SOIL SURVEY OF

Anderson County, Kansas

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Kansas Agricultural Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States De-

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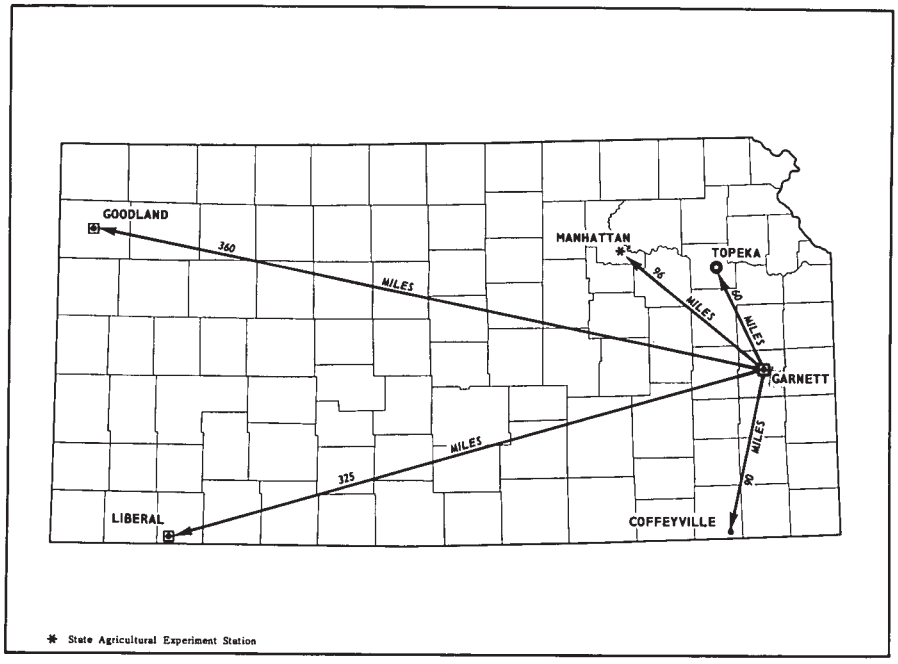


Location of Anderson County in Kansas.

SOIL SURVEY OF ANDERSON COUNTY, KANSAS

By Kenneth H. Sallee, Soil Conservation Service[1]

United States Department of Agriculture, Soil Conservation Service, in cooperation with Kansas Agricultural Experiment Station

ANDERSON COUNTY, in the east-central part of Kansas (see facing page), covers a total area of 577 square miles, or about 369,024 acres. Garnett, in the north-central part of the county, is the county seat. The elevation is about 1,090 feet. In 1970, the population of Anderson County was 8,501. About 60 percent was rural.

Farming is an important enterprise in the county. Soybeans, grain sorghum, corn, wheat, and alfalfa are the main crops. Beef cattle are the main livestock. Some milk cows are kept for dairy products. Raising swine, sheep, and poultry is also important.

Anderson County is in the Osage Plain section of the Central Lowlands physiographic province. The landscape is one of gently rolling prairies, low hills, and well defined drainage patterns. Along the northwest edge of the county are rolling hills of Eram and Summit soils. These hills are capped by limestone bedrock and underlain by interbedded sandstone and shale. To the east of these hills, from along the northern border of the county to the southwest corner, is a nearly level and gently sloping old alluvial plain that is dissected by upland streams. Woodson and Kenoma soils are the main soils. Isolated low hills are common. The south-central part of the county is gently undulating uplands of old alluvium overlying limestone and shale. Kenoma soils are the main soils. Gravelly knolls occupied by Olpe soils are common.

The northeastern and eastern parts of the county are gently sloping to rolling uplands. Steep and broken slopes along drainageways and ridges are common throughout these areas. Catoosa and Clareson soils are in the higher areas and are underlain by limestone bedrock. Outcrops of limestone are common. Eram and Talihina soils are in the steeper areas and Summit and Dennis soils are on the gentle side slopes. The valleys of the major drainageways are occupied by Lanton, Verdigris, and Mason soils.

The main streams in the county are Pottawatomie Creek, into Allen County to join the Neosho River. Sugar Creek and its tributaries drain the eastern part of the county and flow east into Linn County. The Little Osage River drains the southeastern corner of the county.

The lowest point in the county, about 860 feet above sea level, is where Pottawatomie Creek leaves the county north of Greeley. The highest points, about 1,210 feet, are in the gravelly area north and west of Kincaid and between Garnett and Bush City. Most of the county is at an elevation between 1,000 and 1,100 feet. The greatest difference in local relief, about 200 to 300 feet, is along Cedar Creek and Pottawatomie Creek, near Garnett. Here the valley floors are bounded by steep bluffs that have rock escarpments in many places.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Anderson 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. They observed the steepness, length, and shape of slopes, the size and nature 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.

Soils that have profiles alike, or almost alike, make up a

ences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Eram silty clay loam, 1 to 4 percent slopes, is one of several phases within the Eram 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 woodland, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. Or- most maps detailed enough to be useful in planning the

that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in the survey area. A soil association is a landscape that has a distinctive pattern of soils in defined proportions. It typically consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in an association can occur in other associa-

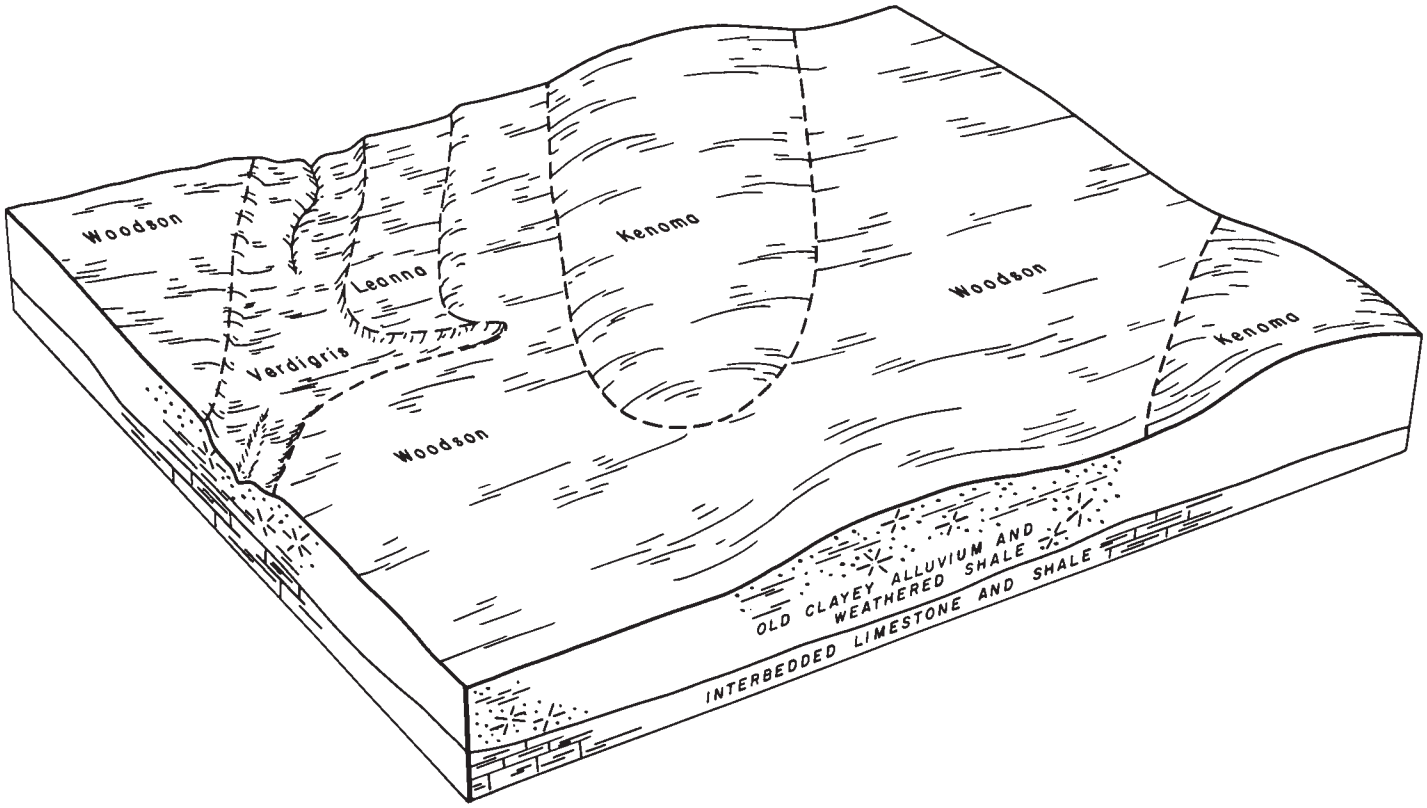


Figure 1.—**Pattern of soils in association 1.**

ways, contour farming, and close-sown crops help control erosion. Proper range use is necessary to maintain native grasses.

2. *Eram-Summit-Collinsville association*

Deep to shallow, gently sloping to strongly sloping, moderately well drained to somewhat excessively drained soils of the uplands

The landscape of this association is one of gently undulating to rolling uplands. The soils are dominantly gently sloping to strongly sloping. They are steep, however, in a few places along drainageways and on side slopes of ridges.

