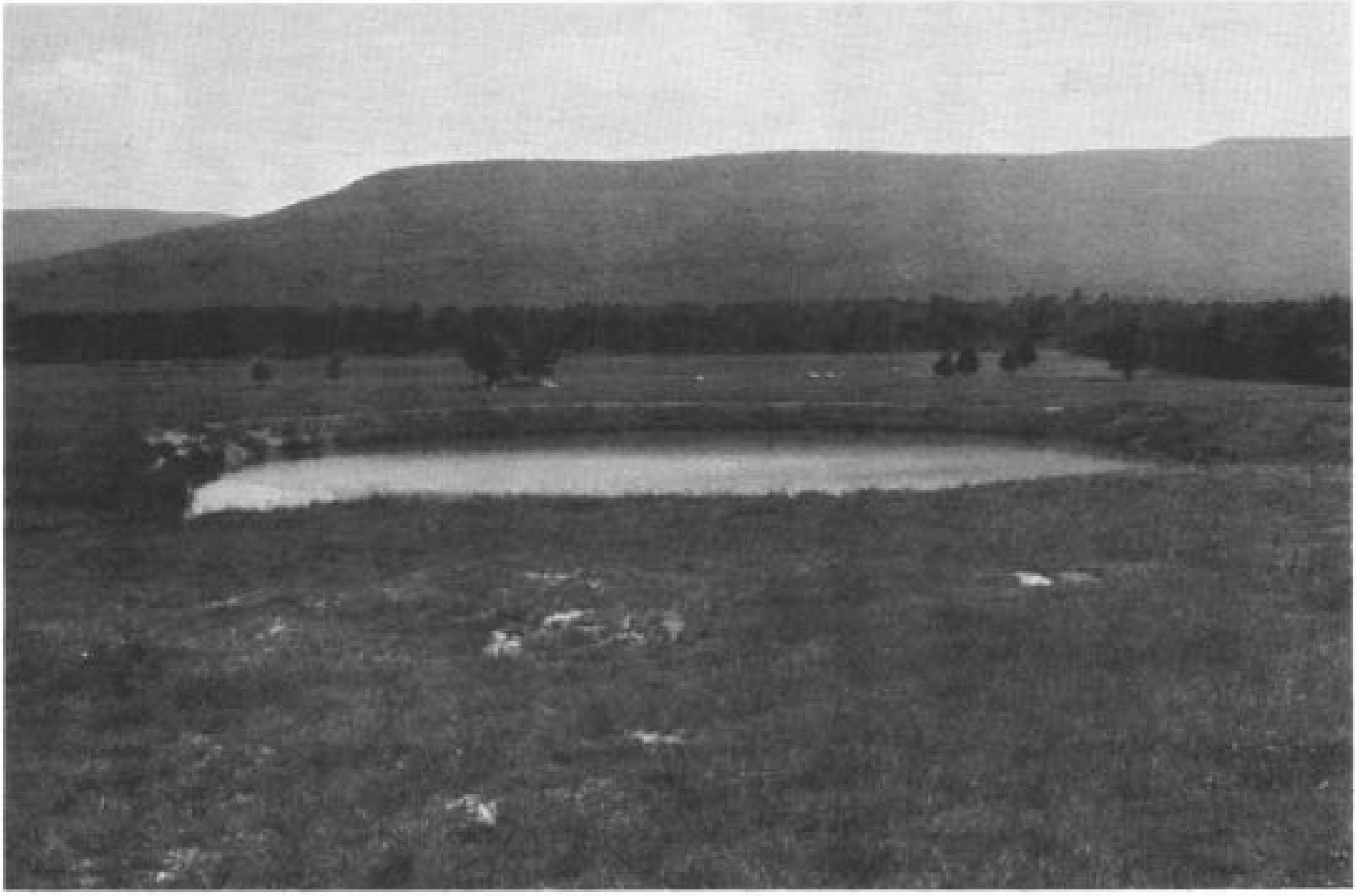
SOIL SURVEY OF

Sebastian County, Arkansas



United States Department of Agriculture
Soil Conservation Service and Forest Service
In cooperation with
Arkansas Agricultural Experiment Station

Issued March 1975

Major fieldwork for this soil survey was done in the period 1964–70. Soil names and descriptions were approved in 1971. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1971. This survey was made cooperatively by the Soil Conservation Service, the Forest Service, and the Arkansas Agricultural Experiment Station. It is part of the technical assistance furnished to the Sebastian County 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, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

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

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. 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. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification and woodland group of each. It also shows the page where each soil is described and the page for the range site in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability grouping, the woodland groups, and the range sites.

Foresters and others can refer to the section "Use of the Soils for Woodland," where the soils of the county are grouped according to their suitability for trees.

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

Ranchers and others can find, under "Use of the Soils for Range," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Community planners and others can read about soil properties that affect the choice of sites for dwellings, industrial buildings, and recreation areas in the sections "Town and Country Planning" and "Use of the Soils for Recreational Development."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

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 Sebastian County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given in the section "General Nature of the County."

Cover: **Area of pasture on Leadville silt loam, 3 to 8 percent slopes. This soil is well suited to bermudagrass and is suitable for ponds that are used for watering livestock.**

Contents

Issued March 1975

SOIL SURVEY OF SEBASTIAN COUNTY, ARKANSAS

BY JOHN B. COX, BILLY A. GARNER, AND FRANK M. VODRAZKA, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE AND FOREST SERVICE, IN COOPERATION WITH THE ARKANSAS AGRICULTURAL EXPERIMENT STATION

SEBASTIAN COUNTY is in western Arkansas and adjoins Le Flore County, Oklahoma (fig. 1). It is irregularly shaped. It ranges from about 12 to 23 miles in width and is about 36 miles in maximum length. The approximate area is 337,280 acres, or 537 square miles.

In 1970 the population of the county was about 79,240. Fort Smith had a population of 62,802. It is the main county seat and the chief trading center for west-central Arkansas and east-central Oklahoma. Greenwood, the other county seat and next largest town, had a population of 2,032 in 1970. Most of the people in the county, including more than half of the farmers, work in industries or supporting businesses within the Fort Smith area.

General Nature of the County

This section discusses farming, physiography and drainage, and climate in Sebastian County.

About 45 percent of the county is made up of the mountainous area in the extreme southern part and the hilly areas scattered throughout the county. Here, the elevation ranges from about 700 feet at the base of the mountains and ridges in the southern part of the county to about 2,670 feet at the lookout tower atop Poteau Mountain. The soils in most of these areas are too steep or too stony for intensive use. They are used mainly for production of wood crops and for native pasture. Some of the less sloping soils are not stony and are suitable for improved pasture.

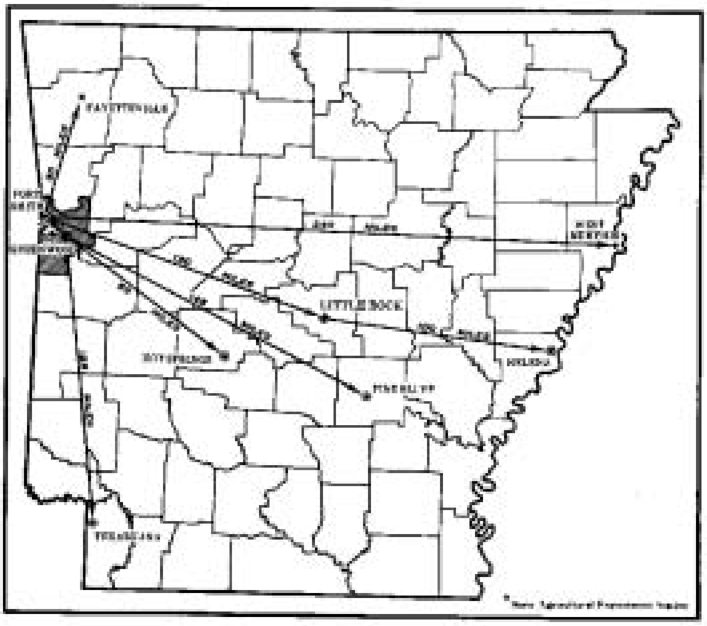


***Figure 1.*—Location of Sebastian County in Arkansas.**

About 55 percent of the county is level to gently sloping valley fill and alluvial sediments that range from young flood plains along the Arkansas River to old stream terraces in the broad valleys between hills throughout the county. Here, the elevation ranges from about 370 feet in areas where Courthouse Slough runs into the Arkansas River in the northeastern part of the county to about 700 feet atop the old stream terraces in the southwestern part of the county.

Except for the soils on bottom lands along the Arkansas River that are intensively farmed, the soils in the county are used mainly for forage crops. The less sloping soils are fairly well suited to cultivation, but very few crops are grown in the county, except on the bottom lands along the river.

Farming

Farming in Sebastian County began on soils that had good natural drainage. These soils were in higher positions near the flood plain of the Arkansas River and on the hills and in the valleys in the central and southern parts of the county. Cotton was the main cash crop. Most areas of the better drained soils were cleared for farming, and the areas of steep, stony, or wetter soils were left in woodland.

Farming has since become more diversified and generally less intensive. In the area of ridges and valleys, dairying, the raising of beef cattle and of poultry, including turkeys, broiler chickens, and laying hens, now provide most of the farm income. Some farms have a small acreage of fruit and berry crops.

On the bottom lands along the Arkansas River, flood control, use of improved crop varieties, and other improved management have led to the expansion of cropland into nearly all of the flood plain. Most of the woodland on the bottom lands along the river has been cleared, and the natural drainage has been improved for more reliable crop production on wet soils.

On these bottom-land farms, soybeans is the main crop. Some farms grow truck crops, such as spinach, okra, snap beans, and melons.

According to the U.S. Census of Agriculture, the acreage of principal crops in the county is as follows:

	Acres in 1964	*Acres in 1969*
Cropland pastured	19, 935	49, 156
Woodland, including wooded pasture	42, 170	41, 010
Hay crops	11, 417	14, 157
Soybeans (for beans)	2, 909	5, 387
Field corn (for all purposes)	353	89
Wheat	623	163
Other small grains	580	315
Truck crops (including potatoes)	394	120

It should be noted that a large acreage of pasture and range is not differentiated in the census but is included as "All other land." In addition, the 1964 census and observations during the fieldwork for this survey indicate that most of the woodland is pastured.

The number of livestock in the county was reported as follows:

	Number in 1964	*Number in 1969*
All cattle and calves on farms and sold	37, 680	47, 858
Milk cows	2, 966	1, 673
Hogs and pigs on farms and sold	1, 967	2, 127
Sheep and lambs on farms and sold	349	407
Chickens more than 3 months old on farms and sold	184, 075	188, 290
Broilers raised and sold	991, 505	2, 019, 816

At the time of the 1969 Census of Agriculture, about 78 percent of the land area in the county was in farms. The rest was mainly in cities and built-up areas, transportation facilities, and Federally owned land within the Ouachita National Forest and the Fort Chaffee Military Reservation.

Farms in Sebastian County are decreasing in number and increasing in size. Between 1964 and 1969, the number of farms decreased from 1,005 to 780 and the average size increased from 152 to 338 acres.

Farms larger than 500 acres increased from 48 in 1964 to 65 in 1969, but farms smaller than 500 acres decreased from 957 to 715. Of the net decrease of 225 farms, 187 farms, or 83 percent, were smaller than 100 acres. Of the farm operators in the county in 1969, 544 were full owners, 176 were part owners, and 60 were tenants. Of these operators, 527, or about 68 percent, held jobs off the farm, and 467 of them worked off the farm for 100 days or more.

Physiography and Drainage

The Arkansas River flows eastward and forms the northern boundary of the county. Its flood plain is a relatively narrow strip that parallels the course of the river. The most fertile soils in the county, those of the Norwood and Severn series, are in this area. The flow of the Arkansas River is regulated by major flood control impoundments upstream and by a series of locks and dams that form navigable pools. The Arkansas River is navigable to barge traffic all year round. It is used as a source of sand and gravel in commercial quantities. This river provides recreational facilities for fishing, boating, and waterfowl hunting. The Poteau River joins the Arkansas River at the west side of Fort Smith, and it forms a part of the State boundary with Oklahoma.

The southern part of Sebastian County is mountainous. In this area steep, stony mountains rise from the Arkansas Valley. The crest of Poteau Mountain forms the south boundary of the county. The north slope of Poteau Mountain is drained by Big and Little Cedar Rapids, Sugar Loaf Creek, West Creek, James Fork, and Rock Creek.

The Sugar Loaf Mountains lie just north of Hartford and rise to a height of about 2,100 feet above sea level. They are drained by Sugar Loaf Creek, School House Branch, Johnson Branch, and Riddle Creek. These mountains are capped by sandstone. The sides of these mountains are interbedded sandstone and shale. The slope ranges from 3 to 40 percent. The elevation ranges from about 700 feet in the stream valleys to about 2,670 feet on the mountaintops.

The Arkansas Valley, which makes up most of the rest of the county, consists of rolling, flat-topped hills, long narrow ridges, and broad valleys. The hilltops and ridges are capped by hard sandstone. The hillsides and valleys are mostly underlain by shale. The slope ranges from 1 to 30 percent. The elevation ranges about 400 to about 1,000 feet. This area is drained by streams, such as James Fork Creek, Vache Grasse Creek, Little Vache Grasse Creek, Doctors Creek, Big Creek, Cherokee Creek, and Prairie Creek.

The main soils on the mountaintops and hilltops are Linker and Mountainburg soils. Enders and Mountainburg soils are the main soils on the narrow ridges, and Leadville, Taft, and Wrightsville soils are the main soils in the broad valleys. Ground water is insufficient for large-scale irrigation. Domestic water is supplied mainly by dug wells and drilled wells; livestock water is supplied mainly by ponds and creeks.

Climate [1]

Sebastian County is in western Arkansas adjacent to the State of Oklahoma. It is bounded on the north by the Arkansas River. To the south of the river flood plain, the terrain consists of broken hills separated by creeks and small rivers. This gives way to more distinctly mountainous terrain in the southern part of the county. The extreme southern part of the county lies within the Ouachita National forest.

The climate of Sebastian County, like that of most of Arkansas, is one of generally warm summers and mild winters. Although the county is within reach of cold arctic outbreaks, these generally are of short duration. The Boston Mountains to the north of Sebastian County, mainly 1,700 to 2,400 feet in elevation, provide a barrier that retards the penetration of cold air from the north in winter. Winters, therefore, are relatively free of severe cold, and outdoor work can be done during most of the winter.

Summer temperatures, especially in the valleys, occasionally rise to uncomfortable heights on the hottest days. The mountainous areas, however, afford some relief. Resorts and cottages are located in these mountainous areas, such as the area around Sugarloaf Lake. In the southern part of the county, the mountainous areas have significantly more precipitation because of the lifting effect

[1] By ELDEN V. JETTON, meteorologist, National Weather Service, U.S. Department of Commerce, Little Rock.

imparted to moist air flowing northward from the Gulf of Mexico. Table 1 is a climatic summary of temperature and precipitation at Fort Smith and is considered representative for most of the county.

Fort Smith, the main city of the county, is at the confluence of the Poteau and Arkansas Rivers. It has recorded maximum temperatures of 90° F. or more on an average of 72 days each year. An all-time high of 113° was recorded in August 1936. Minimum temperatures of 32° or less have been recorded on an average of 81 days each year. The all-time low of −15° occurred in February 1899.

The average length of the growing season is 223 days. The average date of the first freezing temperature (32°) in fall is November 4, and the average date of the last in spring is March 26. The earliest recorded freezing temperature in fall occurred on October 9, and the latest in spring on April 17. The average date of the first 28° reading in fall is November 18, and the average date of the latest in spring is March 15. The earliest date that a temperature of 28° has been recorded in fall is October 19, and the latest recorded in spring is April 4.

Precipitation is ample for most crops. Spring is the wettest season; the month of May generally receives the most rainfall. A total of more than 7 inches occasionally falls in a single storm. Winter normally is the driest season, although August commonly exhibits a significant minimum in precipitation.

The mean annual rainfall ranges from about 42 inches in the northern part of the county to 46 inches or more in the southern part. Annual extremes in the Fort Smith area range from 19.80 inches to 71.81 inches.

Snowfall averages about 5 inches annually in the northern part of the county and somewhat more in the mountainous areas of the southern part. In these areas snowfall is considerable. Along the Arkansas River Valley, snowfall is light. A fall of 1 inch or more occurs on an average of only 3 days a year. The maximum 24-hour snowfall recorded in the Fort Smith area occurred in February 1921, a fall of 17.5 inches.

Evaporation rates in summer can be as high as a third of an inch per day. As a result, a considerable amount of soil moisture may be lost in periods that have abundant sunshine and high temperature.

Although cumulus clouds are evident almost daily in summer, thunderstorms occur on the average of 56 days a year in the Fort Smith area, mainly during the months of April through August. Severe local storms are infrequent, even though Sebastian County is not far from the tornado-alley area in Oklahoma. Between October 1958 and September 1968, however, seven tornadoes were reported in the county.

Droughts are less frequent than in the Plains States. Severe to extreme droughts, which only the hardiest native plants can survive, occur on an average of every 10 to 15 years and last from 3 to 5 months. The most extended drought of recent years was in the period 1954 to 1957, during which there were 23 consecutive months of drought.

The bottom lands are fertile and produce large yields of soybeans, hay, and such crops as beans and spinach. Because the average winter does not bring severe cold, two or more crops can generally be raised in one year. This is especially true of spinach, of which three or four crops can be harvested. The uplands, although they are not so fertile as the lowlands, provide grazing throughout most of the year because the temperature is mild and rainfall is adequate in winter.

The climate is suited to growing vegetables, fruits, and berries. Among the principal crops are peaches, pears, apples, strawberries and boysenberries. The mild winters and abundant rainfall are conducive to plant growth.

TABLE 1.—*Temperature and precipitation data*

[All data from Fort Smith, for the period 1941 through 1970]

Month	Temperature				Precipitation		
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with— Maximum temperature equal to or higher than—	Two years in 10 will have at least 4 days with— Minimum temperature equal to or lower than—	Average total	One year in 10 will have— Less than—	One year in 10 will have— More than—
	° F.	° F.	° F.	° F.	Inches	Inches	Inches
January	49.7	28.6	78	3	2.38	0.61	4.72
February	54.3	32.5	78	12	3.20	1.06	5.80
March	62.4	39.5	85	17	3.52	1.40	6.08
April	74.1	50.8	91	29	4.74	1.70	8.50
May	81.6	59.5	94	41	5.48	1.99	8.79
June	89.2	67.3	100	53	3.93	.65	5.70
July	93.6	71.0	104	57	3.24	.53	7.18
August	93.2	69.7	106	56	2.91	1.27	5.17
September	86.0	62.1	100	44	3.31	.60	5.57
October	76.3	50.4	93	30	3.47	.57	8.41
November	62.5	38.5	82	17	3.08	.62	6.09
December	52.0	31.2	79	8	2.89	.80	5.42
Year	72.9	50.1			42.15		

Small wild game is plentiful. The streams and lakes generally are well filled with water and provide habitat for game fish.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Sebastian 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 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.

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. Sallisaw and Wrightsville, 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 layer 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, Sallisaw loam, 3 to 8 percent slopes, is one of three phases within the Sallisaw 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 at the back of this publication was prepared from aerial photographs.

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. Three such kinds of mapping units are shown on the soil map of Sebastian County: soil complexes, soil associations, 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 a 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. Generally, the name of a soil complex consists of the names of the dominant soil or soils, joined by a hyphen. Wrightsville-Messer complex is an example.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on a soil map but are shown as one unit because the time and effort of delineating them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. The name of an association consists of the names of the dominant soils, joined by a hyphen. Enders-Mountainburg association, rolling, 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 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. Crevasse soils is an example in this county.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and engineering tests. Laboratory data from the same kind of soil in other places are also 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 soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants and as material for structures, as foundations for structures, or as covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or a high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil, and they relate this failure to the high shrink-swell potential of the soil material. Thus they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They 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 current methods of use and management.

The soil map of Sebastian County joins that of the published soil survey of Franklin County, Arkansas. Differences in the names of a few adjoining mapping units are the result of changes in series concepts created by the adoption in 1965 of the Comprehensive System of Soil Classification.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Sebastian 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 land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in Sebastian County are discussed in the following pages. Unless otherwise stated, the terms for texture used in the descriptive heading of each association apply to the surface layer of the major soils.

The soil associations of this county do not precisely join those of Franklin County, to the east. This is because some soils that are major in one county are minor or do not occur in the other county, and because of changes in the soil classification system.

1. Crevasse association

Excessively drained, level and nearly level, deep soils that are sandy throughout; on the Arkansas River flood plains

This association is on young natural levees along the Arkansas River in the northern part of the county. Slope ranges from about 0 to 2 percent.

This association makes up about 2 percent of the county. About 85 percent of the association is Crevasse soils. The remaining 15 percent is mainly Norwood and Severn soils and water areas.

Crevasse soils are excessively drained. The surface layer is dark-brown loamy fine sand. The underlying material is very pale brown, light yellowish-brown, and brown fine sand and sand.

Most areas of the soils in this association are idle or are in pasture and meadow. Some areas are cultivated, but the soils are poorly suited to this use. Droughtiness is a severe hazard. If management is good, clean-tilled crops that leave a large amount of residue can be safely grown year after year. The soils are poorly suited to soybeans and other clean-tilled warm-season crops. Forage crops and winter small grains can be grown, but establishing a stand is commonly difficult, and the crop is damaged by lack of sufficient moisture in some years. This association makes up parts of farms that range from 80 to 600 acres in size. Some farm operators have off-the-farm jobs.

Because flooding is a hazard and permeability is rapid, this association has severe limitations if used as sites for dwellings, other buildings, and systems for disposing of sewage and solid waste. Limitations are less severe for more extensive nonfarm uses.

2. Severn-Iberia-Norwood association

Well-drained and poorly drained, dominantly level, deep, loamy and clayey soils; on the Arkansas River flood plains

This association is along the Arkansas River in the northern part of the county. Slope is dominantly less than 1 percent. Severn soils are intermingled with Norwood soils on the landscape and generally are in the higher parts of the association adjacent to association 1. Iberia soils are in the lowest parts and commonly are farther from the river.

This association makes up about 3 percent of the county. About 40 percent of the association is Severn soils, 20 percent is Iberia soils, and 10 percent is Norwood soils. The remaining 30 percent is mainly Crevasse, McKamie, and Muskogee soils and water areas.

Severn soils are well drained. The surface layer is dark-brown silt loam. The underlying material is brown and reddish-brown, stratified silt loam and very fine sandy loam underlain by very pale brown and reddish-yellow sand and loamy fine sand.

Iberia soils are poorly drained. The surface layer is very dark gray clay. The subsoil is very dark gray and dark grayish-brown, mottled clay underlain by dark reddish-gray clay.

Norwood soils are well drained. The surface layer is reddish brown. The upper part of this layer is silty clay loam, and the lower part is silt loam. The underlying material is brown, dark-brown, and reddish-brown, stratified silt loam, very fine sandy loam, and silty clay loam. This overlies dark reddish-brown clay and thinly stratified, brown to reddish-brown silt loam and loamy fine sand.

The soils in this association are suited to cultivated crops, and most of the acreage is cultivated. The main crops are soybeans, alfalfa, and winter small grains. If management is good and includes adequate drainage of the poorly drained areas, clean-tilled crops that leave a large amount of residue can be safely grown year after year. Most farms are between 40 and 600 acres in size. Some farm operators have off-the-farm jobs.

Because flooding is a hazard, and the soils are wet and have high shrink-swell potential in some places, this association has severe limitations if used as sites for dwellings, other buildings, and systems for disposing of sewage and solid waste. Except on the Iberia soils, limitations are less severe for more extensive nonfarm uses.

3. Leadvale-Taft association

Moderately well drained and somewhat poorly drained, level to gently sloping, deep, loamy soils that have a fragipan; in valleys

This association is on old stream terraces in valleys between hills and ridges throughout the county. Slope ranges from 0 to 8 percent. The nearly level and gently sloping Leadvale soils are in the higher parts of the valleys, adjacent to the hills and ridges. The level Taft soils are generally in the middle parts of the valleys.

This association makes up about 51 percent of the county. About 45 percent of the association is Leadvale soils, and 15 percent is Taft soils. The remaining 40 percent is mainly Barling, Cane, Cleora, Enders, McKamie, Mountainburg, Muskogee, Sallisaw, Wing, and Wrightsville soils and strip-mined areas.

Leadvale soils are moderately well drained. The surface layer is silt loam that is dark brown in the upper part and brown in the lower part. The upper part of the subsoil is yellowish-brown, friable silt loam and silty clay loam. The lower part is a fragipan of mottled, firm and brittle silty clay loam. Depth to the fragipan is 18 to 30 inches. Depth to bedrock ranges from about 5 feet to more than 10 feet.

Taft soils are somewhat poorly drained. The surface layer is dark grayish-brown silt loam that is mottled with yellowish brown in the lower few inches. The upper part of the subsoil is brown and light brownish-gray, mottled, friable silt loam. The middle part is a fragipan of mottled, firm and brittle silty clay loam. The lower part is yellowish-brown, mottled, friable silty clay loam. Depth to the firm and brittle layer is 20 to 30 inches. Depth to bedrock generally is more than 7 feet.

Most areas of the soils in this association are used for pasture and meadow. The soils are suited to such crops as soybeans, grain sorghum, winter small grains, and truck crops, and these are grown in a few areas. If management is good and includes erosion control on slopes and improved drainage in the level areas, much of the association is fairly suitable for cultivated crops. Most farms are 10 to 2,000 acres in size. The farms are operated by the owners. Operators of many of the small farms have off-the-farm jobs.

Because the soils have low bearing strength, low traffic-supporting capacity, and restricted permeability, and because some of the soils are wet, this association has moderate to severe limitations for dwellings, other buildings, or highways. It has moderate to severe limitations for systems that dispose of sewage and solid waste because of the slow percolation rate, soil wetness, and the seasonal high water table.

4. Mountainburg-Linker association

Well-drained, gently sloping to steep, shallow and moderately deep, loamy soils; on ridges and hilltops

This association is mainly on hilltops and sides of low ridges throughout the county, but the largest area is on the Fort Chaffee Military Reservation. Slope ranges from about 3 to 35 percent. The soils are intermingled on the landscape, but the Linker soils are mainly on the gently sloping parts of hilltops, where bedrock is more deeply weathered.

This association makes up about 17 percent of the county. About 70 percent of the association is Mountainburg soils, and about 11 percent is Linker soils. The remaining 19 percent is mainly Cane, Enders, Leadvale, and Montevallo soils.

Mountainburg soils are well drained. The surface layer is dark-brown sandy loam or stony sandy loam. The upper part of the subsoil is reddish-brown sandy loam that is gravelly or stony in some areas. The lower part is yellowish-red gravelly or stony fine sandy loam. Sandstone bedrock is at a depth of 12 to 20 inches.

Linker soils are well drained. The surface layer is dark-brown fine sandy loam. The subsoil is mainly yellowish-red or red sandy clay or clay loam. Sandstone bedrock is at a depth of 24 to 40 inches.

Most of the soils in this association are too shallow, too droughty, too stony, and too steep for cultivation. Most areas have been cleared and are used for pasture and hay crops. Some of the areas are reverting to trees, chiefly those of poor quality. Most of the farms are 20 to 500 acres in size. Most of the farm operators hold off-the-farm jobs.

The Linker soils in the association are suitable as sites for dwellings, but the association generally has severe limitations for dwellings, other buildings, roads, and other nonfarm uses because of slope, stoniness, and the limited depth to bedrock.

5. Wrightsville association

Poorly drained, dominantly level, deep, loamy soils; on old stream terraces in broad valleys

This association is on river terraces and in broad valleys, mainly in the northwestern part of the county. One area is in the central part. Slope is mainly less than 1 percent but ranges to as much as 2 percent.

This association makes up about 5 percent of the county. About 60 percent of the association is Wrightsville soils. The remaining 40 percent is mainly Leadvale, Messer, McKamie, Muskogee, Taft, and Wing soils; soils that are similar to the Wrightsville but have a higher content of sodium in the lower part of the subsoil; and strip-mined areas.

Wrightsville soils are poorly drained. The surface layer is dark grayish-brown silt loam. The subsurface layer is light brownish-gray, mottled silt loam. The upper part of the subsoil is gray and light brownish-gray, mottled silty clay and clay, and the lower part is reddish-brown, mottled clay.

Urban areas have expanded into parts of this association, but most areas are used for native-grass pasture, improved pasture, and meadow. The soils are suited to such crops as soybeans, grain sorghum, and winter small grains, and these are grown in a few areas. If management is good and includes surface drainage in the level areas, this association is fairly suitable for cultivated crops. Most of the farms are 40 to 1,000 acres in size and are operated by the owners. Many of the farmers have off-the-farm jobs.

Because the soils are wet, and because they have low bearing strength, high shrink-swell potential, low traffic-supporting capacity, and slow percolation, this association has severe limitations if used as sites for dwellings, other buildings, highways, septic tank absorption fields, and other nonfarm uses.

6. Enders-Mountainburg association

Well-drained, gently sloping to steep, deep and shallow, loamy soils; on hills, mountains, and ridges

This association is on hills and mountains and on sides of ridges, mainly in the central and southern parts of the county. Slope ranges from 3 to 40 percent. About 13,000 acres of this association is within the Ouachita National

Forest in the southern part of the county. The Enders soils are mainly on foot slopes and on hillsides and mountainsides between sandstone ledges and benches. Mountainburg soils are on the tops of hills and mountains, on ledges and benches, and on sides of ridges.

This association makes up about 20 percent of the county. About 54 percent of the association is Enders soils, and 34 percent is Mountainburg soils. The remaining 12 percent is mainly Cleora, Linker, and Montevallo soils.

Enders soils are well drained. The surface layer is very dark grayish-brown silt loam that is gravelly or stony in many areas. The upper part of the subsoil is dark-brown silt loam, the middle part is yellowish-red silty clay, and the lower part and the underlying material are brown, mottled silty clay. Shale bedrock is at a depth of about 3½ to 7 feet.

Mountainburg soils are well drained. The surface layer is dark-brown sandy loam that is gravelly or stony in many areas. The upper part of the subsoil is reddish-brown gravelly or stony sandy loam, and the lower part is yellowish-red gravelly or stony fine sandy loam. Sandstone bedrock is at a depth of 12 to 20 inches.

The soils in this association generally are too steep and too stony for cultivation. Most of the association is wooded (fig. 2). Enders soils are fairly suitable for wood crops, and most areas have fair to good stands of mixed pine and hardwood. Mountainburg soils generally have more open stands of poorer quality trees. Except within the boundary of the Ouachita National Forest, this association is in ownerships that range from 40 to 3,000 acres in size. Most farms are operated by the owners. Many of the farmers have off-the-farm jobs.

Because the soils are stony and sloping to steep, are shallow to bedrock, or have a slow percolation rate, this association has severe limitations if used as sites for dwellings and other buildings, highways, and other nonfarm uses.

7. *Sallisaw association*

Well-drained, nearly level and gently sloping, deep, loamy soils; on stream terraces

This association is on stream terraces along the drainageways from Poteau Mountain in the southwestern part of the county. Slope ranges from about 1 to 8 percent.

This association makes up about 2 percent of the county. About 85 percent of the association is Sallisaw soils. The remaining 15 percent is mainly Barling, Cane, Leadvale, Linker, Mountainburg, and Taft soils.

Sallisaw soils are well drained. The surface layer is dark-brown loam that is stony in some areas. The subsoil is reddish-brown, yellowish-red, and red loam and sandy clay loam that is gravelly or stony in some areas.

Except for the stony areas, the soils of this association are suitable for cultivation if management is good and includes treatment to control erosion. Most areas are used for pasture or meadow, and some are wooded. Most of the farms are 40 to 400 acres in size and are operated by the owners. Many of the farmers have off-the-farm jobs.

Figure 2.—Sugarloaf Lake lies among wooded ridges and mountains of the Enders-Mountainburg association in the southern part of the county. This lake provides water-based recreation.

Most of this association has slight to moderate limitations if used as sites for dwellings and other buildings, highways, and other nonfarm uses.

Descriptions of the Soils

This section describes the soil series and mapping units in Sebastian County. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile; that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit. Color terms are for moist soil unless otherwise stated.

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 each description of a mapping unit is the capability unit, range site, and woodland group in which the mapping unit has been placed. The "Guide to Mapping Units," at the back of this survey, shows all the mapping units in the county. It also shows the capability unit, woodland group, and range site in which each mapping unit has been placed, and it lists the page where the range site is described.

The acreage and proportionate extent of each mapping unit are shown in table 2. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*12*).[2]

TABLE 2.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent
	Acres	*Percent*
Barling silt loam	4,074	1.2
Cane fine sandy loam, 3 to 8 percent slopes	16,828	5.0
Cleora fine sandy loam	349	.1
Crevasse soils	7,783	2.3
Enders silt loam, 3 to 8 percent slopes	1,642	.5
Enders silt loam, 1 to 12 percent slopes	968	.3
Enders stony silt loam, 12 to 30 percent slopes	8,999	2.7
Enders-Mountainburg association, rolling	29,546	8.8
Enders-Mountainburg association, steep	49,500	14.7
Iberia clay	2,179	.7
Leadvale silt loam, 1 to 3 percent slopes	41,779	12.4
Leadvale silt loam, 3 to 8 percent slopes	42,179	12.5
Linker fine sandy loam, 3 to 8 percent slopes	6,995	2.1
McKamie silt loam, 3 to 8 percent slopes	1,290	.4
Montevallo gravelly loam, 3 to 12 percent slopes	2,639	.8
Mountainburg sandy loam, 3 to 12 percent slopes	24,974	7.4
Mountainburg stony sandy loam, 3 to 12 percent slopes	19,972	5.9
Mountainburg stony sandy loam, 12 to 35 percent slopes	6,888	2.0
Muskogee silt loam, 3 to 8 percent slopes	3,772	1.1
Norwood silty clay loam	1,098	.3
Sallisaw loam, 1 to 3 percent slopes	2,736	.8
Sallisaw loam, 3 to 8 percent slopes	3,225	.9
Sallisaw stony loam, 1 to 8 percent slopes	3,254	.9
Severn silt loam	4,410	1.3
Taft silt loam	27,490	8.2
Wing silt loam	699	.2
Wrightsville silt loam	2,688	.8
Wrightsville complex, 0 to 2 percent slopes	10,369	3.1
Wrightsville-Messer complex	6,490	1.9
Strip mines	2,465	.7
Total	337,280	100.0

Barling Series

The Barling series consists of moderately well drained, level soils on flood plains of local streams. These soils formed in loamy sediment washed from uplands of weathered sandstone and shale. The native vegetation was mixed hardwood trees.

In a representative profile the surface layer is silt loam about 11 inches thick. The upper 5 inches of the surface layer is dark brown, and the lower 6 inches is dark grayish brown. The subsoil extends to a depth of 72 inches or more. The upper 8 inches of the subsoil is dark-brown silt loam; the next 7 inches is dark-brown, mottled silt loam; the next 10 inches is mottled, grayish-brown and dark yellowish-brown silt loam; and the lower 36 inches is dark yellowish-brown, mottled silt loam.

Barling soils are moderate in natural fertility. Permeability is moderate, and the available water capacity is high.

Most areas of these soils are subject to occasional flooding. Nearly all areas have been cleared and are cultivated or used for pasture. The soils respond well to fertilization. They are easy to till and can be cultivated throughout a wide range of moisture content.

Representative profile of Barling silt loam, in a moist pasture in the SE¼SE¼SE¼ sec. 21, T. 7 N., R. 31 W.:

Ap—0 to 5 inches, dark-brown (10YR 4/3) silt loam; weak, fine, granular structure; friable; many fine roots; few pores; strongly acid; clear, smooth boundary.

A12—5 to 11 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, subangular blocky structure; friable; many fine roots; few pores; medium acid; clear, smooth boundary.

B1—11 to 19 inches, dark-brown (10YR 4/3) silt loam; weak, medium, subangular blocky structure; friable; many fine roots; few pores; slightly acid; clear, smooth boundary.

B21—19 to 26 inches, dark-brown (10YR 4/3) silt loam; common, medium, faint, grayish-brown (10YR 5/2) mottles; weak, medium, subangular blocky structure; friable; common fine roots; few pores; slightly acid; gradual, smooth boundary.

[2] *Italic numbers in parentheses refer to Literature Cited, p. 64.*

B22—26 to 36 inches, mottled grayish-brown (10YR 5/2) and dark yellowish-brown (10YR 4/4) silt loam; weak, medium, subangular blocky structure; friable; few fine roots; common pores; medium acid; gradual, smooth boundary.

B23—36 to 54 inches, dark yellowish-brown (10YR 4/4) silt loam; common, coarse, distinct, gray (10YR 6/1) mottles; weak, medium, subangular blocky structure; friable; few fine roots; common pores; strongly acid; gradual, smooth boundary.

B24—54 to 72 inches, dark yellowish-brown (10YR 4/4) silt loam; common, coarse, distinct, gray (10YR 6/1) mottles; weak, medium, subangular blocky structure; friable; few fine roots; common pores; medium acid.

The A horizon ranges from dark brown and dark grayish brown to grayish brown. The B horizon is silt loam or loam. The B1 and B21 horizons range from brown or dark brown to yellowish brown. The B22 horizon and subsequent subhorizons of the B horizon are dark yellowish brown or yellowish brown mottled with shades of gray. In some profiles, one or more subhorizons of the B horizons are very fine sandy loam. Reaction ranges from strongly acid to slightly acid throughout.

Barling soils are associated with Cleora, Sallisaw, and Taft soils. They have an A1 or Ap horizon of higher value than Cleora soils and have a B horizon that is lacking in those soils. They have gray mottles in the lower horizons, but the Cleora and Sallisaw soils do not. Barling soils lack a B horizon of clay accumulation that Sallisaw soils have. They are better drained than Taft soils and do not have the fragipan of those soils.

Barling silt loam (Ba).—This soil is on flood plains of small streams. Slope is less than 1 percent. Areas are long and narrow, and they range from 50 to 120 acres in size. Included with this soil in mapping are spots of Cleora, Sallisaw, and Taft soils.

This soil is suited to farming. Most areas are flooded occasionally, but floods rarely occur between June and January. If management is good, clean-tilled, warm-season crops that leave a large amount of residue can be safely grown year after year.

This soil is used mainly for pasture or meadow. Among the suitable crops are corn, grain sorghum, soybeans, and truck crops. Winter small grains can be grown, but the crop may be damaged by floods in some years. Adapted pasture plants are bermudagrass, tall fescue, bahiagrass, and white clover. Capability unit IIw-1; woodland group 2o7; not in a range site.

Cane Series

The Cane series consists of moderately well drained, gently sloping soils on colluvial foot slopes and old stream terraces in broad valleys on uplands. These soils formed in loamy sediment that was washed from weathered sandstone and shale on uplands. The native vegetation is mainly mixed hardwoods and some pines.

In a representative profile the surface layer is brown fine sandy loam about 5 inches thick. The subsoil extends to a depth of 72 inches or more. The upper 4 inches of the subsoil is yellowish-red, friable loam; the next 16 inches is yellowish-red, friable clay loam; and the lower 47 inches is a firm, brittle fragipan. The upper 15 inches of the fragipan is red, mottled clay loam; the next 16 inches is mottled light brownish-gray and red clay loam; and the lower 16 inches is mottled light-gray, strong-brown, and red clay loam.

Cane soils are low in natural fertility. Permeability is slow, and the available water capacity is moderate. The firm, brittle fragipan in the subsoil restricts the penetration of roots and slows the movement of water through the soil.

Most areas of these soils are cleared and were cultivated in the past, but they are now used for pasture and meadow. These soils respond well to fertilization. They are easy to till and can be cultivated throughout a wide range of moisture content.

Representative profile of Cane fine sandy loam, 3 to 8 percent slopes in a moist pasture in the SE¼NE¼NE¼ sec. 21, T. 7 N., R. 31 W.:

Ap—0 to 5 inches, brown (7.5YR 5/4) fine sandy loam; weak medium, granular structure; friable; many fine roots; few pores; medium acid; clear, smooth boundary.

B1—5 to 9 inches, yellowish-red (5YR 5/6) loam; weak, medium, subangular blocky structure; friable; many fine roots; few pores; few, fine, angular sandstone fragments; medium acid; clear, smooth boundary.

B2t—9 to 25 inches, yellowish-red (5YR 5/8) clay loam; moderate, medium, subangular blocky structure; friable; patchy clay films on faces of peds; common fine roots; few pores; few, fine, angular sandstone fragments; strongly acid; clear, wavy boundary.

Bx1—25 to 40 inches, red (2.5YR 4/6) clay loam; many, coarse, prominent, pale-brown (10YR 6/3) mottles and common, coarse, prominent, strong-brown (7.5YR 5/6) mottles; moderate, medium, subangular blocky structure; firm, brittle; patchy clay films on faces of peds; few fine roots on faces of peds; common pores; few, fine, dark-colored concretions; strongly acid; gradual, wavy boundary.

Bx2—40 to 56 inches, mottled light brownish-gray (10YR 6/2) and red (2.5YR 4/6) clay loam; moderate, medium, subangular blocky structure; firm, brittle; patchy clay films on faces of peds; few fine roots on faces of peds; common pores; common, medium, dark-colored concretions; strongly acid; gradual, wavy boundary.

Bx3—56 to 72 inches, mottled light-gray (10YR 7/1), strong-brown (7.5YR 5/6), and red (2.5YR 4/6) clay loam; weak, medium, subangular blocky structure; firm, brittle; patchy clay films on faces of peds; common pores; strongly acid.

The A horizon is dark grayish brown to brown. The B1 horizon is strong brown or yellowish red. The B2t horizon is strong-brown or yellowish-red loam or clay loam. Depth to the Bx horizon ranges from 20 to 30 inches. This horizon is loam to silty clay loam. Depth to bedrock is 60 to more than 90 inches. Reaction is medium acid or strongly acid in the A and B1 horizons and strongly acid or very strongly acid below.

Cane soils are associated with Enders, Leadvale, and Sallisaw soils. They have a fragipan, but Enders and Sallisaw soils do not. They have a coarser textured B horizon than Enders soils. Cane soils have a redder, coarser textured B horizon than Leadvale soils.

Cane fine sandy loam, 3 to 8 percent slopes (CaC).—This soil is on colluvial foot slopes and old stream terraces in broad valleys. Areas range from 5 to 120 acres in size. Included with this soil in mapping are a few small areas where slopes are as much as 12 percent, and a few spots of Enders, Leadvale, and Sallisaw soils.

This soil is suited to farming. Runoff is medium to rapid, however, and the hazard of erosion is severe. If management is good and includes contour cultivation and terraces, clean-tilled crops that leave a large amount of residue can be safely grown year after year in the less sloping areas. Conservation treatment needs to be intensified as slope increases.

This soil is used mainly for pasture or meadow (fig. 3). Suitable crops are corn, grain sorghum, soybeans, winter small grains, and truck crops. Adapted pasture plants

Figure 3.—The harvesting of an excellent crop of hay from a meadow of Pensacola bahiagrass. The soil is Cane fine sandy loam, 3 to 8 percent slopes.

are bahiagrass, bermudagrass, tall fescue, white clover, and annual lespedeza. Capability unit IIIe-1; woodland group 3o7; not in a range site.

Cleora Series

The Cleora series consists of well-drained, level soils on flood plains of local streams. These soils formed in loamy sediment that was washed from uplands of weathered sandstone and shale. The native vegetation was mixed hardwood trees.

In a representative profile the surface layer is fine sandy loam about 16 inches thick. The upper 7 inches of this layer is dark brown, and the lower 9 inches is brown. The underlying material is dark yellowish-brown and yellowish-brown fine sandy loam.

Cleora soils are moderate in natural fertility. Permeability is moderately rapid, and the available water capacity is moderate.

Most areas of these soils are subject to occasional flooding. Nearly all areas have been cleared and are cultivated or used for pasture and meadow. The soils respond well to fertilization. They are easy to till and can be cultivated throughout a wide range of moisture content.

Representative profile of Cleora fine sandy loam, in a moist woodland in the NE¼NW¼NW¼ sec. 7, T. 7 N., R. 30 W.:

O1—½ inch to 0, matted hardwood twigs and leaves.

A11—0 to 7 inches, dark-brown (10YR 3/3) fine sandy loam; weak, medium, granular structure; friable; many fine and medium roots; common pores; medium acid; clear, smooth boundary.

A12—7 to 16 inches, brown (10YR 4/3) fine sandy loam; weak, medium, subangular blocky structure; friable; common fine and medium roots; common pores; strongly acid; gradual, smooth boundary.

C1—16 to 23 inches, dark yellowish-brown (10 YR 4/4) fine sandy loam; weak, medium, subangular blocky structure; friable; common fine roots; common pores; medium acid; gradual, smooth boundary.

C2—23 to 37 inches, dark yellowish-brown (10YR 4/4) fine sandy loam; weak, medium, subangular blocky structure; friable; few fine roots; common pores; medium acid; gradual, smooth boundary.

C3—37 to 72 inches, yellowish-brown (10YR 5/4) fine sandy loam; massive; friable; few fine roots; common pores; medium acid.

The A11 or Ap horizon ranges from dark brown to very dark grayish brown. The A12 horizon is brown or dark brown. The C horizon is yellowish-brown to dark-brown fine sandy loam or loam. Some profiles have thin strata of brown or pale-brown sandy loam within the C horizon. Reaction is medium acid or strongly acid throughout.

These soils have a slightly thinner, dark-brown A horizon than is defined as the range for the series, but this difference does not alter the usefulness and behavior of the soils.

Cleora soils are associated with Barling, Sallisaw, and Taft soils. They lack the B horizon of all those soils. Cleora soils do not have the gray mottles in the lower horizons that are in Barling soils. They are browner and coarser textured than the Taft soils, and they lack the gray, mottled fragipan of those soils.

Cleora fine sandy loam (Cr).—This soil is on flood plains of small streams. Slope is less than 1 percent. Areas are long and narrow and range from 10 to 40 acres in size. Included with this soil in mapping are spots of Barling and Taft soils.

This soil is suited to farming. Most areas are flooded occasionally, but floods rarely occur between June and January. If management is good, clean-tilled, warm-season crops that leave a large amount of residue can be safely grown year after year.

This soil is used mainly for pasture or meadow. Among the suitable crops are corn, grain sorghum, soybeans, and truck crops. Winter small grains can be grown, but the crop may be damaged by floods in some years. Adapted pasture plants are bermudagrass, tall fescue, bahiagrass, and white clover. Capability unit IIw-1; woodland group 2o7; not in a range site.

Crevasse Series

The Crevasse series consists of excessively drained, level and nearly level soils on young natural levees along the Arkansas River. These soils formed in mixed sandy sediment brought in from the west by the Arkansas River. The native vegetation was mixed hardwood trees.

In a representative profile the surface layer is dark-brown loamy fine sand about 8 inches thick. The underlying material is very pale brown, light yellowish-brown, and brown fine sand and sand.

Crevasse soils are low in natural fertility. Permeability is rapid, and the available water capacity is low.

These soils are fairly suitable for forage crops that are adapted to the local climate. Most of the acreage is in pasture, in meadow, or idle. Some of it is cultivated. These soils are subject to infrequent flooding in winter, but this does not seriously limit their use for farming. They respond poorly to fertilization, but they are easy to till and can be cultivated over a wide range of moisture content.

Representative profile of Crevasse loamy fine sand, in a moist meadow in the SW¼NE¼NE¼ sec. 1, T. 8 N., R. 32 W.:

Ap—0 to 8 inches, dark-brown (7.5YR 4/4) loamy fine sand; weak, medium, granular structure; very friable; many fine and medium roots; moderately alkaline; abrupt, smooth boundary.

C1—8 to 20 inches, very pale brown (10YR 7/4) fine sand; medium to coarse, platy structure; loose; common fine roots; many bedding planes; moderately alkaline; calcareous; abrupt, smooth boundary.

C2—20 to 28 inches, light yellowish-brown (10YR 6/4) fine sand; medium to coarse, platy structure; loose, common fine roots; many bedding planes; moderately alkaline; calcareous; abrupt, smooth boundary.

C3—28 to 35 inches, brown (7.5YR 5/4) fine sand; medium to coarse, platy structure; loose; few fine roots; many bedding planes; moderately alkaline; calcareous; abrupt, smooth boundary.

C4—35 to 72 inches, very pale brown (10YR 7/4) sand; medium to coarse, platy structure; loose; few fine roots; many bedding planes; moderately alkaline; calcareous.

The A horizon is dark-brown to yellowish-brown loamy fine sand, loamy sand, or fine sand. The C horizon is brown, pale-brown, very pale brown, yellowish-brown, or light yellowish-brown sand, fine sand, or loamy sand in subhorizons without regular sequence. Reaction is slightly acid to moderately alkaline throughout.

Crevasse soils are associated with Norwood and Severn soils. They are more sandy and more rapidly drained than those soils.

Crevasse soils (Cv).—The soils in this undifferentiated group are on young natural levees along the Arkansas River. Slope ranges from 0 to 2 percent. Areas range from 20 to 1,000 acres in size. The surface layer is loamy fine sand, loamy sand, or fine sand. Included with these soils in mapping are a few spots of Norwood and Severn soils.

The soils in this mapping unit are poorly suited to farming. Because of the low available water capacity, droughtiness is a very severe limitation. Soil blowing is a severe hazard in spring if the soil is left bare. If management is good, clean-tilled crops that leave a large amount of residue can be safely grown year after year.

These soils are used mainly for forage crops. Winter small grains can be grown, but establishing a stand is often difficult, and the crop is damaged in places by lack of sufficient moisture. These soils are poorly suited to soybeans and other clean-tilled, warm-season crops (fig. 4). Adapted forage plants are bermudagrass, bahiagrass, johnsongrass, and crimson clover. Capability unit IVs-1; woodland group 3s8; not in a range site.

Enders Series

The Enders series consists of well-drained, gently sloping to steep soils on the sides of hills, mountains, and ridges on uplands. These soils formed in a thin layer of loamy material and the underlying clayey material that has weathered from shale. The native vegetation is hardwood trees or mixed pines and hardwoods.

In a representative profile the surface layer is very dark grayish-brown silt loam about 3 inches thick. The upper 4 inches of the subsoil is dark-brown silt loam. The next 29 inches is yellowish-red silty clay, and the lower 12 inches is brown, mottled silty clay. The underlying material is brown, mottled silty clay that extends to a depth of 72 inches or more.

Enders soils are low in natural fertility. The surface layer is thin, and root penetration into the subsoil is restricted. Permeability is very slow, and the available water capacity is high.

These soils are generally unsuitable for cultivation. They are better suited to pasture, wildlife habitat, and woodland. A small acreage has been cleared, but most areas are wooded. These soils respond fairly well to fertilization. They are difficult to stabilize where engineering structures are built.

Representative profile of Enders silt loam in an area of Enders-Mountainburg association, rolling, in a moist wooded area in the NE¼NW¼NE¼ sec. 13, T. 7 N., R. 32 W.:

O1—½ inch to 0, matted twigs and leaves from hardwood trees.

A1—0 to 3 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, medium, granular structure; very friable; many fine roots; few small sandstone and shale fragments; strongly acid; clear, wavy boundary.

B1—3 to 7 inches, dark-brown (7.5YR 4/4) silt loam; weak, medium, subangular blocky structure; friable; many fine roots; few shale fragments; strongly acid; gradual, wavy boundary.

Figure 4.—In foreground are Crevasse soils, which are droughty and poorly suited to soybeans and most other summer crops. In the background is Severn silt loam, which is well suited to summer crops.

B21t—7 to 19 inches, yellowish-red (5YR 4/6) silty clay; strong, medium, angular blocky structure; firm; continuous clay films on faces of peds; common fine roots; few pores; very strongly acid; gradual, wavy boundary.

B22t—19 to 36 inches, yellowish-red (5YR 4/8) silty clay; moderate, medium, subangular blocky structure; firm; continuous clay films on faces of peds; few fine roots; few pores; common gray shale fragments; very strongly acid; gradual, wavy boundary.

B3—36 to 48 inches, brown (7.5YR 5/4) silty clay; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; friable; few black stains on faces of peds; few, small, gray shale fragments; strongly acid; gradual, wavy boundary.

C—48 to 72 inches, brown (7.5YR 5/4) silty clay; many, medium, distinct, light-gray (10YR 6/1) mottles; weak, medium, subangular blocky and platy structure, relict of shale beds; friable; few black stains on faces of peds; many, soft, gray shale fragments; strongly acid.

The A1 horizon ranges from dark brown to very dark grayish brown and is gravelly or stony in many areas. In some profiles there is an A2 horizon of brown or yellowish-brown silt loam or loam 3 to 5 inches thick. The B1 horizon is dark-brown or brown to yellowish-red loam or silt loam. The B2t horizon is yellowish-red or red silty clay or clay. The B3 horizon is red, yellowish red, or brown and is mottled or variegated with shades of brown and gray. It is silty clay or clay. The C horizon ranges from red to brown silty clay loam to clay. Depth to shale bedrock is about 3½ to 8 feet. Reaction is strongly acid or very strongly acid throughout.

Enders soils are associated with Cane, Linker, Montevallo, and Mountainburg soils. They have more clay in the B horizon than any of those soils. They lack the fragipan of Cane soils. Enders soils are deeper to bedrock than Linker, Montevallo, and Mountainburg soils. They are underlain by shale, but Linker and Mountainburg soils are underlain by sandstone.

Enders silt loam, 3 to 8 percent slopes (EdC).—This soil is on crests and toe slopes of ridges and hills. Areas range from about 10 to 40 acres in size. Included with this soil mapping are a few spots of Cane, Linker, Montevallo, and Mountainburg soils.

This soil is poorly suited to cultivated crops. Runoff is rapid, and the hazard of erosion is very severe. In places, sown crops can be safely grown occassionally in a cropping system that includes close-growing cover most of the time. This soil is better suited to pasture, wildlife habitat, and woodland than to other uses. Adapted pasture plants are bermudagrass, tall fescue, annual lespedeza, and sericea lespedeza. Capability unit IVe-1; woodland group 4o1; Clay Break, Shale range site.

Enders silt loam, 8 to 12 percent slopes (EdD).—This soil is on toe slopes of hills. Areas range from about 10 to 160 acres in size. Included in mapping are a few spots of Cane, Linker, Montevallo, and Mountainburg soils.

This soil is not suitable for cultivation. Runoff is rapid, and the hazard of erosion is severe. The soil is better suited to pasture, wildlife habitat, and woodland than to other uses. Adapted pasture plants are bermudagrass, bahiagrass, tall fescue, annual lespedeza, and sericea lespedeza. Capability unit VIe-1; woodland group 4o1; Clay Break, Shale range site.

Enders stony silt loam, 12 to 30 percent slopes (EeE).—This soil is on toe slopes of hills. Areas range from about 10 to 100 acres in size. The profile of this soil is similar to the one described as representative for the series, except that the surface is stony. Included with this soil in mapping are a few spots of Linker, Montevallo, and Mountainburg soils.

This soil is not suitable for cultivation, and it is poorly suited to pasture. Runoff is rapid, and the hazard of erosion is very severe. This soil is better suited to woodland or wildlife habitat than to other uses. A few small areas are used for pasture or range. Surface stones and slope make pasture management difficult. Adapted pasture plants are bermudagrass, annual lespedeza, and sericea lespedeza. Capability unit VIIs-1; woodland group 4x2; Clay Break, Shale range site.

Enders-Mountainburg association, rolling (EmC).—The soils in this mapping unit are on hillsides and mountainsides. Slope ranges from 8 to 20 percent. The individual soils are in areas large enough to map separately, but they were not separated because of poor accessibility and low intensity of use. The soils generally occur in a regular pattern and in about the same relative proportions.

This association is about 50 to 65 percent Enders silt loam that is gravelly or stony in many areas and 25 to 40 percent Mountainburg gravelly or stony sandy loam. The rest is small areas of Linker and Montevallo soils and rock outcrops. Enders soils are between sandstone ledges or benches and on foot slopes. Mountainburg soils are on the narrow sandstone ledges and benches. Areas of the association range from 100 to 500 acres in size. One of the Enders soils has the profile described as representative for the Enders series; others have a profile similar to the one described, except that the surface layer is gravelly or stony. The Mountainburg soils have a profile similar to the one described as representative for the Mountainburg series, except that the surface layer is gravelly or stony.

The soils in this association are not suitable for cultivation and are poorly suited to pasture. Runoff is rapid, and the hazard of erosion is very severe. The soils are better suited to wildlife habitat or woodland than to other uses. A few small areas are used for pasture or range. Surface stones and slopes make pasture management difficult. Adapted pasture plants are bermudagrass, annual lespedeza, and sericea lespedeza. Enders part in capability unit VIIs-1; woodland group 4x2; Clay Break, Shale range site. Mountainburg part in capability unit VIIs-2; woodland group 5x3; Sandstone Ridge range site.

Enders-Mountainburg association, steep (EmE).—The soils in this mapping unit are on hillsides and mountainsides. Slope ranges from 20 to 40 percent. The individual soils are in areas large enough to map separately, but they were not separated because of poor accessibility and low intensity of use. The soils generally occur in a regular pattern and in about the same relative proportions.

This association is 45 to 65 percent Enders silt loam that is gravelly or stony in most areas and 25 to 45 percent Mountainburg gravelly or stony sandy loam. The rest is small areas of Linker and Montevallo soils and rock outcrops. Enders soils are between sandstone ledges or benches and on foot slopes. Mountainburg soils are on the narrow sandstone ledges and benches. Areas of the association range from 100 to 800 acres in size. Enders soils have a profile similar to the one described as representative for the Enders series, except that in most places they have a gravelly or stony surface layer. Mountainburg soils have a profile similar to the one described as representative for the Mountainburg series, except that the surface layer is gravelly or stony.

These soils are not suitable for cultivation. Runoff is very rapid, and the hazard of erosion is very severe. The soils are better suited to wildlife habitat or woodland than to other uses. Enders part in capability unit VIIs-1; woodland group 5r3; Clay Break, Shale range site. Mountainburg part in capability unit VIIs-2; woodland group 5x3; Sandstone Ridge range site.

Iberia Series

The Iberia series consists of poorly drained, level soils in slack-water areas along the Arkansas River. These soils formed in clayey sediment. The native vegetation was mixed hardwood trees.

In a representative profile the surface layer is very dark clay about 18 inches thick. The upper part of the subsoil is very dark gray, mottled clay about 9 inches thick. The lower part is dark grayish-brown, mottled clay about 26 inches thick. The underlying material is dark reddish-gray clay.

Iberia soils are high in natural fertility. Permeability is very slow, and the available water capacity is high.

If adequately drained, the Iberia soils are suited to most crops grown in the county. Most of the acreage is cultivated. These soils are subject to infrequent flooding in winter, but this does not seriously limit their use for farming. They respond well to fertilization. The surface layer forms clods if plowed when too wet, and it is difficult to till. Iberia soils shrink and crack when dry, and when wet they expand and the cracks seal.

Representative profile of Iberia clay, in a moist pasture in the SW¼SW¼NW¼ sec. 36, T. 8 N., R. 31 W.:

Ap—0 to 6 inches, very dark gray (10YR 3/1) clay; moderate, medium, granular structure; firm, plastic; many fine roots; slightly acid; clear, smooth boundary.

A12—6 to 18 inches, very dark gray (10YR 3/1) clay; weak, medium, angular blocky structure; firm, plastic; many fine roots; slightly acid; gradual, smooth boundary.

B21g—18 to 27 inches, very dark gray (10YR 3/1) clay; common, fine, distinct, dark yellowish-brown mottles; moderate, medium, angular blocky structure; very firm, very plastic; common fine roots; common slickensides; common pressure faces; neutral; gradual, smooth boundary.

B22g—27 to 53 inches, dark grayish-brown (10YR 4/2) clay; few, fine, faint, dark yellowish-brown mottles; moderate, medium, angular blocky structure; very firm, very plastic; few fine roots; common slickensides; common pressure faces; few calcium coatings; mildly alkaline; gradual, smooth boundary.

Cg—53 to 72 inches, dark reddish-gray (5YR 4/2) clay; massive; very firm; very plastic; common calcium concretions; mildly alkaline.

The A horizon is very dark gray or black. The B21g horizon ranges from very dark gray to gray. The B22g horizon ranges from dark grayish brown to gray. The Cg horizon is dark reddish-brown to gray clay or silty clay. Reaction ranges from slightly acid to mildly alkaline in the A horizon, neutral to moderately alkaline in the B horizon, and mildly alkaline to moderately alkaline in the C horizon.

These soils have upper horizons of low value that are slightly thicker than the defined range for the series, but this difference does not alter the usefulness and behavior of the soils.

Iberia soils are associated with Norwood and Severn soils. They are grayer and contain more clay than the associated soils.

Iberia clay (Ib).—This soil is in slack-water areas of the flood plain of the Arkansas River. Slope is less than 1 percent. Areas are about 20 to 400 acres in size. Included with this soil in mapping are a few spots of Norwood and Severn soils.

This soil is suited to farming, but excess water is a severe limitation (fig. 5). Farming is delayed several days after a rain unless surface drains are installed. If management is good and includes adequate drainage, clean-tilled crops that leave a large amount of residue can be safely grown year after year.

Figure 5.—This stand of soybeans is poor because of excess surface water. The soil is Iberia clay, which shrinks and cracks when dry and swells to close the cracks when wet.

The main crop is soybeans. Other suitable crops are grain sorghum, cotton, and rice. Winter small grains can be grown if surface drainage is adequate. Adapted pasture plants are bermudagrass, tall fescue, and white clover. Capability unit IIIw–1; woodland group 2w6; not in a range site.

Leadvale Series

The Leadvale series consists of moderately well drained, nearly level and gently sloping soils on colluvial foot slopes and old stream terraces in broad valleys. These soils formed in loamy sediment washed from uplands of weathered sandstone and shale. The native vegetation was chiefly mixed hardwood trees and some pines.

In a representative profile the surface layer is silt loam about 6 inches thick. The upper 2 inches of this layer is dark brown, and the lower 4 inches is brown. The subsoil extends to a depth of 72 inches or more. The upper 4 inches of the subsoil is yellowish-brown, friable silty clay loam; and below this is a firm, brittle fragipan. The upper 9 inches of the fragipan is light yellowish-brown, mottled silty clay loam; the next 19 inches is mottled yellowish-brown gray, and red silty clay loam; and the lower 19 inches is mottled yellowish-brown and gray silty clay loam.

Leadvale soils are low in natural fertility. Permeability is moderately slow, and the available water capacity is moderate. The firm, brittle layer in the subsoil restricts the penetration of roots and slows the movement of water through the soil.

These soils are suitable for cultivation if they are protected from erosion. Most areas are cleared and were cultivated in the past, but they are now used mainly for pasture and meadow. These soils respond well to fertilization, and they are easy to till.

Representative profile of Leadvale silt loam, 1 to 3 percent slopes, in a moist pasture in the SW¼SW¼NE¼ sec. 21, T. 7 N., R. 31 W.:

Ap1—0 to 2 inches, dark-brown (10YR 4/3) silt loam; weak, fine, granular structure; friable; many fine roots; few pores; strongly acid; clear, smooth boundary.

Ap2—2 to 6 inches, brown (10YR 5/3) silt loam; weak, medium, granular structure; friable; common fine roots; few pores; strongly acid; clear, smooth boundary.

B1—6 to 10 inches, yellowish-brown (10YR 5/6) silt loam; weak, medium, subangular blocky structure; friable; common fine roots; few pores; strongly acid; clear, smooth boundary.

B2t—10 to 25 inches, yellowish-brown (10YR 5/6) silty clay loam; moderate, medium, subangular blocky structure; friable; patchy clay films on faces of peds; few fine roots; few pores; strongly acid; clear, wavy boundary.

Bx1—25 to 34 inches, light yellowish-brown (10YR 6/4) silty clay loam; few, fine, faint, light brownish-gray mottles; moderate, medium, subangular blocky structure; firm, brittle; patchy clay films on faces of peds; few fine roots; common pores; few, medium, dark-brown concretions; vertical gray streaks in seams between polygons; very strongly acid; gradual, smooth boundary.

Bx2—34 to 53 inches, mottled yellowish-brown (10YR 5/6), gray (10YR 6/1), and red (2.5YR 4/6) silty clay loam; moderate, medium, subangular blocky structure; firm, brittle; patchy clay films on faces of peds; few fine roots; common pores; few, medium, dark-brown concretions; vertical gray streaks in seams between polygons; very strongly acid; gradual, smooth boundary.

Bx3—53 to 72 inches, mottled yellowish-brown (10YR 5/6) and gray (10YR 6/1) silty clay loam; weak, medium, subangular blocky structure; firm, brittle; patchy clay films on faces of peds; few fine roots; common pores; few, medium, dark-brown concretions, vertical gray streaks in seams between polygons; very strongly acid.

The Ap horizon is brown or dark brown. The B1 horizon is brown or yellowish-brown silt loam or loam. Depth to the Bx horizon is 18 to 30 inches. Reaction is medium acid or strongly acid in the A horizon and is strongly acid or very strongly acid in the B horizon.

Leadvale soils are associated with Cane, Sallisaw, Taft, Wing, and Wrightsville soils. They are not so red in the B horizon as Cane and Sallisaw soils, and they contain more silt and less sand than those soils. They have a fragipan that is lacking in Sallisaw, Wing, and Wrightsville soils. They lack mottling in the upper part of the B horizon that Taft soils have, and they are not so gray as Wrightsville soils. They contain less clay in the B horizon than Wing and Wrightsville soils, and have less sodium in the B horizon than Wing soils.

Leadvale silt loam, 1 to 3 percent slopes (LeB).—This soil is on old stream terraces in broad valleys. Areas range from about 10 to 200 acres in size. The profile of this soil is the one described as representative for the series. Included in mapping are a few spots of Cane, Sallisaw, Taft, Wing, and Wrightsville soils. Also included are spots where bedrock is within a depth of 60 inches.

This soil is suitable for cultivation, but erosion is a moderate hazard. If management is good and includes contour cultivation and terracing on long slopes, clean-tilled crops that leave a large amount of residues can be safely grown year after year. Sown crops can be grown without attention to row direction.

This soil is used mainly for pasture or meadow. It is suited to such crops as soybeans, grain sorghum, winter small grains, and truck crops, and these are grown in a few areas. Among the adapted pasture plants are bahiagrass, bermudagrass, tall fescue, white clover, sericea lespedeza, and annual lespedeza. Urban areas are expanding into some of this soil. Capability unit IIe-1; woodland group 3o7; not in a range site.

Leadvale silt loam, 3 to 8 percent slopes (LeC).—This soil is on toe slopes of hills and on old stream terraces in broad valleys. Areas range from about 10 to 300 acres in size. Included with this soil in mapping are a few spots of Cane, Sallisaw, and Taft soils. Also included are spots where bedrock is within a depth of 60 inches.

This soil is suitable for cultivation. Runoff is medium, however, and erosion is a severe hazard. If management is good and includes contour cultivation and terraces, clean-tilled crops that leave a large amount of residue can be safely grown year after year in the less sloping areas. Conservation treatment needs to be intensified as slope increases.

This soil is used mainly for pasture or meadows. A small acreage is used for such crops as soybeans, grain sorghum, winter small grains, and truck crops. Adapted pasture plants are bahiagrass, bermudagrass, tall fescue, white clover, sericea lespedeza, and annual lespedeza. Capability unit IIIe-1; woodland group 3o7; not in a range site.

Linker Series

The Linker series consists of well-drained, gently sloping soils on hilltops, hillsides, and benches. These soils formed in loamy material that weathered from sandstone. The native vegetation was mixed pine and hardwood trees.

In a representative profile the surface layer is dark-brown fine sandy loam about 5 inches thick. The upper part of the subsoil is yellowish-red loam about 3 inches thick; the middle part is yellowish-red clay loam about 16 inches thick; and the lower part is red, mottled sandy clay loam that extends to a depth of about 36 inches. Below is sandstone bedrock.

Linker soils are low in natural fertility. Permeability and the water capacity are moderate.

If erosion is controlled, these soils generally are suitable for cultivation. Most areas are cleared and were cultivated in the past, but they are now used for pasture and meadow. Linker soils respond well to fertilization. The surface layer is easy to till and can be cultivated throughout a wide range of moisture content.

Representative profile of Linker sandy loam, 3 to 8 percent slopes, in a moist pasture in the NW¼NW¼NE¼ sec. 7, T. 7 N., R. 31 W.:

Ap—0 to 5 inches, dark-brown (7.5YR 4/4) fine sandy loam; weak, fine, granular structure; friable; many fine roots; few pores; few angular sandstone fragments as much as 3 inches in diameter; strongly acid; clear, smooth boundary.

B1—5 to 8 inches, yellowish-red (5YR 4/6) loam; weak, medium, subangular blocky structure; friable; many fine roots; few pores; few angular sandstone fragments as much as 3 inches in diameter; very strongly acid; clear, smooth boundary.

B2t—8 to 24 inches, yellowish-red (5YR 4/6) clay loam; moderate, medium, subangular blocky structure; friable; patchy clay films on faces of peds; common fine roots; common pores; few angular sandstone fragments as much as 3 inches in diameter; very strongly acid; clear, wavy boundary.

B3—24 to 36 inches, red (2.5YR 4/6) sandy clay loam; many, coarse, distinct, strong-brown (7.5YR 5/8) mottles and many, coarse, prominent, light yellowish-brown (10YR 6/4) mottles; weak, medium, subangular blocky structure; friable; few fine roots; few pores; about 5 percent angular sandstone fragments as much as 3 inches in diameter; very strongly acid; abrupt, wavy boundary.

R—36 inches, sandstone bedrock.

The A horizon is brown, dark brown, or dark yellowish brown. The B1 horizon is brown to yellowish-red fine sandy loam or loam. The B2t horizon is yellowish red or red sandy clay loam or clay loam. Depth to bedrock ranges from about 24 to 40 inches. Reaction is medium acid or strongly acid in the A horizon and is strongly acid or very strongly acid in the B horizon.

Linker soils are associated with Enders, Mountainburg, and Montevallo soils. They have more sand and less clay in the B horizon than Enders and Montevallo soils. They are deeper to bedrock than Mountainburg and Montevallo soils.

Linker fine sandy loam, 3 to 8 percent slopes (LnC).—This soil is on hilltops, hillsides, and benches. Areas range from about 10 to 200 acres in size. Included with this soil in mapping are a few small areas that have slopes of less than 3 percent; a few small gravelly spots; and spots of Enders, Mountainburg, and Montevallo soils.

This soil is suited to farming. Runoff is medium, however, and erosion is a severe hazard. If management is good and includes contour cultivation and terraces, clean-tilled crops that leave a large amount of residue can be safely grown year after year in the less sloping areas. Conservation treatment needs to be intensified as slope increases.

This soil is used mainly for pasture or meadow. Among the suitable crops are corn, grain sorghum, soybeans, winter small grains, and truck crops. Fruit crops, such as peaches, apples, and pears, are adapted to this soil. Suitable pasture plants are bahiagrass (fig. 6), bermudagrass, white clover, sericea lespedeza, and annual lespedeza. Capability unit IIIe-1; woodland group 4o1; Loamy Upland range site.

McKamie Series

The McKamie series consists of well-drained, gently sloping soils on high terraces along the Arkansas River. These soils formed in loamy and clayey sediment brought in by the Arkansas River from the prairies and mountains to the west. The native vegetation was chiefly mixed hardwood trees and some pines.

In a representative profile the surface layer is dark-brown silt loam about 4 inches thick. The subsoil extends to a depth of 66 inches or more. The upper part of the subsoil is strong-brown silty clay loam about 4 inches thick. The middle part is yellowish-red clay about 39 inches thick. The lower part is yellowish-red sandy clay loam.

McKamie soils are moderate in natural fertility. Permeability is very slow and the available water capacity is high.

Most areas of these soils are cleared and were cultivated in the past, but they are now used for pasture and meadow or are in urban areas. These soils respond well to fertilization. The subsoil shrinks and cracks during prolonged dry periods, and when wet it expands and the cracks seal.

Representative profile of McKamie silt loam, 3 to 8 percent slopes, in a moist pasture in the NE¼SW¼NE¼ sec. 34, T. 8 N., R. 31 W.:

Ap—0 to 4 inches, dark-brown (7.5YR 4/4) silt loam; weak, fine, granular structure; friable; many fine and medium roots; few pores; strongly acid; abrupt, smooth boundary.

B1—4 to 8 inches, strong-brown (7.5YR 5/6) silty clay loam; weak, fine, subangular blocky structure; friable; many fine and medium roots; few pores; strongly acid; clear, smooth boundary.

B21t—8 to 22 inches, yellowish-red (5YR 4/6) clay; moderate, medium, subangular blocky structure; very firm, very plastic; common fine and medium roots; few pores; continuous clay films on faces of peds; very strongly acid; gradual, smooth boundary.

B22t—22 to 36 inches, yellowish-red (5YR 4/6) clay; many, fine and medium, faint, reddish-yellow (5YR 6/8) mottles; moderate, medium, subangular blocky structure; very firm, very plastic; continuous clay films or pressure faces on peds; few slickensides; strongly acid; gradual, smooth boundary.

B23t—36 to 47 inches, yellowish-red (5YR 4/6) clay; moderate, medium, subangular blocky structure; very firm, very plastic; continuous clay films or pressure faces on peds; few slickensides; mildly alkaline; gradual, smooth boundary.

IIB3—47 to 66 inches, yellowish-red (5YR 4/6) sandy clay loam; weak, medium, subangular blocky structure; friable; mildly alkaline.

The Ap horizon is dark brown or brown. The B1 horizon is strong-brown or yellowish-red silt loam or silty clay loam. The B2t horizon is yellowish-red or red clay or silty clay.

Figure 6.—A well-managed pasture of Pensacola bahiagrass. The soil is Linker fine sandy loam, 3 to 8 percent slopes.

The IIB3 horizon is yellowish-red, red, or reddish-brown silty clay loam to sandy clay loam. Reaction is medium acid or strongly acid in the A horizon, strongly acid or very strongly acid in the B21t horizon, and medium acid to mildly alkaline in the B23t and IIB3 horizons.

McKamie soils are associated with Muskogee and Wrightsville soils. They are redder in the B horizon than the associated soils. They have more clay in the upper part of the B horizon than Muskogee soils.

McKamie silt loam, 3 to 8 percent slopes (MkC).—This soil is on high terraces along the Arkansas River. Areas range from about 10 to 100 acres in size. Included with this soil in mapping are a few small areas that have slopes of as much as 12 percent, eroded spots where the subsoil is exposed, and a few spots of Muskogee and Wrightsville soils.

This soil is poorly suited to cultivated crops. Runoff is rapid, and the hazard of erosion is very severe. Sown crops can safely be grown occasionally in a cropping system that includes close-growing cover most of the time. The soil is better suited to pasture, woodland, and wildlife habitat than to other uses. Adapted pasture plants are bahiagrass, bermudagrass, johnsongrass, annual lespedeza, and sericea lespedeza. Capability unit IVe-2; woodland group 3c2; not in a range site.

Messer Series

The Messer series consists of moderately well drained, nearly level and gently sloping soils on low mounds on old stream terraces in broad valleys. These soils formed in loamy and clayey sediment washed from uplands of material weathered from several kinds of rocks. The native vegetation was chiefly tall grasses.

In a representative profile the surface layer is dark-brown silt loam about 16 inches thick. The subsoil extends to a depth of 72 inches or more. The upper 16 inches of the subsoil is yellowish-brown silt loam; the next 17 inches is mottled yellowish-brown, light-gray, and strong-brown silt loam that has tongues of light-gray silt loam extending into the underlying layer; the next 19 inches mottled yellowish-brown, light-gray, and strong-brown silty clay loam; and the lower 14 inches is mottled yellowish-brown, light-gray, and yellowish-red silty clay.

Messer soils are low in natural fertility. Permeability is slow, and the available water capacity is high.

If these soils are well managed, they are suited to most crops grown in the county. Most of the acreage is used for pasture or meadow. These soils respond fairly well to fertilization. They are easy to till, but slope and size of the mounds where the soils occur limit the use of some kinds of farm equipment.

Messer soils are mapped only in a complex with Wrightsville soils. For a description of this complex, see the Wrightsville series.

Representative profile of Messer silt loam in an area of Wrightsville-Messer complex, in a moist prairie in the NW¼SE¼SE¼ sec. 10, T. 7 N., R. 32 W.:

A11—0 to 5 inches, dark-brown (10YR 3/3) silt loam; weak, fine, granular structure; friable; many fine roots; strongly acid; clear, smooth boundary.

A12—5 to 16 inches, dark-brown (10YR 4/3) silt loam; moderate, medium, granular structure; friable; many fine roots; common fine pores; common, fine, dark-brown concretions; strongly acid; gradual, smooth boundary.

B1—16 to 32 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium, subangular blocky structure; friable; common fine roots; many pores; common, fine, dark-brown concretions; strongly acid; clear, smooth boundary.

B&A—32 to 39 inches, mottled yellowish-brown (10YR 5/4), light-gray (10YR 7/1), and strong-brown (7.5YR 5/6) silt loam; moderate, medium, subangular blocky structure; firm; common tongues of light-gray (10YR 7/2) silt loam make up about 25 percent of this horizon; few fine roots; many pores; many, fine, dark-brown concretions; medium acid; gradual, irregular boundary.

B21t—39 to 58 inches, mottled yellowish-brown (10YR 5/4), light-gray (10YR 7/1), and strong-brown (7.5YR 5/6) silty clay loam; moderate, medium, subangular blocky structure; firm; patchy clay films on faces of peds; few tongues of light gray (10YR 7/2) silt loam extending 5 to 10 inches into horizon from B&A horizon; few fine roots; few pores; slightly acid; clear, smooth boundary.

IIB22t—58 to 72 inches, mottled yellowish-brown (10YR 5/6), light-gray (10YR 7/1), and yellowish-red (5YR 5/6) silty clay; moderate, medium, subangular blocky structure; firm; continuous clay films and common black stains on faces of peds; many, fine, dark-colored concretions; slightly acid.

The A11 or Ap horizon ranges from very dark grayish brown to brown. The A12 horizon ranges from dark grayish brown to brown. The B1 horizon ranges from pale brown to yellowish brown. The B&A horizon has tongues that make up 20 to 40 percent of the horizon. The B21t horizon is mottled yellowish brown, light gray, and strong brown or is light gray mottled with shades of brown. The IIB22t horizon is mottled yellowish brown, light gray, and yellowish red or is light gray mottled with shades of red and brown. It is silty clay or clay. Reaction is medium acid to very strongly acid in the A, B1, and B&A horizons and is strongly acid to neutral in the B21t and IIB22t horizons.

Messer soils are associated with Wrightsville soils. They are less gray and contain less clay in the upper part of the B horizon than Wrightsville soils.

Montevallo Series

The Montevallo series consists of well-drained, gently sloping to moderately sloping soils on hilltops and ridges. These soils formed in loamy material weathered from shale. The native vegetation is chiefly mixed hardwood trees, some pines, and an understory of tall grasses.

In a representative profile the surface layer is about 8 inches thick. The upper 3 inches of this layer is dark-brown gravelly loam, and the lower 5 inches is dark-brown shaly silt loam. The subsoil is yellowish-brown shaly silty clay loam that extends to a depth of about 16 inches. Below is gray and brown, soft, fractured shale.

Montevallo soils are low in natural fertility. Permeability is moderate, and the available water capacity is low. These soils are shallow and droughty.

Montevallo soils are unsuitable for clean-tilled crops. Slopes in some areas restrict the use of farm equipment. These soils are better suited to pasture and wildlife habitat than to other uses. They respond poorly to fertilization.

Representative profile of Montevallo gravelly loam, 3 to 12 percent slopes, in a moist wooded area in the NE¼NW¼NE¼ sec. 13, T. 7 N., R. 32 W.:

O1—½ inch to 0, matted twigs and leaves from hardwoods.

A11—0 to 3 inches, dark-brown (10YR 3/3) gravelly; loam; moderate, fine, granular structure; very friable; about 10 percent sandstone fragments as much as 3 inches in diameter; about 15 percent shale fragments; many fine and medium roots; few pores; strongly acid; clear, smooth boundary.

A12—3 to 8 inches, dark-brown (10YR 4/3) shaly silt loam; weak, fine, subangular blocky structure; friable; about 20 percent shale fragments; common fine roots; few pores; very strongly acid; clear, smooth boundary.

B—8 to 16 inches, yellowish-brown (10YR 5/4) shaly silty clay loam; common, fine, prominent, yellowish-red mottles; weak, fine, subangular blocky structure; friable; about 45 percent shale fragments; few fine roots; few pores; very strongly acid; clear, wavy boundary.

R—16 to 22 inches, gray and brown, soft, fractured, acid shale.

The A1 or Ap horizon is dark grayish brown or dark brown. The B horizon is brown, strong-brown, or yellowish-brown shaly silt loam or shaly silty clay loam. Depth to shale bedrock is 10 to 20 inches. Reaction is strongly acid or very strongly acid throughout.

Montevallo soils are associated with Enders, Linker, and Mountainburg soils. They are shallower to bedrock than Enders and Linker soils. They have less clay in the B horizon than Enders soils, and they have more coarse fragments in the B horizon than Linker soils. Montevallo soils formed in material weathered from shale and are underlain by shale, whereas Linker and Mountainburg soils formed in material weathered from sandstone and are underlain by sandstone.

Montevallo gravelly loam, 3 to 12 percent slopes (MID).—This soil is on hilltops and ridges. Areas range from about 15 to 50 acres in size. Included in mapping are shale outcrops and a few spots of Enders, Linker, and Mountainburg soils.

This soil is not suited to clean-tilled crops. Runoff is rapid, and the hazard of erosion is very severe. Sown crops can safely be grown occasionally in a cropping system that includes close-growing cover most of the time. This soil is better suited to pasture or wildlife habitat than to other uses. Adapted pasture plants are bahiagrass, bermudagrass, annual lespedeza, and sericea lespedeza. Capability unit IVe-3; woodland group 5d3; Shale Break range site.

Mountainburg Series

The Mountainburg series consists of well-drained, gently sloping to steep soils on benches, on tops of hills and mountains, and on sides of ridges. These soils formed in loamy material weathered from sandstone. The native vegetation is chiefly mixed hardwood trees, some pines, and an understory of tall grasses.

In a representative profile the surface layer is dark-brown sandy loam about 5 inches thick. The upper part of the subsoil is reddish-brown sandy loam about 4 inches thick, and the lower part is yellowish-red gravelly fine sandy loam that extends to a depth of about 18 inches. Below is sandstone bedrock.

Mountainburg soils are low in natural fertility. Permeability is moderately rapid, and the available water capacity is low.

Mountainburg soils are unsuitable for clean-tilled crops. The soils are droughty. Furthermore, surface stones and the moderately steep to steep slopes in some areas severely restrict the use of farm equipment. These soils are better suited to pasture, woodland, or wildlife habitat than to other uses. Most of the acreage is in poor-quality woodland and savanna. Mountainburg soils respond poorly to fertilization. They are shallow, and the surface is gravelly or stony in many areas.

Representative profile of Mountainburg sandy loam, 3 to 12 percent slopes, in a moist pasture in the NW¼SW¼NE¼ sec. 7, T. 7 N., R. 31 W.:

Ap—0 to 5 inches, dark-brown (10YR 4/3) sandy loam; weak, fine, granular structure; friable; many fine roots; few pores; about 5 percent angular sandstone fragments as much as 4 inches in diameter; strongly acid; clear, smooth boundary.

B1—5 to 9 inches, reddish-brown (5YR 5/4) sandy loam; weak, medium, subangular blocky structure; friable; many fine roots; few pores; about 5 percent angular sandstone fragments as much as 4 inches in diameter; strongly acid; clear, smooth boundary.

B2t—9 to 18 inches, yellowish-red (5YR 5/6) gravelly fine sandy loam; weak, medium, subangular blocky structure; friable; patchy clay films on faces of peds and in pores; common fine roots; few pores; about 45 percent angular sandstone fragments as much as 4 inches in diameter; very strongly acid; abrupt, irregular boundary.

R—18 inches, level-bedded, acid sandstone bedrock.

The A1 or Ap horizon ranges from dark brown to very dark grayish brown and is gravelly or stony in many areas. The B1 horizon ranges from brown to reddish brown and is gravelly or stony in many areas. The B2t horizon ranges from strong-brown to yellowish-red gravelly or stony fine sandy clay loam. The content of coarse fragments in the Bt horizon ranges from 40 to 60 percent. Depth to bedrock is 12 to 20 inches. Reaction is medium acid or strongly acid in the A horizon and is strongly acid or very strongly acid in the B horizon.

Mountainburg soils are associated with Enders, Linker, and Montevallo soils. They have more coarse fragments in the Bt horizon and are shallower over bedrock than Enders and Linker soils, and they have less clay in the Bt horizon than Enders soils. Mountainburg soils are underlain by sandstone, whereas Enders and Montevallo soils are underlain by shale.

Mountainburg sandy loam, 3 to 12 percent slopes (MmD).—This soil is on hilltops, mountaintops, and ridges. Areas range from about 10 to 60 acres in size. This soil has the profile described as representative for the series. Included in mapping are rock outcrops; a few spots of Enders, Linker, and Montevallo soils; gravelly and stony spots; and a few small areas that have slopes of less than 3 percent.

This soil is not suited to clean-tilled crops. Runoff is medium to rapid, and the hazard of erosion is very severe. Sown crops can safely be grown occasionally in a cropping system that includes close-growing cover most of the time. This soil is better suited to pasture (fig. 7) or wildlife habitat than to other uses. Adapted pasture plants are bermudagrass, bahiagrass, annual lespedeza, and sericea lespedeza. Much of this soil is wooded, but the trees are of poor quality. Capability unit IVe-3; woodland group 5d3; Sandstone Ridge range site.

Mountainburg stony sandy loam, 3 to 12 percent slopes (MnD).—This soil is on hilltops, mountaintops, and ridges. Areas range from about 10 to 500 acres in size. This soil has a profile similar to the one described as representative for the series, except that the surface layer is stony. Included in mapping are a few spots of Enders, Linker, and Montevallo soils and rock outcrops.

This soil is not suitable for cultivation, and it is poorly suited to improved pasture. Surface stones and rock outcrops limit the use of farm equipment. The soil is also droughty (fig. 8). This soil is better suited to native pasture or wildlife habitat than to other uses. Most of this soil is wooded, but the trees are of poor quality. Capabil-

Figure 7.—Area of pasture on Mountainburg sandy loam, 3 to 12 per cent slopes. The growth of forage plants is reduced by even a short drought because this soil has low available water capacity.

ity unit VIs-1; woodland group 5x3; Sandstone Ridge range site.

Mountainburg stony sandy loam, 12 to 35 percent slopes (MrE).—This soil is on hilltops, mountaintops, and ridges. Areas range from about 20 to 600 acres in size. The soil has a profile similar to the one described as representative for the series, except that the surface layer is stony. Included in mapping are rock outcrops and a few small spots of Enders, Linker, and Montevallo soils.

Figure 8.—In foreground is native grass pasture on Mountainburg stony sandy loam, 3 to 12 percent slopes. Limitations to the use of this soil for most purposes are severe.

This soil is not suitable for cultivation or improved pasture. Surface stones, rock outcrops, and slope limit the use of farm equipment. The soil is also droughty. It is better suited to native pasture or wildlife habitat than to other uses. Most of this soil is wooded, but the trees are of poor quality. Capability unit VIIs-2; woodland group 5x3; Sandstone Ridge range site.

Muskogee Series

The Muskogee series consists of moderately well drained, gently sloping soils on high terraces along the Arkansas River. These soils formed in stratified loamy and clayey sediment brought in by the Arkansas River from the prairies and mountains to the west. The native vegetation was chiefly mixed hardwood trees and some pine.

In a representative profile the surface layer is dark-brown silt loam about 4 inches thick. The subsurface layer is brown silt loam about 5 inches thick. The subsoil extends to a depth of 72 inches or more. The upper 8 inches of the subsoil is yellowish-brown silt loam; the next 10 inches is yellowish-brown, mottled silty clay loam; the next 13 inches is light brownish-gray, mottled silty clay; the next 15 inches is yellowish-red, mottled silty clay; and the lower 17 inches is reddish-yellow, mottled silty clay.

Muskogee soils are moderate in natural fertility. Permeability is slow, and the available water capacity is high.

If erosion is controlled, these soils are suitable for cultivation. Most areas are cleared and were cultivated in the past, but they are now used mainly for pasture and meadow. These soils respond well to fertilization and are easy to till.

Representative profile of Muskogee silt loam, 3 to 8 percent slopes, in a moist pasture in the SE¼SW¼NW¼ sec. 34, T. 8 N., R. 31 W.:

- Ap—0 to 4 inches, dark-brown (10YR 4/3) silt loam; weak, fine, granular structure; friable; many fine roots; few pores; medium acid; clear, smooth boundary.
- A2—4 to 9 inches, brown (10YR 5/3) silt loam; weak, fine, subangular blocky structure; friable; many fine roots; few pores; medium acid; clear, smooth boundary.
- B1—9 to 17 inches, yellowish-brown (10YR 5/) silt loam; weak, medium, subangular blocky structure; friable; common fine roots; few pores; few, medium, dark-colored concretions; medium acid; clear, smooth boundary.
- B21t—17 to 27 inches, yellowish-brown (10YR 5/4) silty clay loam; few, fine, faint, grayish-brown mottles; moderate, fine, subangular blocky structures; friable; patchy clay films on faces of peds; common roots; few pores; common, medium, dark-colored concretions; strongly acid; clear, smooth boundary.
- B22t—27 to 40 inches, light brownish-gray (10YR 6/2) silty clay; common, medium, distinct, yellowish-brown (10YR 5/4) mottles and common, medium, prominent, yellowish-red (5YR 4/6) mottles; moderate, medium, films on faces of peds; few fine roots; few pores; strongly acid; gradual, smooth boundary.
- B23t—40 to 55 inches, yellowish-red (5YR 4/6) silty clay; few, fine, prominent, grayish-brown mottles; moderate, medium, subangular blocky structure; firm; continuous clay films on faces of peds; few fine roots; few pores; strongly acid; gradual, wavy boundary.
- B3—55 to 72 inches, reddish-yellow (7.5YR 6/6) silty clay; common, medium, distinct, yellowish-red (5YR 4/5) mottles; weak, medium, subangular blocky structure; firm; few patchy clay films or pressure faces on peds; few fine roots; few pores; strongly acid.

The Ap horizon is dark brown or dark grayish brown. The A2 horizon is brown or yellowish brown. The B21t horizon is yellowish brown or mottled yellowish brown, light gray, and pale brown. The B22t and B23t horizons are light gray, and pale brown. The B22t and B23t horizons are light brownish gray, light gray, or yellowish red and are mottled with light gray, brown, grayish brown, or yellowish red. The horizons are silty clay or clay. The B3 horizon is red to reddish-yellow silty clay or clay and is mottled with light gray to yellowish red. Reaction is medium acid or strongly acid in the A horizon through the B23t horizon and is strongly acid to neutral in the B3 horizon.

Muskogee soils are associated with McKamie and Wrightsville soils. They contain less clay and more silt in the upper part of the B horizon than the associated soils. They have more mottling and are more poorly drained than McKamie soils, but they are better drained and less gray than Wrightsville soils.

Muskogee silt loam, 3 to 8 percent slopes (MuC).—This soil is on high terraces along the Arkansas River. Areas range from about 20 to 400 acres in size. Included with this soil in mapping are spots of McKamie and Wrightsville soils and a few small areas that have slopes of less than 3 percent.

This soil is suitable for cultivation. Runoff is medium, however, and the hazard of erosion is severe. If management is good and includes contour cultivation and terraces, clean-tilled crops can be safely grown year after year in the less sloping areas. Conservation treatment needs to be intensified as slope increases.

This soil is used mainly for pasture or meadow. A small acreage is used for such crops as soybeans, grain sorghum, winter small grains, and truck crops. Adapted pasture plants are bahiagrass, bermudagrass, tall fescue, white clover, sericea lespedeza, and annual lespedeza. Capability unit IIIe-2; woodland group 3o7; not in a range site.

Norwood Series

The Norwood series consists of well-drained, level soils on natural levees along the Arkansas River. These soils formed in loamy sediment brought in from the west by the Arkansas River. The native vegetation was mixed hardwood trees.

In a representative profile the surface layer is about 16 inches thick and is reddish brown. The upper 8 inches of this layer is silty clay loam, and the lower 8 inches is silt loam. The upper 10 inches of the underlying material is brown silt loam; the next 4 inches is dark-brown very fine sandy loam; the next 8 inches is reddish-brown silty clay loam; and the next 21 inches is dark reddish-brown clay that is underlain by reddish-brown, brown, and strong-brown, thinly stratified silt loam and loamy fine sand.

Norwood soils are high in natural fertility. Permeability generally is moderate in the upper 3 feet, but in many places there is a slowly permeable layer below that depth. The available water capacity is high.

These soils are well suited to cultivated crops. Most of the acreage is cultivated, but a few areas are in alfalfa or improved pasture. These soils are subject to infrequent flooding in winter, but this does not seriously limit their use for farming. They respond well to fertilization. They are somewhat difficult to till because of the clay content in the surface layer.

Representative profile of Norwood silty clay loam, in a moist meadow in the NW¼NW¼NW¼ sec. 36, T. 8 N., R. 31 W.:

- Ap—0 to 8 inches, reddish-brown (5YR 4/3) silty clay loam; moderate, medium, granular structure; friable; many fine roots; mildly alkaline; calcareous; clear, smooth boundary.
- A12—8 to 16 inches, reddish-brown (5YR 4/4) silt loam; common, medium, brown (7.5YR 4/4) silt coatings on faces of peds; weak, medium, subangular blocky structure; friable; common fine roots; mildly alkaline; calcareous; abrupt, wavy boundary.
- C1—16 to 26 inches, brown (7.5YR 5/4) silt loam; weak, fine, subangular blocky structure; friable; common worm tunnels; mildly alkaline; calcareous; abrupt, wavy boundary.
- C2—26 to 30 inches, dark-brown (7.5YR 4/4) very fine sandy loam; platy structure; friable; common bedding planes; common worm tunnels; mildly alkaline; calcareous; abrupt, wavy boundary.
- C3—30 to 38 inches, reddish-brown (5YR 4/3) silty clay loam; weak, fine, subangular blocky structure; friable; mildly alkaline; calcareous; abrupt, smooth boundary.
- C4—38 to 59 inches, dark reddish-brown (5YR 3/4) clay; common, faint, brown splotches; massive; firm, plastic; neutral; abrupt, wavy boundary.
- C5—59 to 72 inches, thinly stratified, reddish-brown (5YR 4/3), brown (7.5YR 5/4), and strong-brown (7.5YR 5/6) silt loam and loamy fine sand; platy structure; friable; neutral.

The A horizon is reddish brown or dark reddish brown. The C horizon ranges from dark reddish-brown to brown very fine sandy loam to clay in subhorizons without regular sequence. Reaction is neutral or mildly alkaline and calcareous throughout.

Norwood soils are associated with Crevasse, Iberia, and Severn soils. They contain more silt and clay and less sand than Crevasse soils. They contain more sand and silt and less clay than Iberia soils and are better drained and browner than those poorly drained soils. They also lack the dark surface layer of Iberia soils. Norwood soils contain more clay than Severn soils.

Norwood silty clay loam (No).—This soil is on natural levees along the Arkansas River. Slope is less than 1 percent. Areas range from about 20 to 200 acres in size. Included with this soil in mapping are a few spots of Crevasse, Iberia, and Severn soils.

This soil is well suited to cultivated crops, but it is somewhat difficult to till because of the clay content in the surface layer. If management is good, clean-tilled crops that leave a large amount of residue can be safely grown year after year.

Most of the acreage of this soil is in soybeans and alfalfa, but a few areas are in improved pasture. This soil is suited to winter small grains. Adapted pasture plants are bermudagrass, bahiagrass, tall fescue, and white clover. Capability unit IIs-1; woodland group 2o4; not in a range site.

Sallisaw Series

The Sallisaw series consists of well-drained, nearly level to gently sloping soils on stream terraces. These soils formed in alluvium washed from uplands of weathered sandstone and shale. The native vegetation was mainly hardwood trees and some pines.

In a representative profile the surface layer is dark-brown loam about 6 inches thick. The subsoil extends to a depth of 72 inches or more. The upper 7 inches of the subsoil is reddish-brown loam; the next 7 inches is yellowish-red loam; the next 26 inches is red loam; the next 13 inches is yellowish-red, mottled loam; and the lower 13 inches is mottled yellowish-red, yellowish-brown, and light-brown sandy clay loam.

Sallisaw soils are moderate to low in natural fertility. Permeability is moderate, and the available water capacity is high.

If erosion is controlled, these soils are suitable for cultivation. Most areas are cleared and were cultivated in the past, but they are now used mainly for pasture and meadow. These soils respond well to fertilization and are easy to till.

Representative profile of Sallisaw loam, 3 to 8 percent slopes, in a moist pasture in the SE¼SW¼NE¼ sec. 6, T. 7 N., R. 30 W.:

Ap—0 to 6 inches, dark-brown (7.5YR 4/4) loam; weak, fine, granular structure; friable; many fine roots; many pores; about 3 percent sandstone pebbles as much as 3 inches in diameter; slightly acid; clear, smooth boundary.

B1—6 to 13 inches, reddish-brown (5YR 4/4) loam; weak, fine, subangular blocky structure; friable; common fine roots; common pores; about 3 percent sandstone pebbles as much as 3 inches in diameter; neutral; gradual, smooth boundary.

B21t—13 to 20 inches, yellowish-red (5YR 4/6) loam; moderate, medium, subangular blocky structure; friable; common patchy clay films on faces of peds; common fine roots; common pores; about 3 percent sandstone pebbles as much as 3 inches in diameter; slightly acid; gradual, smooth boundary.

B22t—20 to 33 inches, red (2.5YR 4/6) loam; moderate, medium, subangular blocky structure; friable; many patchy clay films on faces of peds; common fine roots; common pores; slightly acid; gradual, smooth boundary.

B23t—33 to 46 inches, red (2.5YR 4/6) loam; moderate, medium, subangular blocky structure; friable; many patchy clay films on faces of peds; few fine roots; common pores; medium acid; gradual, smooth boundary.

B24t—46 to 59 inches, yellowish-red (5YR 4/6) loam; common, medium, distinct, light-brown (7.5YR 6/4) mottles; moderate, medium, subangular blocky structure; friable; common patchy clay films on faces of peds; few fine roots; common pores; medium acid; gradual, smooth boundary.

B3—59 to 72 inches, mottled yellowish-red (5YR 5/6), yellowish-brown (10YR 5/6), and light-brown (7.5YR 6/4) sandy clay loam; weak, medium, subangular blocky structure; friable; few patchy clay films and common black stains on faces of peds; few fine roots; common pores; medium acid.

The Ap horizon is loam or stony loam. The B1 horizon is brown to reddish-brown loam or stony loam. The B2t horizon is yellowish-red or red loam or sandy clay loam. Content of coarse fragments ranges from 0 to 30 percent throughout. Where the soil has been limed, reaction is slightly acid or neutral in the A and B1 horizons. Normally it is slightly acid or medium acid in these horizons. The upper subhorizons of the B2t horizon are slightly acid where the soil has been limed, but normally the B2t and B3 horizons are medium acid or strongly acid.

Sallisaw soils are associated with Barling, Cane, Cleora, Leadvale, and Taft soils. They are better drained than any of the associated soils, except Cleora soils. They have a B horizon of clay accumulation that is lacking in Barling and Cleora soils. They lack the mottled, firm and brittle fragipan horizon of the Cane, Leadvale, and Taft soils.

Sallisaw loam, 1 to 3 percent slopes (SoB).—This soil is on stream terraces. Areas range from about 10 to 200 acres in size. Included with this soil in mapping are a few spots of Barling, Cane, Cleora, Leadville, and Taft soils and spots that have a gravelly or stony surface.

This soil is suitable for cultivation, but erosion is a moderate hazard. If management is good and includes contour cultivation and terracing on long slopes, clean-tilled crops that leave a large amount of residue can be safely grown year after year. Sown crops can be grown without attention to row direction.

This soil is used mainly for pasture or meadow. It is suited to such crops as soybeans, grain sorghum, winter small grains, and truck crops, and these are grown in a few areas. Among the adapted pasture plants are bahiagrass, bermudagrass, tall fescue, white clover, sericea lespedeza, and annual lespedeza. Capability unit IIe-1; woodland group 3o7; not in a range site.

Sallisaw loam, 3 to 8 percent slopes (SoC).—This soil is on stream terraces. Areas range from about 10 to 400 acres in size. This soil has the profile described as representative for the series. Included in mapping are a few small areas that have a gravelly or stony surface and a few spots of Cane and Leadville soils.

This soil is suitable for cultivation. