetation, Stidham soils, for example, are low in organic-matter content and have a light-colored surface layer.

Parent material

Parent material is the unconsolidated material from which the soil forms. It determines the limits of the chemical and mineralogical composition of the soil. It also influences the texture and color of the soil and the rate of soil development.

There are many kinds of parent material in Pittsburg County. The surface rocks are mostly Pennsylvanian in age. Some of the major formations are the Boggy, Savanna, Thurman, McAlester, Atoka, and Jackfork. The Jackfork formation is Mississippian in age. These formations are predominantly interbedded sandstone and shale. Hector and Hartsells soils are examples of soils derived from sandstone. Enders soils are derived from shale.

The alluvium of the county is of Pleistocene and Recent origin. Stidham, Dougherty, and Eufaula soils are among those that formed in Pleistocene deposits. Yahola and Norwood soils formed in recent alluvium.

Relief

Relief affects soil formation through its influence on drainage, erosion, plant cover, and soil temperature. The relief of Pittsburg County ranges from level to very steep. The shallow Hector soils and the moderately deep Enders soils occupy the areas of steepest relief in the county. Deep, strongly developed soils, such as Parsons soils, occur on nearly level areas.

Time

A long time is required for the formation of soils that have distinct horizons. The soils in Pittsburg County range from young soils that have little or no development to older soils that have somewhat pronounced development. Parsons and Wrightsville soils are examples of older soils; they have well-developed horizons. The Yahola soil is an example of a young soil; it is deep but has little horizon development.

Representative Soil Horizons

The basic processes involved in the formation of soil horizons, or layers, are the accumulation of organic matter, the leaching of calcium carbonate and bases, the reduction and transfer of iron, and the formation and translocation of silicate clay minerals. These processes have been active in varying degrees in the development of the soils in Pittsburg County. Some of the properties in which horizons differ are color, texture, structure, consistence, organic-matter content, and thickness.

Old, or mature, soils have three major horizons, designated as A, B, and C. Subdivisions of these horizons are based on minor differences.

The A horizon is the surface layer. Many soils in Pittsburg County have A1 and A2 horizons. The A1 horizon is the uppermost part of the surface layer in which there is an accumulation of organic matter. The A2 horizon is immediately below the A1 horizon. It is lighter in color and is strongly leached of bases.

The B horizon, commonly called the subsoil, is immediately below the A horizon. This is the horizon of maximum silicate clay accumulation. Parsons soils, for example, have prominent A1, A2, and B horizons.

The C horizon is below the B horizon. It is little affected by soil-forming processes, but it may be modified by weathering, iron reduction, calcium carbonate accumulation, or cementation.

Some soils, Hector soils, for example, are underlain by unconsolidated bedrock. This layer is designated as the R horizon.

Classification of the Soils

Classification consists of an orderly grouping of soils according to a system designed to make it easier to remember soil characteristics and interrelationships. Classification is useful in organizing and applying the results of experience and research. Soils are placed in narrow classes for discussion in detailed soil surveys and for application of knowledge within farms and fields. The many thousands of narrow classes are then grouped into progressively fewer and broader classes in successively higher categories, so that information can be applied to large geographic areas.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*2*) and revised later (*4*). The system currently used by the National Cooperative Soil Survey was adopted in 1965 (*6*). It is under continual study. Readers interested in the development of the system should refer to the latest literature available (*3*).

The current system of classification has six categories. Beginning with the most inclusive, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. The criteria for classification are soil properties that are observable or measurable, but the properties are selected so that soils of similar genesis are grouped together. The placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

Table 8 shows the classification of each soil series of Pittsburg County by family, subgroup, and order, according to the current system.

Order.—Ten soil orders are recognized in the current system. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. Two exceptions are Entisols and Histosols, which occur in many different climates.