This association makes up about 10 percent of the county. It is about 25 percent Eram soils (fig. 2), 20 percent Summit soils, 15 percent Collinsville soils, and 40 percent minor soils.

Eram soils, on summits of ridges and on side slopes, are gently sloping to strongly sloping. They are moderately well drained, moderately deep over shale, and slowly permeable. The surface layer typically is very dark brown light silty clay loam about 9 inches thick. The subsoil is very dark grayish brown, brown, and gray silty clay loam and clay loam. It is underlain by dark grayish brown and yellowish brown silty and sandy shale at a depth of about 33 inches.

Summit soils, on the lower side slopes of ridges, are gently sloping and sloping. They are deep, moderately well drained, and slowly permeable. The surface layer typically is black silty clay loam about 8 inches thick. The subsoil is black, very dark grayish brown, and dark gray silty clay. It is underlain by gray silty clay at a depth of 47 inches.

Collinsville soils, on the summits and side slopes of ridges, are gently sloping to strongly sloping. They are shallow over sandstone and sandy shale, well drained to somewhat excessively drained, and moderately rapidly permeable. The surface layer typically is very dark grayish brown loam about 6 inches thick. The subsoil is dark brown channery loam. It is underlain by interbedded sandstone and sandy shale at a depth of about 11 inches.

Minor in this association are Catoosa, Lula, Clareson, Dennis, Okemah, Kenoma, Talihina, Mason, and Verdigris soils. Catoosa, Lula, and Clareson soils are on ridgetops and in gently undulating areas underlain by limestone. Dennis and Okemah soils are on gentle foot slopes. Kenoma soils are on some ridge summits. Talihina soils, which are shallow over shale, are on steep sides of ridges. Mason and Verdigris soils are along and in drainageways.

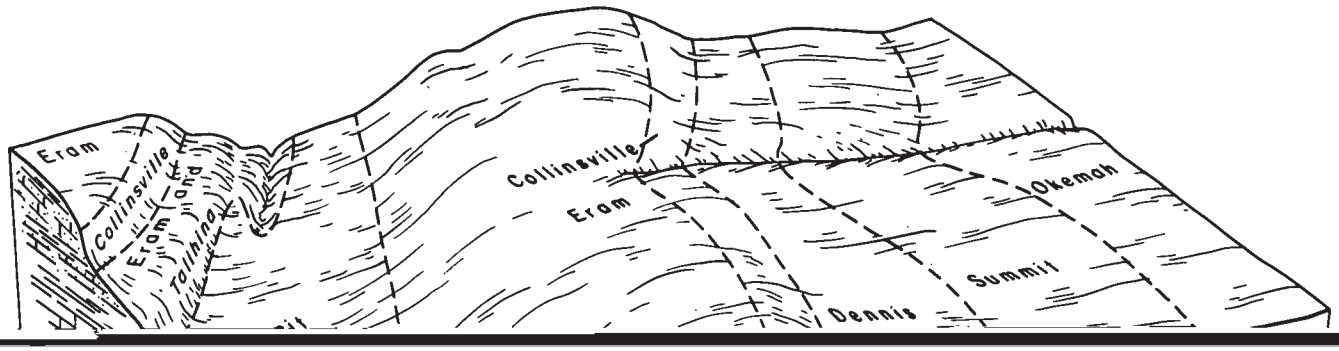
Most of the strongly sloping areas are used for native range and tame pasture. The gently sloping areas are in soybeans, wheat, and grain sorghum. Water erosion is the dominant hazard. Terraces, waterways, contour farming, and close sown crops help control erosion. Proper range use is necessary to maintain native grasses.

3. *Catoosa-Eram-Clareson association*

Moderately deep, nearly level to strongly sloping, well drained and moderately well drained soils of the uplands

The landscape of this association is one of gently undulating and rolling uplands dissected by deeply entrenched drainageways. The soils are nearly level to strongly sloping.

This association makes up about 32 percent of the county. It is about 16 percent Catoosa soils, 12 percent Eram soils, 12 percent Clareson soils, and 60 percent minor soils.


Eram
Collinsville
Eram
Tallinda
Collinsville
Eram
Okemah
Summit
Dennis

to strongly sloping. They are deep, well drained, and slowly or very slowly permeable. The surface layer typically is dark brown gravelly silt loam about 10 inches thick. The subsoil is dark brown to reddish brown gravelly silty clay loam, clay loam, and silty clay that extends to a depth of 60 inches or

5. *Verdigris-Lanton-Leanna association*

Deep, nearly level, moderately well drained to poorly drained soils of the bottom land

This soil association is in the valleys of the larger streams.

Leanna soils, on low stream terraces, have slopes of less than 1 percent. They are somewhat poorly drained and very slowly permeable. The surface layer typically is very dark gray silty loam about 11 inches thick. The subsurface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is very dark gray and dark gray silty clay. The substratum, at a depth of 56 inches, is gray silty clay.

Minor in this association are Mason, Osage, Welda, Summit, and Woodson soils. Mason and Welda soils are on high, seldom flooded stream terraces. Osage soils are on low, wet bottom land. Adjoining the bottom land soils in places are the gently sloping Summit and nearly level and gently sloping Woodson soils on foot slopes of the uplands.

This association is used for both crops and native range. The soils are well-suited to crops. Corn, grain sorghum, soy

mapping can be obtained from the Soil Survey Manual (*15*).[2]

Catoosa Series

The Catoosa series consists of moderately deep, nearly level and gently sloping, well drained soils of the uplands. These soils formed in material weathered from limestone. They commonly are on convex ridgetops and gently undulating uplands. Native vegetation is tall prairie grasses.

In a representative profile the surface layer is very dark brown silt loam about 8 inches thick. The subsoil is about 20 inches thick. The upper 15 inches is dark reddish brown, friable silty clay loam, and the lower 5 inches very dusky

Soil	Area	Extent	Soil	Area	Extent
	Acres	*Percent*		*Acres*	*Percent*
Catoosa silt loam, 0 to 3 percent slopes	28,090	7.6	Mayes silty clay loam	4,260	1.1
Clareson complex, 1 to 4 percent slopes	22,060	6.0	Okemah silt loam, 0 to 2 percent slopes	3,510	1.0
Collinsville complex, 2 to 15 percent slopes	3,290	.9	Olpe gravelly silt loam, 3 to 15 percent slopes	7,020	1.9
Dennis silt loam, 1 to 4 percent slopes	5,820	1.6	Osage silty clay loam	4,830	1.3
Dennis silty clay loam, 1 to 4 percent slopes, eroded	1,180	.3	Stony land-Talihina complex, steep	7,470	2.0
Eram silty clay loam, 1 to 4 percent slopes	5,040	1.4	Summit silty clay loam, 1 to 4 percent slopes	13,940	3.8
Eram silty clay loam, 4 to 7 percent slopes	3,230	.9	Summit silty clay loam, 4 to 7 percent slopes	5,320	1.4
Eram soils, 1 to 4 percent slopes, eroded	1,620	.4	Summit soils, 1 to 4 percent slopes, eroded	2,310	1.0
Eram soils, 4 to 7 percent slopes, eroded	2,520	.7	Summit-Eram complex, 4 to 7 percent slopes, eroded	2,230	1.0
			Verdigris silt loam, occasionally flooded	9,060	2.4

high percentage of flaggy limestone fragments, whereas Catoosa and Lula soils have none to few of these fragments.

Cc—Clareson complex, 1 to 4 percent slopes. This mapping unit is mainly on the crests of ridgetops and on outer edges of limestone areas. It is about 60 percent Clareson soils, 10 percent Catoosa soils, 10 percent outcrops of limestone, 5 percent soils very shallow over limestone, 5 percent soils that are similar to Catoosa soils but have limestone at a depth of between 10 and 20 inches, and 10 percent sloping Talihina soils. The areas are 5 to 400 acres in size and irregular in shape. The Clareson soil has a surface layer that is dominantly flaggy silty clay loam. Included in mapping and shown by a spot symbol are small depressions.

Collinsville soils are near Dennis, Eram, and Talihina soils. They are underlain by sandstone and sandy shale, whereas Talihina soils are underlain by silty and clayey shales. They are not so deep as Dennis and Eram soils.

Cd—Collinsville complex, 2 to 15 percent slopes. This mapping unit is on the summit and upper slopes of ridges and high knolls. It is about 65 percent Collinsville soils, 20 percent a soil that is similar to Collinsville soils but is 20 to 26 inches deep over sandstone, and 15 percent mostly Talihina, Eram, Dennis, and Summit soils.

Most of this unit is used for native range and meadow. Runoff is medium to rapid. Because of the slope and the hazard of erosion, the soils generally are not suited to cultivated crops. They are better suited to native

roots; few pores; few fine and medium black concretions; few fine shale fragments; medium acid; gradual smooth boundary.
B23t—34 to 47 inches; coarsely mottled strong brown (7.5YR 5/6) and grayish brown (10YR 5/2) light silty clay, reddish yellow

Eram Series

The Eram series consists of gently sloping to strongly

areas of limestone bedrock, and Summit and Dennis soils on lower slopes.

About half the acreage has been cultivated, of which part is tame pasture. The other half is native range. This soil is suited to all crops commonly grown in the county. Runoff is medium. Water erosion is a hazard.

A cropping system that conserves soil and water, residue

long and narrow in shape and between 10 and 60 acres in size. So much of the original surface layer has been removed by erosion that ordinary tillage has mixed subsoil material with the remaining surface layer. The texture of the surface layer is silty clay loam, clay loam, or silty clay. In most areas a few shallow gullies and gully scars are evident. In some of the more severely eroded areas shale material is exposed at

soils is moderately eroded and 20 percent is severely eroded. Most areas are alternating gullies and areas of identifiable soils. The gullies range from a few feet to 15 feet in width and from a few feet to 10 feet in depth. A few areas are broad, gently sloping, and severely eroded, but have only a few gullies.

Areas of this mapping unit are so severely eroded that they no longer are suitable for cultivation. Gullied and sev-

and added run-in water from surrounding sloping soils, these soils are not well suited to crops. These areas are well suited to wildlife habitat.

The main management needs are practices that control runoff and erosion and maintain or improve tilth and fertility. A cropping system that conserves soil and water and uses close-sown crops is necessary for controlling erosion. Minimum tillage and crop-residue management are helpful

firm when moist; few fine roots; few very fine pores; thin distinct clay films; black concretions (oxides); few fine chert fragments; neutral; gradual irregular boundary.

B3—26 to 38 inches; dark yellowish brown (10YR 4/4) silty clay, yellowish brown (10YR 5/6) when dry; common very fine faint yellowish brown (10YR 5/4) mottles; weak very fine subangular blocky structure; very hard when dry, firm when moist; few fine roots; black concretions; moderately alkaline; diffuse boundary.

C1—38 to 56 inches; brown (7.5YR 4/4) silty clay; common fine faint yellowish brown (10YR 5/4) mottles; massive; very

grayish brown silty clay loam about 17 inches thick. The subsoil extends to a depth greater than 60 inches. It is mottled, very dark gray silty clay loam. It is friable to a depth of 31 inches and firm below.

Lanton soils have moderately slow permeability, high available water capacity, and high natural fertility. Crops respond to additions of fertilizer and in some areas to additions of lime.

Lanton soils are used mainly for crops. Corn, grain sorghum, and soybeans are the main crops. A few areas are used for range and tame pasture, and a few areas remain wooded with deciduous trees.

Representative profile of Lanton silty clay loam in cropland; 2,800 feet east and 650 feet south of the northwest corner of sec. 5, T. 20 S., R. 20 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) when dry; weak fine and moderate medium granular structure; hard when dry, friable when moist; few roots; neutral; clear boundary.

A12—9 to 17 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) when dry; moderate medium subangular blocky structure; hard when dry, friable when moist; few fine roots; many fine pores; few worm casts; neutral; clear wavy boundary.

B21g—17 to 31 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) when dry; few fine faint dark grayish brown (10YR 4/2) and brown (10YR 4/3) mottles; moderate

drainage is practical in some local areas. Fertilization is beneficial in areas of tame grasses. Wood crop yields can be increased by thinning stands, selective cutting, controlling grazing, and preventing fires. Capability unit IIw–1; Loamy Lowland range site; woodland suitability group 3w.

Leanna Series

The Leanna series consists of deep, nearly level, somewhat poorly drained soils. These soils formed in clayey alluvium. They are on low stream terraces and are subject to occasional flooding. The native vegetation is tall prairie grasses interspersed with hardwood trees.

In a representative profile the surface layer is very dark gray silt loam about 11 inches thick. The subsurface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is very firm silty clay about 39 inches thick. It is very dark gray in the upper part and dark gray in the lower part. The substratum is gray silty clay.

Leanna soils have very slow permeability, moderate available water capacity, and medium to high fertility.

Leanna soils are used mainly for crops, but some large areas are in native range, and a few areas are wooded.

Representative profile of Leanna silt loam in native grass; 700 feet south and 100 feet east of the northwest corner of

Managing residue and maintaining fertility and tilth are Areas are between 20 and 600 acres in size and are irregular

B31—38 to 54 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) when dry; many fine distinct strong brown (7.5YR 5/6) mottles; very dark brown staining along pore channels; weak medium prismatic structure parting to weak fine and medium granular; very hard when dry, firm when moist; few roots; many pores; few worm casts; slightly acid; diffuse boundary.

B32—54 to 65 inches; brown (10YR 4/3) silty clay loam, pale brown (10YR 6/3) when dry; common medium distinct [illegible] mottles; dark gray staining [illegible] fine black concretions; neutral to mildly alkaline; diffuse irregular boundary.

B3g—41 to 64 inches; black (5Y 2/1) silty clay, very dark gray (5Y 3/1) when dry; common fine distinct dark yellowish brown (10YR 4/4) mottles; black (10YR 2/1) vertical streaks; weak fine blocky structure; extremely hard when dry, extremely firm when moist; few very fine roots; few fine black and brown concretions; mildly alkaline.

The A horizon is 7 to 16 inches thick and is black to very dark

ture; hard when dry, friable when moist; many roots; many fine pores; medium acid; gradual smooth boundary.

B21t—13 to 22 inches; very dark gray (10YR 3/1) heavy silty clay loam, dark gray (10YR 4/1) when dry; few fine distinct brown (10YR 5/3) and dark brown (10YR 3/3) mottles; moderate coarse subangular blocky structure parting to moderate medium blocky; very hard when dry, firm when moist; many roots; many fine pores; thin discontinuous clay films; few fine brown concretions; slightly acid; gradual smooth boundary.

B22t—22 to 31 inches; dark grayish brown (10YR 4/2) silty clay, grayish brown (10YR 5/2) when dry; common fine distinct dark yellowish brown (10YR 5/6) mottles and common medium prominent yellowish red (5YR 5/6) mottles; vertical fillings of very dark gray (10YR 3/1) silty clay loam; moderate medium subangular blocky and fine blocky structure; very hard when dry, firm when moist; many roots; few pores; continuous clay films; few fine black and brown concretions; neutral; gradual smoothy boundary.

B23t—31 to 39 inches; dark grayish brown (10YR 4/2) silty clay, grayish brown (10YR 5/2) when dry; many coarse strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) mottles; vertical fillings of very dark gray (10YR 3/1); moderate coarse subangular blocky structure; very hard when dry, firm when moist; few roots; thick continuous clay films; many black and brown concretions; mildly alkaline; gradual wavy boundary.

B31g—39 to 47 inches; coarsely mottled gray (10YR 5/1), dark gray (N 4/0), gray (N 5/0), grayish brown (10YR 5/2), and yellowish brown (10YR 5/6) silty clay; vertical fillings of very dark gray (10YR 3/1); moderate medium prismatic structure parting to moderate fine subangular blocky; very hard when dry, firm when moist; slickensides; calcium carbonate concretions; moderately alkaline; gradual wavy boundary.

B32g—47 to 60 inches; coarsely mottled gray (10YR 5/1), yellowish brown (10YR 5/6 and 5/8), and light gray (10YR 7/1) light silty clay; vertical fillings of very dark gray (10YR 3/1); massive; hard when dry, firm when moist; slickensides; calcium carbonate concretions; moderately alkaline.

The A horizon is 9 to 20 inches thick and is very dark gray, black, or very dark brown.

Okemah soils are near Dennis, Eram, Summit, and Woodson soils. They have a grayish B2t horizon, whereas Dennis soils have a brownish B2t horizon. They are deeper than Eram soils and less clayey above a depth of 10 inches than Summit soils. They do not have the change in texture between the A and B horizons of Woodson soils.

Ok—Okemah silt loam, 0 to 2 percent slopes. This soil is on foot slopes along drainageways in the uplands. Areas are between 10 and 150 acres in size. Included with this soil in mapping are about 30 percent Summit, Woodson, and Dennis soils and about 5 percent small areas of Eram, Lula, and Catoosa soils.

Some of the acreage is cultivated. Many areas in native range are included with larger areas of soils that are unsuited to cultivation. Runoff is slow to medium. This soil is well suited to all crops commonly grown and is among the best soils for farming in the county.

About the only conservation practices needed are those that maintain tilth and fertility. Diversion terraces are needed to divert run-in water from higher sloping soils. Although terraces may not be necessary, they will reduce runoff and possible erosion. Regulation of grazing and control of weeds and brush are needed to maintain a desirable stand of native grasses. Capability unit I–1; Loamy Upland range site; not assigned to a woodland suitability group.

Olpe Series

The Olpe series consists of deep, sloping to strongly sloping, well drained soils of the uplands. These soils are on the tops of ridges and knolls in the rolling and hummocky uplands. They formed in old loamy and clayey alluvial sediment that had a high content of waterworn (rounded) chert gravel (fig. 6). The native vegetation is tall prairie grasses.

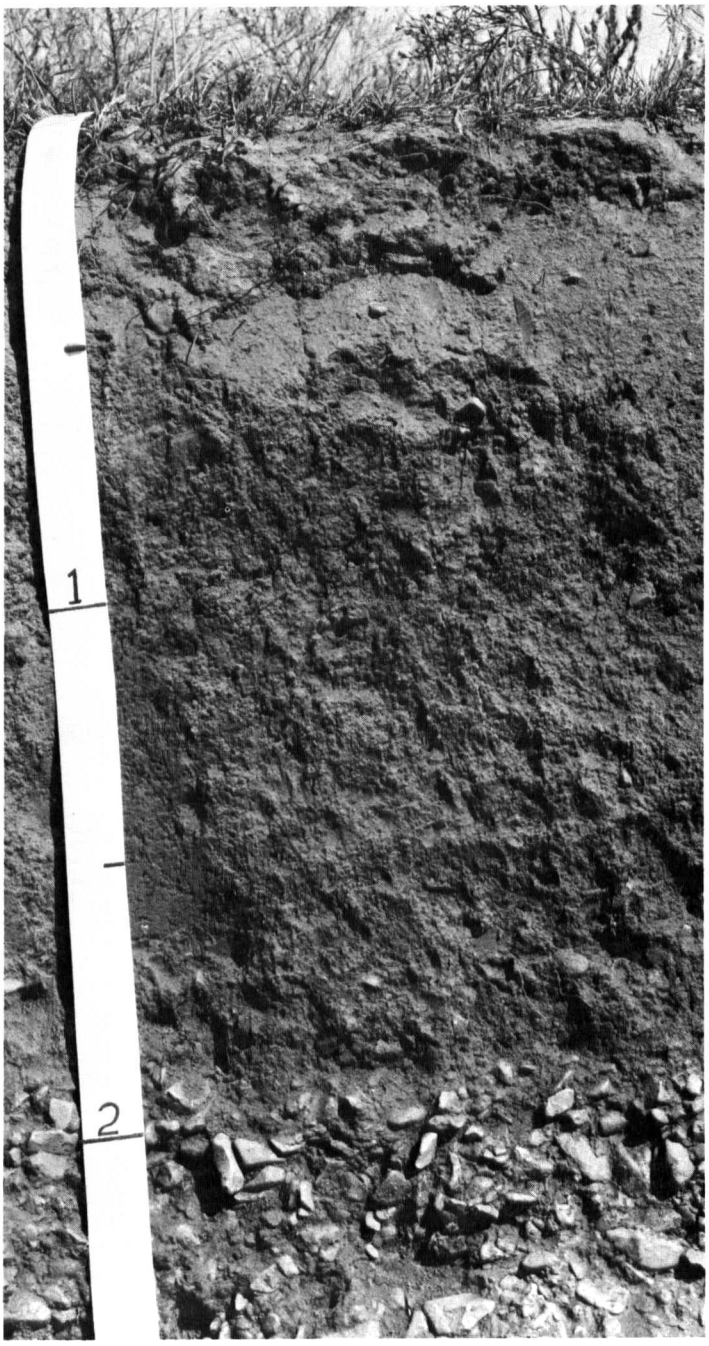


Figure 6.—**Profile of Olpe gravelly silt loam showing the very gravelly subsoil.**

In a representative profile the surface layer is dark brown gravelly silt loam about 10 inches thick. The subsoil extends to a depth of 70 inches. It is dark brown, friable gravelly silty clay loam in the upper 6 inches; dark reddish brown, friable very gravelly clay loam in the next 18 inches; mottled reddish brown, firm very gravelly silty clay in the next 26 inches; and red, very firm silty clay in the lower 10 inches.

Olpe soils have slow or very slow permeability, low avail-

able water capacity, and low fertility. Crops respond to additions of fertilizer and lime.

Olpe soils are used mainly for range and native meadow. Only a small part of the acreage is used for crops. Small areas of Olpe soils occur in fields with other soils. Many areas have been mined for road surfacing material.

Representative profile of Olpe gravelly silt loam, 3 to 15 [illegible] slopes, in native meadow; 2,000 feet south and 90 [illegible]

alluvial sediment. The native vegetation is tall grasses and bottom land hardwoods.

In a representative profile the surface layer is very dark brown silty clay loam about 13 inches thick. The subsoil extends to a depth of 64 inches. It is mottled very dark gray, firm and very firm silty clay to a depth of 56 inches and mottled very dark grayish brown, very firm silty clay below that.

the water table fluctuates to the surface during prolonged wet periods.

Diversion terraces are needed to control run-in water in areas near the uplands that stay wet from the runoff from the adjacent uplands. This soil is not easily worked. It is sticky and plastic if worked when too wet and is very hard if worked when too dry. If this soil is cultivated, adequate drainage is needed. Wetness is the main limitation. Managing crop residue and maintaining soil tilth and fertility are [illegible] fertilization benefits tame grasses. Yields of

dark grayish brown, very firm silty clay in the next 14 inches; and dark gray, firm silty clay in the lower 9 inches. The substratum is gray silty clay to a depth of 69 inches.

Summit soils have slow permeability, moderate available water capacity, and high fertility. Crops respond well to additions of lime and fertilizer.

About 60 percent of the acreage of Summit soils is cultivated, and most of the rest is in range or pasture. A few areas are wooded.

Representative profile of Summit silty clay loam, 1 to 4

wood crops can be increased by thinning stands, selective cutting, controlling grazing, and preventing fires. Capability unit IIw–2; Clay Lowland range site; woodland suitability group 4w.

Stony Land

percent slopes, in tame pasture; 2,400 feet south and 100 feet east of the northwest corner of sec. 24, T. 20 S., R. 20 E.

Ap—0 to 8 inches; black (10YR 2/1) heavy silt clay loam, dark gray (10YR 4/1) when dry; moderate medium subangular blocky structure; hard when dry, firm when moist; few roots; few pores; slightly acid; gradual smooth boundary.

B1—8 to 12 inches; black (10YR 2/1) light silty clay, very dark [illegible]

Sh—Summit silty clay loam, 4 to 7 percent slopes. This soil is on convex hillsides. Included in mapping are small areas of Okemah, Dennis, and Eram soils and small areas of Clareson soils that have outcrops of limestone.

This soil is used for crops and native range. A few areas are wooded. This soil is suited to all uses. Runoff is rapid. Water erosion is a severe hazard.

A cropping system that conserves soil and water, crop-residue management, minimum tillage, terracing, and contour farming help to control erosion. Also needed are practices that improve tilth and fertility. Proper range use and control of trees and brush are essential for good range management. Proper fertilization is beneficial to tame grasses. Yields of wood crops can be increased by thinning stands, selective cutting, controlling grazing, and preventing fires. Capability unit IIIe–2; Loamy Upland range site; not assigned to a woodland suitability group.

Sk—Summit soils, 1 to 4 percent slopes, eroded. These soils commonly occur on lower side slopes. So much of the original surface soil has been removed by erosion that ordinary tillage has mixed subsoil material with the remaining surface layer. In most areas shallow gullies and gully scars are evident. About 30 percent of the acreage is moderately eroded, and about 20 percent is severely eroded. The surface layer of most areas is about 65 percent silty clay loam and 35 percent silty clay. Included with this soil in mapping are small areas of Dennis, Eram, and Woodson soils.

Nearly all the acreage has been cultivated. The soils are

Talihina Series

The Talihina series consists of sloping to steep, moderately well drained soils that are shallow over shale. These soils formed in material weathered from shale in the rolling and hilly uplands of the county. The native vegetation is tall prairie grasses.

In a representative profile the surface layer is very dark grayish brown silty clay loam about 7 inches thick. The subsoil is about 8 inches thick. It is dark grayish brown, friable silty clay loam containing many fragments of shale in the lower part. Mildly alkaline yellowish brown shale is at a depth of 15 inches.

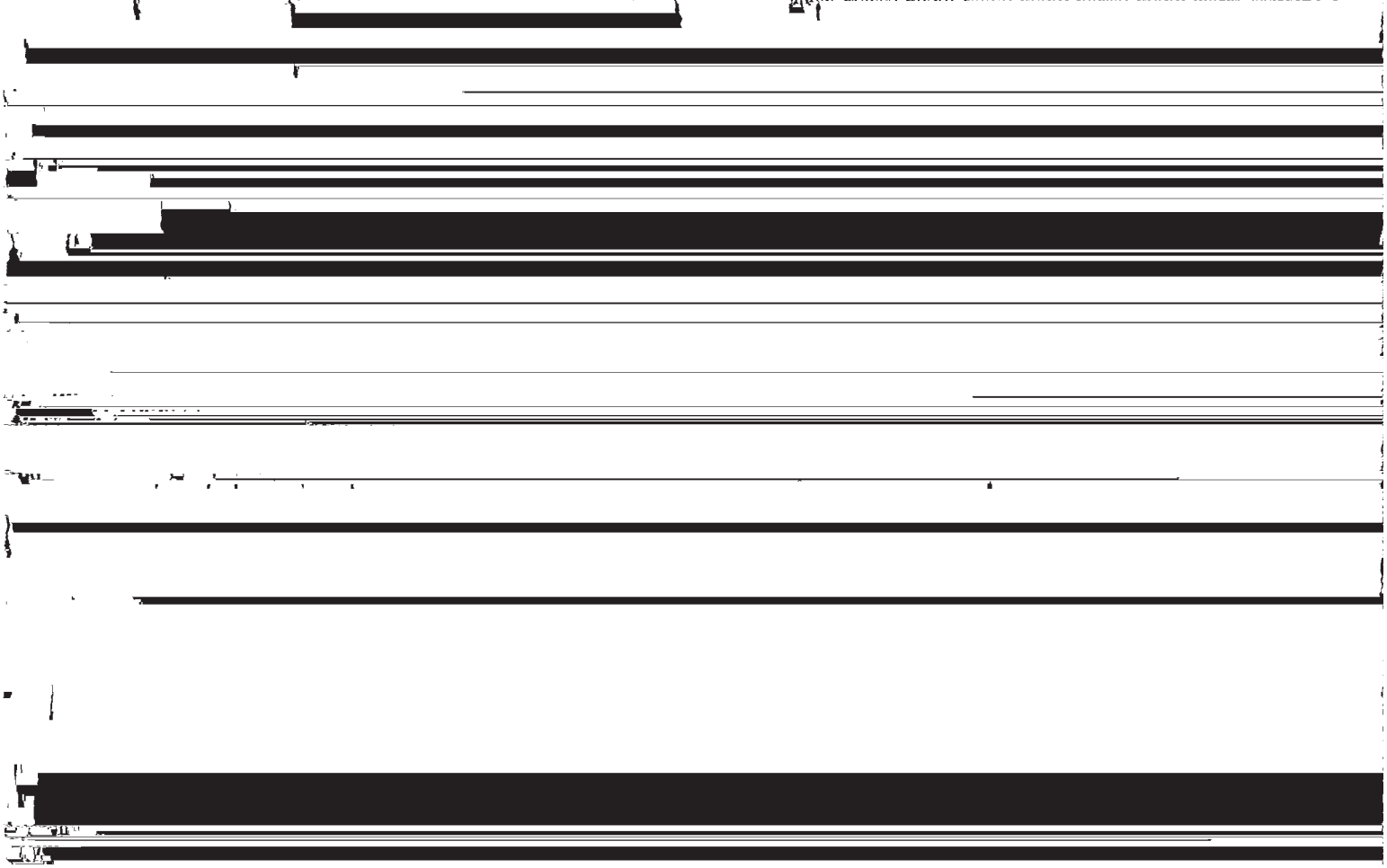
Talihina soils have slow permeability, very low available water capacity, and low fertility.

Most of the acreage is in native prairie grass, range and meadow. A number of areas in tame grasses are used for hay or grazing. Part of the acreage is wooded.

Representative profile of Talihina silty clay loam in an area of Eram-Talihina silty clay loams, 5 to 20 percent slopes, in tame grass pasture; 1,700 feet north and 300 feet west of the southeast corner of sec. 17, T. 20 S., R. 21 E.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) when dry; moderate fine and very fine granular structure; hard when dry, friable when moist; many roots; many pores; few worm casts; few thin shale fragments; mildly alkaline; gradual wavy boundary.

B21—7 to 12 inches; dark grayish brown (2.5Y 4/2) heavy silty clay loam, grayish brown (10YR 5/2) when dry; moderate fine and very fine granular structure; hard when dry, friable



Representative profile of Verdigris silt loam in an area of Verdigris silt loam, occasionally flooded, in cropland; 1,700 feet east and 80 feet south of the northwest corner of sec. 16,

but most are less than 2 percent. The adjoining slopes are short and steep. Included in mapping are small areas of gravelly sediment.

more clay in the B horizon than Mason soils. In contrast with Verdigris soils, they have a Bt horizon.

Wb—Welda silt loam, 0 to 2 percent slopes. This soil is on high terraces or benches. It has the profile described as representative of the series. Included with this soil in

gray (10YR 4/1) when dry; common fine faint gray (10RY 5/1), brown (10YR 5/3), and dark grayish brown (10YR 4/2) mottles; black vertical streaks; moderate very fine blocky structure; extremely hard when dry, very firm when moist; few roots; common fine black concretions; slightly acid; gradual wavy boundary.

B21 20 to 28 inches; dark grayish brown (10YR 4/2) silty clay

three levels: the capability class, the subclass, and the unit. The broadest grouping, the capability class, is designated by Roman numerals I through VIII. In class I are the soils that have the fewest limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limita-

Unit IIs–1. Deep, nearly level, somewhat poorly drained silt loams on uplands.

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

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

[redacted]

or otherwise limited, that they do not produce worthwhile

drained and somewhat poorly drained silt loams

risk of erosion, unless protective cover is maintained.

Unit VII–1. Shallow to deep, steep soils and stony land.

Class VIII soils and landforms have limitations that preclude their use for commercial crop production and restrict their use to recreation, wildlife habitat, or water

production can be higher than on uneroded fertile soils. Tillage is more costly, and in places uncrossable gullies prevent the use of the soil for crops.

In addition to controlling erosion, fertility and good tilth of cultivated soils must be maintained. Many soils in this county, unless recently limed, are strongly acid or medium

and contour farming are needed on the sloping soils when cultivated crops are grown. Soil loss is high on slowly permeable soils if row crops are planted up and down the slope, especially if they are grown continuously year after year. In these fields the supply of organic matter is decreasing.

The crops commonly grown in Anderson County are soybeans, corn, grain sorghum, wheat, and alfalfa. Tame grasses, mostly brome and fescue, are used for grazing hay and as a plant cover in waterways (fig. 8). These crops and grasses respond well to commercial fertilizer, manure, and lime. The kind and amount of fertilizer to be used on each also varies from farm to farm. Alternating years of drought and high rainfall can cause great fluctuations in crop yields from year to year. Wind, hail, or heavy rains may cause heavy local crop damage.

The yields listed in table 2 can be expected under improved management. On sloping soils, erosion is controlled by terraces, contour farming, and crop residue management. Drainage is provided where needed. Adequate fertilizer is used, generally on the basis of a soil test or field trials. The more productive crop varieties are planted, commonly at rates heavier than in ordinary management. All tillage, seed-

land area in the county. An additional 20,000 acres of native grassland is used for hay. The range provides the base for a livestock economy that produces about 30 percent of the farm income in the county.

Livestock that use the range consist mainly of cow-calf units, some yearlings, and a few stocker-feeders. The range [illegible] to some extent in the dairying enterprise. Deer

other benefits while still protecting the soil and water resources.

In the following section the range sites of Anderson County are described and the climax plants are listed for each site. Plant species most likely to invade are also shown. In addition, an estimate of the potential annual production of air-dry vegetation is indicated for each site. The soils in each

This range site is Leanna, Mayes, and Osage soils. If the plant community is in climax condition, prairie cordgrass and eastern gamagrass provide half or more of the total production.

Production ranges from 10,000 pounds of air-dry forage per acre in favorable years to 4,000 pounds in unfavorable years. In climax condition, all species provide forage for cattle.

Heavy grazing causes an increase in prairie cordgrass, tall dropseed, and ironweed and a decrease in eastern gamagrass, big bluestem, and indiangrass. If grazing pressure continues, prairie cordgrass and switchgrass also decline with a corresponding increase in tall dropseed and the invaders, sumpweed, annual ragweed, barnyardgrass and annual three-awn. Under continued overuse and lack of brush control, the canopy is osage-orange, green ash, and other trees and the understory is sedges, purpletop, tall dropseed, and annual invaders.

Grazed areas in poor to fair condition can be restored by controlling brush and deferring grazing during the growing season. Where feasible, this site should be fenced and man-

on this site:

	Percent composition by weight
Big bluestem	20
Eastern gamagrass	20
Indiangrass	15
Switchgrass	10
Prairie cordgrass	5
Tall dropseed	5
Virginia wildrye	3
Canada wildrye	2
Sedge species	5
Forb decreasers	5
Forb increasers	5
Woody increasers	5

This range site is Lanton, Mason, and Verdigris soils. If the plant community is in climax condition, it is the most productive range site in the county. Most of these soils are used for crops, introduced pasture, woodland, or native meadow.

Production from the climax plant community ranges from

Heavy grazing causes a decrease in big bluestem, indiangrass, little bluestem, and switchgrass and an increase in tall dropseed, annual three-awn, and buckbrush. Side-oats grama is an increaser on Lula soils, and rosette panicums are increasers on Olpe soils. Blackberry and broomsedge are invaders on Dennis soils, and weed trees are invaders on Welda soils. If heavy grazing continues, tall dropseed, annual three-awn, buckbrush, annual broomweed, annual ragweed, blackberry, broomsedge, annual bromes, and weed trees become the major species on one or more soils of this range site when it is in poor to fair range condition.

A planned grazing system is most effective in restoring the climax plant community on this range site. Brush control and controlled burning are also helpful. Abandoned crop fields can be restored by seeding the suitable native species.

SHALLOW FLATS RANGE SITE

The following tabulation indicates the percentage of major

Production from the climax plant community ranges from 4,000 pounds of air-dry forage per acre in favorable years to 2,000 pounds in unfavorable years. All species but the woody increasers are readily grazed by cattle. Sheep and goats graze the woody species and forbs.

Heavy grazing causes a decrease in little bluestem, big bluestem, indiangrass, and switchgrass and an increase in blackberry, sumac, broomsedge, and purple lovegrass. If grazing continues, the plant community degenerates to woody shrubs, eastern redcedar, broomsedge, purpletop, annual grasses, and forb increasers. Under overgrazing by sheep and goats, the forbs and woody shrubs are eliminated and the chief remaining plant species are annual three-awn, broomsedge, purpletop, and annual bromes.

Brush control in combination with deferred grazing and controlled burning is most practical in restoring the climax plant community on this range site. Mechanical treatment

in 50 years. For cottonwood, however, it is the height reached in 30 years.

The five foregoing ratings are based on field determination of average site index of an indicator forest type or species. Site indexes are grouped into site quality classes, and the classes are used to determine approximate expected yields

Seedling mortality refers to the expected degree of mortality of naturally occurring or planted seedlings as influenced by soil texture, depth, drainage, flooding, height of the water table, and degree of erosion. Normal rainfall, good planting stock, and proper planting are assumed. Mortality is *slight* if the expected loss is less than 25 percent, *moderate*

per acre in cords and board feet. On basis of research studies, site index can be converted into approximate expected growth and yield per acre in cords and board feet.

The second part of the symbol identifying a woodland group is a small letter. This letter indicates an important soil property that imposes a slight to severe hazard or limitation in managing the soils of the group for wood crops. The letter *c* indicates that the main limitation is the kind or amount of clay in the upper part of the soils in the group; *o*, that the soils have few limitations restricting their use for

if 25 to 50 percent, and *severe* if more than 50 percent.

Erosion hazard is rated according to the risk of erosion on woodland where normal methods are used in managing and harvesting trees. The hazard is *slight* if erosion control is not an important concern, *moderate* if some attention is needed to check soil losses, and *severe* if special treatment or special methods are necessary.

Windthrow hazard depends on the growth of roots and the capacity of the soil to hold trees firmly. The hazard is *slight* if windthrow is no special concern; *moderate* if roots hold the

needed or if the use of such equipment is severely restricted by one or more unfavorable soil characteristics.

The species listed in the last two columns of table 3 are

drained and poorly drained soils. These soils have a surface layer of silt loam and silty clay loam and a subsoil of silty clay loam and silty clay. They are on flood plains and low

portant species. Productivity is good for pin oak, hackberry, and green ash.

Wildlife [4]

The kind and abundance of wildlife in Anderson County and elsewhere is mainly determined by land use and by the fertility, topography, permeability, and depth of the soils. If land use is changed, the wildlife in the area also is likely to change.

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the development of water impoundments. The kind and abundance of wildlife that populates an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, inadequate, or inaccessible, wildlife will either be scarce or will not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate plant cover, by properly managing the existing plant cover, and by fostering the natural establishment of desirable plants.

In table 4 the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in—

1. Planning the use of parks, wildlife refuges, nature

habitat

Wildlife habitat elements—Continued			Kinds of wildlife			
Shrubs	Wetland plants	Shallow water areas	Openland	Woodland	Wetland	Rangeland

2. Selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat.

Coniferous plants are cone-bearing trees, shrubs, and ground cover that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. They are com-

Numerous farm ponds provide good to excellent fishing ties that are generally favorable and limitations so minor

TABLE 5.—*Degree of limitation and soil features affecting the use of soils for recreation*

[An asterisk in the first column indicates that at least one mapping unit is made up of two or more kinds of soils. The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column of this table]

Soil series and map symbols	Camp areas	Picnic areas	Playgrounds	Paths and trails
Catoosa: Cb	Slight	Slight	Slight	Slight.
Clareson: Cc	Moderate: silty clay loam.	Moderate: silty clay loam.	Moderate: coarse fragments.	Moderate: coarse fragments and silty clay loam.
Collinsville: Cd	Slight where slopes are less than 8 percent. Moderate where slopes are more than 8 percent.	Slight where slopes are less than 8 percent. Moderate where slopes are more than 8 percent.	Severe: slope; depth to bedrock.	Slight.
Dennis: Db, De	Moderate: slow permeability; moderately well drained.	Slight	Moderate: slow permeability; moderately well drained.	Slight.
*Eram: Eb, Ec, Ed, Eh, Ek, Eo, Ep, Ev.	Moderate: slow permeability; silty clay loam;	Moderate: silty clay loam; moderately well	Moderate where slopes are less than 6 percent;	Moderate: silty clay loam.

TABLE 5.—*Degree of limitation and soil features affecting the use of soils for recreation*—Continued

Soil series and map symbols	Camp areas	Picnic areas	Playgrounds	Paths and trails
[redacted]				

TABLE 6.—*Estimated physical and*

[An asterisk in the first column indicates that at least one mapping unit is made up of two or more kinds of soils. The soils in such mapping units appear in the first column of this table. Absence of data indicates that the soil is too variable to be

Soil series and map symbols	Depth to bedrock	Depth from surface	USDA texture	Classification		Percentage less than 3 inches passing sieve—	
				Unified	AASHTO	No. 4 (4.7 mm)	No. 10 (2.0 mm)
	Ft	*In*					
Catoosa: Cb	20–40	0–8	Silt loam	CL	A–4 or A–6	100	100
		8–28	Silty clay loam	CL	A–4, A–6, or A–7	100	100
		28	Limestone.				
Clareson: Cc	20–40	0–7	Flaggy silty clay loam.	CL	A–6	80–100	70–95
		7–24	Very flaggy silty clay.	CL or CH	A–7	80–100	70–95
		24	Limestone.				
Collinsville: Cd	4–20	0–6	Loam	ML or SM	A–4	80–100	60–100
		6–11	Channery loam	ML or SM	A–4	80–100	60–100
		11	Sandstone.				
Dennis: Db, De	40–70	0–10	Silt loam	ML or CL	A–4 or A–6	100	100
		10–21	Silty clay loam	CL	A–6 or A–7	100	100
		21–56	Silty clay loam and silty clay.	CL or CH	A–6 or A–7	100	100
		56	Shale.				
*Eram: Eb, Ec, Ed, Eh, Ek, Eo, Ep, Ev. For Clareson part of Ek, see Clareson series; for Talihina part of Ep, see Talihina series; for Verdigris part of Ev, see Verdigris series. Gullied land part of Eo is too variable to be rated.	20–40 Shale	0–15	Silty clay loam	ML or CL	A–6 or A–7	100	100
		15–28	Clay loam	CL, CH, or MH	A–6 or A–7	100	100
		28–33	Silty clay loam	CH or CL	A–6 or A–7	100	100
		33	Shale.				
*Kenoma: Kb, Kd, Kh For Olpe part of Kh, see Olpe series.	40–70	0–7	Silt loam	ML or CL	A–4 or A–6	85–100	85–100
		7–56	Silty clay	CH or CL	A–7	85–100	85–100
		56–61	Silty clay loam	CH or CL	A–7	80–100	80–100
Lanton: La	>60	0–60	Silty clay loam	CL	A–6 or A–7	100	100
Leanna: Le	>60	0–17	Silt loam	ML or CL	A–4 or A–6	100	98–100
		17–64	Silty clay	CH or CL	A–7	98–100	98–100
Lula: Lh	40–60	0–13	Silt loam	ML or CL	A–4 or A–6	100	100
		13–49	Silty clay loam	CL	A–6 or A–7	100	97–100
		49	Limestone.				
Mason: Me	>60	0–13	Silt loam	ML or CL	A–4 or A–6	100	100
		13–60	Silty clay loam	CL	A–6 or A–7	98–100	98–100
Mayes: Mf	>60	0–11	Silty clay loam	CL or CH	A–6 or A–7	100	100
		11–64	Silty clay	CH	A–7	100	100
Okemah: Ok	>60	0–9	Silt loam	CL or ML	A–4, A–6, or A–7	100	100
		9–22	Silty clay loam	CL or CH	A–7	100	100
		22–60	Silty clay	CH or CL	A–7	100	100

chemical properties of the soils

may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series that rated or that no estimate was made. The symbol > means greater than; the symbol < means less than]

Percentage less than 2							

TABLE 6.—*Estimated physical and*

chemical properties of the soils—Continued

Percentage less than 3 inches passing sieve—Continued		Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Risk of corrosion for—	
No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
65–95	60–90	15–30	7–10	*In per hr* 0.6–2.0	*In per in of soil* 0.14–0.18	*pH* 5.1–6.5	Low	Low	Low to moderate

TABLE 7.—*Engineering*

[Lawrence E. Robins, civil engineer, helped prepare this table. An asterisk in the first column indicates that at least one mapping unit is made up follow carefully the instructions for referring to other

Soil series and map symbols	Degree and kind of limitation for—						
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings	Local roads and streets [1]	Sanitary landfill	
						Trench type	Area type
Catoosa: Cb	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe with basements: bedrock at a depth of 20 to 40 inches. Moderate without basements: bedrock at a depth of 20 to 40 inches; low strength; moderate shrink-swell potential.	Moderate: limestone at a depth of 20 to 40 inches; moderate shrink-swell potential.	Severe: bedrock at a depth of 20 to 40 inches.	Slight
Clareson: Cc	Severe: bedrock at a depth of 20 to 40 inches; more than 35 percent coarse fragments in subsoil.	Severe: bedrock at a depth of 20 to 40 inches; more than 35 percent coarse fragments in subsoil.	Severe: bedrock at a depth of 20 to 40 inches; more than 35 percent coarse fragments in subsoil.	Severe with basements: bedrock at a depth of 20 to 40 inches. Moderate without basements: bedrock at a depth of 20 to 40 inches; more than 35 percent coarse fragments in subsoil.	Moderate to severe: moderate to high shrink-swell potential; coarse fragments; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches; coarse fragments in subsoil.	Slight
Collinsville: Cd	Severe: bedrock at a depth of 4 to 20 inches.	Severe: bedrock at a depth of 4 to 20 inches.	Severe: bedrock at a depth of 4 to 20 inches.	Severe: bedrock at a depth of 4 to 20 inches.	Severe: bedrock at a depth of 4 to 20 inches.	Severe: bedrock at a depth of 4 to 20 inches.	Severe: moderately rapid permeability.
Dennis: Db, De	Severe: slow permeability.	Slight where slope is less than 2 percent. Moderate where slope is 2 to 4 percent.	Severe: silty clay below a depth of 21 inches.	Severe: high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: silty clay.	Slight

interpretations

of two or more kinds of soils. The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to series that appear in the first column of this table]

Degree and kind of limitation for—Continued	Suitability as source of—			Soil features affecting—			
Sanitary landfill—Continued Cover material	Topsoil	Road subgrade [1]	Road fill [1]	Highway location [1]	Pond reservoir areas	Embankments, dikes, and levees	Terraces, diversions, and waterways
Fair: bedrock at a depth of 20 to 40 inches; silty clay loam below a depth of 8 inches.	Fair: silty clay loam below a depth of 8 inches.	Fair: medium soil support.	Good	Limestone at a depth of 20 to 40 inches; 0 to 3 percent slopes.	Bedrock at a depth of 20 to 40 inches.	Unstable fill; susceptible to piping; bedrock at a depth of 20 to 40 inches.	Bedrock at a depth of 20 to 40 inches; limited rooting depth; droughty.
Poor: more than 35 percent coarse fragments in subsoil.	Poor: more than 15 percent coarse fragments.	Poor: low soil support.	Fair: fair shear strength.	Limestone at a depth of 20 to 40 inches; more than 35 percent coarse fragments in subsoil; 1 to 4 percent slopes.	Bedrock at a depth of 20 to 40 inches.	Fair to poor compaction and stability; bedrock at a depth of 20 to 40 inches.	More than 35 percent coarse fragments in subsoil.
Poor: bedrock at a depth of 4 to 20 inches.	Fair to poor: bedrock at a depth of 4 to 20 percent.	Good	Good	Sandstone at a depth of 4 to 20 inches; erodible; 2 to 15 percent slopes.	Bedrock at a depth of 4 to 20 inches; moderately rapid permeability.	Bedrock at a depth of 4 to 20 inches; medium to high susceptibility to piping.	Bedrock at a depth of 4 to 20 inches; 2 to 15 percent slopes.
Poor: silty clay below a depth of 21 inches.	Fair: silty clay loam below a depth of 10 inches.	Fair to poor: low to medium soil support; medium to high plasticity.	Fair: moderate to high shrink-swell potential; fair shear strength.	1 to 4 percent slopes.	All features favorable.	Poor to fair compaction characteristics; unstable fill; susceptible to piping.	All features favorable.

TABLE 7.—*Engineering*

Soil series and map symbols	Degree and kind of limitation for—						
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings	Local roads and streets [1]	Sanitary landfill	
						Trench type	Area type
*Eram: Eb, Ec, [illegible]	Severe: slow [illegible]	Severe: shale [illegible]	Severe: shale [illegible]	Severe: high [illegible]	Severe: high [illegible]	Severe: shale [illegible]	Slight

interpretations—Continued

Degree and kind of limitation for—Continued	Suitability as source of—			Soil features affecting—			
Sanitary							

TABLE 7.—*Engineering*

Soil series and map symbols	Degree and kind of limitation for—						
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings	Local roads and streets [1]	Sanitary landfill	
						Trench type	Area type
Mason: Me	Severe: moderately slow permeability.	Slight	Moderate: rarely flooded.	Severe: rarely flooded.	Moderate: floods less than once in 5 years; moderate shrink-swell potential.	Moderate: rarely flooded; silty clay loam.	Moderate: rarely flooded.
Mayes: Mf	Severe: very slow perme-	Slight	Severe: silty clay below a	Severe: high shrink-swell	Severe: high shrink-swell	Severe: silty clay below a	Severe: high water table.

interpretations—Continued

Degree and kind of limitation for—Continued	Suitability as source of—			Soil features affecting—			
Sanitary landfill—Continued Cover material	Topsoil	Road subgrade [1]	Road fill [1]	Highway location [1]	Pond reservoir areas	Embankments, dikes, and levees	Terraces, diversions, and waterways
Fair: silty clay loam below a depth of 13 inches.	Fair: silt loam to a depth of 13 inches.	Fair: medium soil support.	Good	Rare flooding; nearly level.	Nearly level	Medium to low shear strength; fair to good compaction characteristics.	Nearly level; rare flooding.
Poor: silty clay below a depth of 11 inches.	Poor: silty clay below a depth of 11 inches.	Poor: low soil support; high plasticity.	Fair: fair shear strength.	Nearly level; slow internal drainage.	Less than 1 percent slopes.	Unstable fill; high shrink-swell potential.	Less than 1 percent slopes; high shrink-swell potential.
Fair: silty clay loam below a	Fair: silty clay loam below a depth	Poor: high plasticity; low soil	Fair: fair shear strength.	0 to 2 percent slopes; poor workability.	0 to 2 percent slopes.	Low shear strength; high shrink-	All features favorable.

TABLE 7.—*Engineering*

Soil series and map symbols	Degree and kind of limitation for—						
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings	Local roads and streets [1]	Sanitary landfill	
						Trench type	Area type
Verdigris: Vf, Vx	Severe: frequent flooding.	Severe: frequent flooding.	Severe: frequent flooding.	Severe: frequent flooding.	Severe: floods more than once in 5 years.	Severe: frequent flooding.	Severe: frequent flooding.
Welda: Wb, Wc	Severe: mod	Moderate	Slight	Moderate	Moderate	Moderate	Slight

interpretations—Continued

Degree and kind of limitation for—Continued	Suitability as source of—			Soil features affecting—			
Sanitary landfill—Continued Cover material	Topsoil	Road subgrade [1]	Road fill [1]	Highway location [1]	Pond reservoir areas	Embankments, dikes, and levees	Terraces, diversions, and waterways
Good	Good	Fair: medium soil support.	Good	Frequent flooding; nearly level.	Frequent flooding; nearly level.	Fair compaction characteristics; medium to low shear strength.	Frequent flooding; nearly level.
Fair: silty clay loam below a depth of 12 inches.	Fair: silty clay loam below a depth of 12 inches.	Fair: medium soil support.	Fair: fair shear strength.	Erodible; 0 to 6 percent slopes.	0 to 6 percent slopes.	Fair to good compaction characteristics; medium to low shear strength.	All features favorable.
Poor: silty	Fair: silty	Poor: low	Fair: fair	0 to 3 percent	0 to 3 percent	Fair to poor	Silty clay at a

TABLE 8.—*Engineering*

[Tests performed by the State Highway Commission of Kansas in accordance with standard procedures of the

Soil name and location	Parent material	Report number	Depth	Moisture density [1]	
				Maximum dry density	Optimum moisture
			In	*Lb/ft³*	*Pct*
Eram silty clay loam:					
2,100 feet N. and 550 feet W. of the SE. corner of sec. 13, T. 23 S., R. 19 E. (Modal)	Clay shale	S72-Kans. 2-6-1	0–9	93	23
		S72-Kans. 2-6-4	20–28	96	22
		S72-Kans. 2-6-5	28–33	99	21
Kenoma silt loam:					
1,750 feet E. and 550 feet N. of the SW. corner of sec. 32, T. 22 S., R. 20 E. (Modal)	Weathered old clay alluvium	S72-Kans. 2-8-1	0–7	97	18
		S72-Kans. 2-8-2	7–11	95	24
		S72-Kans. 2-8-6	38–56	95	24
Lanton silty clay loam:					
2,800 feet E. and 650 feet S. of the NW. corner of sec. 5, T. 20 S., R. 20 E. (Modal)	Silty alluvium	S71-Kans. 2-5-2	9–17	102	18
		S71-Kans. 2-5-5	45–63	102	18
Okemah silt loam:					
1,425 feet N. and 700 feet W. of the SE. corner of sec. 13, T. 23 S., R. 19 E. (Modal)	Residuum or colluvium weathered from shaly clay.	S72-Kans. 2-7-1	0–9	91	22
		S72-Kans. 2-7-4	22–31	93	25
		S72-Kans. 2-7-7	47–60	97	23
Summit silty clay loam:					
1,000 feet W. and 200 feet S. of the NE. corner of sec. 25, T. 20 S., R. 19 E. (Nonmodal—B21t horizon low in clay content).	Residuum or colluvium weathered from clay or soft clay shale.	S72-Kans. 2-9-1	0–8	92	22
		S72-Kans. 2-9-2	12–19	93	25
		S72-Kans. 2-9-3	68–84	102	20

[1] Based on AASHTO Designation T99-61, Method A, with the following variations: (1) all material is oven dried at 230°F.; (2) all material is crushed in a laboratory crusher after drying; and (3) no time is allowed for dispersion of moisture after mixing with the soil material.

[2] Mechanical analysis is according to the AASHTO Designation T 88-57 with the following variations: (1) all material is oven dried at 230°F. and crushed in a laboratory crusher; (2) the sample is not soaked prior to dispersion; (3) sodium silicate is used as the dispersing agent; and (4) dispersing time, in minutes, is established by dividing the plasticity index value by 2; the maximum time is 15 minutes, and the minimum time is 1 minute. Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the

stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage.

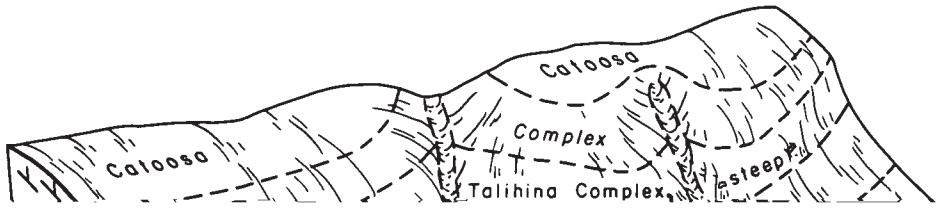
turbed soil that affect construction and maintenance of highways. The soil features given in table 7, favorable as well as unfavorable, are the chief ones that affect the loca-

test data

American Association of State Highway and Transportation Officials (AASHTO) except as stated in footnotes 2 and 3]

Mechanical analysis [2]				Classification	
Percentage less than 2 inches	Percentage smaller than—	Liquid	Plasticity		

physical and mineralogical composition of the parent ma- shale. These soils have a loamy surface layer and a loamy or


Calooso
Calooso
Complex
Talihina Complex, steep

chemical, physical, and biological processes that strongly affect soil formation. Earthworms feed on organic matter and make channels, and in this way they thoroughly mix the soil in which they live. Burrowing animals affect soil formation mainly by mixing soil horizons. They also bring fresh material into the surface horizons.

Most soils in Anderson County formed under tall prairie grasses. These grasses add a great deal of organic matter to the soil, darken the surface layer, and strengthen soil structure. Welda soils formed under a cover of deciduous trees and a sparse stand of native grass. The surface layer of this soil is light brownish gray and very strongly acid.

Man has a great effect on the formation of soil. Management that controls erosion is changing the relief, or lay of the land, and the surface and subsurface drainage pattern. Erosion and earthmoving in some locations have removed the developed upper layer of the soil, the part containing the highest amount of organic matter and nutrients, and exposed the subsoil and substratum, both of which in many areas are deficient in plant nutrients. In this way, man has offset the normal processes of soil formation (*7*).

Relief

Relief, or lay of the land, influences soil formation through its effect on the amount of water retained, erosion, the direction that material in suspension or solution is moved, and plant cover. The amount of water that moves into the soil depends partly on topography. In the steeper areas the continued removal of surface soil and the loss of water through runoff slow down the processes of soil formation. The soils in nearly level and depressed areas receive the same amount of precipitation annually as the soils on steeper slopes, but they also receive the runoff and deposition from the sloping areas. Consequently, these soils generally show stronger evidence of soil formation than those in the sloping areas and are darkened to a greater depth. For example, Talihina soils, which are on the steeper upper side slopes, are shallow, and Summit soils, which are on the less steep lower side slopes, are deep.

Time

Time is required for soil formation. The length of time required depends mainly on the other factors of soil forma-

to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Because this system is under continual study readers interested in developments of the current system should search the latest literature available.

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped. The same property or subdivisions of this property may be used in several different categories. In table 9, the soil series of Anderson County are placed in four categories of the current system. Classes of the current system are briefly defined in the following paragraphs.

ORDER. Ten soils orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. Three exceptions to this are the Entisols, Histosols, and Vertisols, which occur in many different climates. Each order is identified by a word of three of four syllables ending in *sol* (Moll-i-sol).

SUBORDER. Each order is divided into suborders that are based on those soil characteristics that seem to produce classes with the greatest genetic similarity. The suborders are more narrowly defined than the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of a shallow water table; soil climate; the accumulation of clay, iron, or organic carbon in the upper part of the solum; cracking of soils caused by a

TABLE 9.—*Soil series classification*

Series	Family	Subgroup	Order
Catoosa	Fine-silty, mixed, thermic	Typic Argiudolls	Mollisols.
Clareson	Clayey-skeletal, mixed, thermic	Typic Argiudolls	Mollisols.
Collinsville	Loamy, siliceous, thermic	Lithic Hapludolls	Mollisols.
Dennis [1]	Fine, mixed, thermic	Aquic Paleudolls	Mollisols.
Eram	Fine, mixed, thermic	Aquic Argiudolls	Mollisols.
Kenoma	Fine, montmorillonitic, thermic	Vertic Argiudolls	Mollisols.
Lanton	Fine-silty, mixed, thermic	Cumulic Haplaquolls	Mollisols.
Leanna	Fine, mixed, thermic	Typic Argialbolls	Mollisols.
Lula	Fine-silty, mixed, thermic	Typic Argiudolls	Mollisols.
Mason	Fine-silty, mixed, thermic	Typic Argiudolls	Mollisols.
Mayes	Fine, montmorillonitic, thermic	Vertic Argiaquolls	Mollisols.
Okemah	Fine, mixed, thermic	Aquic Paleudolls	Mollisols.
Olpe	Clayey-skeletal, montmorillonitic,, thermic	Typic Paleudolls	Mollisols.
Osage	Fine, montmorillonitic, thermic	Vertic Haplaquolls	Mollisols.
Summit	Fine, montmorillonitic, thermic	Vertic Argiudolls	Mollisols.
Talihina	Clayey, mixed, thermic, shallow	Aquic Hapludolls	Mollisols.
Verdigris	Fine-silty, mixed, thermic	Cumulic Hapludolls	Mollisols.
Welda	Fine, montmorillonitic, mesic	Typic Hapludalfs	Alfisols.
Woodson	Fine, mixed, thermic	Abruptic Argiaquolls	Mollisols.

[1] The Dennis soils are taxadjuncts to the Dennis series. They are not so deep over shale as is typical for the series. This difference, however, does not alter use or management.

properties unlike those of any other group, suborder, or order. Each subgroup is identified by the name of the great group preceded by one or more adjectives. An example is Typic Haplaquolls (a typical Haplaquoll).

FAMILY. Soil families are established within a subgroup primarily on the basis of properties important to the growth of plants or to the behavior of soils when used for engi-

Some were established along the railroads built in the early 1870's. At one time three railroads junctioned at Garnett—the Atchison Topeka and Santa Fe, the Missouri Pacific, and the Kansas, Nebraska, and Dakota. The Kansas, Nebraska, and Dakota has since been abandoned. The Missouri-Kansas-Texas Railroad crosses the southeast corner of the county near Kincaid and Selma.

In 1887, according to records in the county clerk's office

falls in the April through September growing season. Meas- In winter, from December through February, the tempera-

TABLE 11.—*Probabilities of last freezing temperatures in spring and first in fall*

[redacted]

Oil and gas were formerly obtained from shallow wells in parts of the county. The largest boom was in the early 1920's when fields near Colony and Welda were brought into production. Production now is very limited. Natural gas storage, near Welda and Colony, is important in the county. The natural gas is piped in and stored underground, in natural reservoirs, until needed. A number of transporting pipelines cross the county.

Transportation and Markets

Except for a few areas, there are improved roads throughout the county. Most are graveled, and a few are hard surfaced. Two Federal highways and three State highways serve the county. U.S. Highway 59 passes through Garnett. U.S. Highway 169 joins U.S. Highway 59 near Garnett. Motor truck lines use all highways and hard-surfaced roads.

The Atchison, Topeka, and Santa Fe Railroad passes through Garnett, Welda, and Colony. The Missouri Pacific passes through Greeley, Garnett, Mont Ida, and Westphalia. A line of the Missouri-Kansas-Texas passes through Kincaid and Selma. Regular bus service is available to Garnett from the north and the south.

Markets for all farm products are readily available. Corn, wheat, and grain sorghum that are not fed to animals on the farm are sold to local elevators. Most of the soybeans are sold. Garnett, Greeley, Colony, Harris, Westphalia, and Kincaid have facilities for handling and storing grain, which is shipped by railroad and truck. Part of the hay is shipped by truck to Missouri, Arkansas, and Oklahoma. Most of the

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Glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

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

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth

mineral material in which soil forms. Consolidated bedrock is not [redacted] material by this concept.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature

[redacted]

GUIDE TO MAPPING UNITS

Map symbol	Mapping unit	Page	Capability unit	Range site		Woodland suitability group
			Symbol	Name	Page	Number
Cb	Catoosa silt loam, 0 to 3 percent slopes-----	6	IIe-2	Loamy Upland	27	--
Cc	Clareson complex, 1 to 4 percent slopes------	8	VIs-1	Shallow Flats	28	--
Cd	Collinsville complex, 2 to 15 percent slopes-	8	VIe-2	Shallow Sandstone	28	--
Db	Dennis silt loam, 1 to 4 percent slopes------	9	IIe-1	Loamy Upland	27	--
De	Dennis silty clay loam, 1 to 4 percent slopes, eroded----------	9	IIIe-3	Clay Upland	27	--
Eb	From silty clay loam, 1 to 4 percent slopes	9	IIIe-5	Clay Upland	27	

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