TABLE 8.—*Soil series classified according to the current system of classification*

Series	Family	Subgroup	Order
Bates	Fine-loamy, siliceous, thermic	Typic Argiudolls	Mollisols.
Chastain	Fine, kaolinitic, acid, thermic	Fluventic Haplaquepts	Inceptisols.
Choteau	Fine, mixed, thermic	Aquic Paleudolls	Mollisols.
Collinsville	Loamy, siliceous, thermic	Lithic Hapludolls	Mollisols.
Counts	Fine, mixed, thermic	Albaquic Paleudalfs	Alfisols.
Dennis	Fine, mixed, thermic	Aquic Paleudolls	Mollisols.
Dougherty	Loamy, mixed, thermic	Arenic Haplustalfs	Alfisols.
Dwight	Fine, mixed, mesic	Typic Natrustalfs	Alfisols.
Enders	Clayey, mixed, thermic	Typic Hapludults	Ultisols.
Ennis	Fine-loamy, siliceous, thermic	Fluventic Dystrochrepts	Inceptisols.
Eram	Fine, mixed, thermic	Mollic Hapludalfs	Alfisols.
Eufaula	Sandy, siliceous, thermic	Psammetic Paleustalfs	Alfisols.
Guin	Sandy-skeletal, siliceous, thermic	Typic Dystrochrepts	Inceptisols.
Hartsells	Fine-loamy, siliceous, thermic	Typic Hapludults	Ultisols.
Hector	Loamy, siliceous, thermic	Lithic Dystrochrepts	Inceptisols.
Konawa	Fine-loamy, mixed, thermic	Ultic Haplustalfs	Alfisols.
Norwood	Fine-silty, mixed, calcareous, thermic	Typic Udifluvents	Entisols.
Ochlockonee	Coarse-loamy, siliceous, acid, thermic	Typic Udifluvents	Entisols.
Parsons	Fine, mixed, thermic	Mollic Albaqualfs	Alfisols.
Rosebloom	Fine-silty, mixed, acid, thermic	Fluventic Haplaquepts	Inceptisols.
Stidham	Loamy, mixed, thermic	Arenic Ultic Paleustalfs	Alfisols.
Summit	Fine, mixed, thermic	Vertic Argiudolls	Mollisols.
Talihina	Clayey, mixed, thermic, shallow	Typic Hapludolls	Mollisols.
Taloka	Fine, mixed, thermic	Mollic Albaqualfs	Alfisols.
Talpa	Loamy, mixed, thermic	Lithic Haplustolls	Mollisols.
Vanoss	Fine-silty, mixed, thermic	Udic Argiustolls	Mollisols.
Verdigris	Fine-silty, mixed, thermic	Cumulic Hapludolls	Mollisols.
Woodson	Fine, mixed, noncalcareous, thermic	Abruptic Argiaquolls	Mollisols.
Wrightsville	Fine, mixed, thermic	Typic Glossaqualfs	Alfisols.
Yahola	Coarse-loamy, mixed, calcareous, thermic	Typic Ustifluvents	Entisols.

Five of the soil orders are recognized in Pittsburg County. They are Entisols, Inceptisols, Mollisols, Alfisols, and Ultisols. Entisols are recent mineral soils that either lack genetic horizons or have only the beginnings of such horizons. Inceptisols generally form on young but not recent land surfaces. They have weak genetic horizons of alteration of parent material but not of accumulation. Mollisols have a nearly black, organic-rich surface layer and high base supply. Alfisols have an argillic horizon in which base saturation is more than 35 percent. Ultisols have an argillic horizon in which base saturation is less than 35 percent.

Suborder.—Each order is divided into suborders, primarily on the basis of soil characteristics that produce classes having genetic similarity. A suborder has a narrower climatic range than an order has. The criteria for suborders reflect either the presence or absence of waterlogging or differences in climate or vegetation.

Great Group.—Each suborder is divided into great groups on the basis of uniformity in the kind and sequence of genetic horizons. The horizons used to make separations are those in which clay, iron, or humus has accumulated or those in which pans interfere with growth of roots or movement of water.

Subgroup.—Each great group is divided into subgroups, one representing the central (typic) segment of the group, and others, called intergrades, made up of soils that have mostly properties of one great group but also one or more properties of another great group.

Family.—Families are established within each subgroup, primarily on the basis of properties important to plant growth. Some of these properties are texture, mineralogy, reaction, soil temperature, permeability, consistence, and thickness of horizons.

Series.—The series has the narrowest range of characteristics of the categories in the classification system. It is explained in the section "How This Survey Was Made."

A detailed description of each soil series represented in Pittsburg County is given in the section "Descriptions of the Soils."

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Glossary

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Horizon, soil. A layer of soil, approximately parallel to the surface that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon of the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger color than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid, and very rapid.*

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Relief. The elevations or inequalities of a land surface, considered collectively.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay. (See also Texture, soil.)

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

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 primary soil particles. The principal forms of soil structure 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 together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

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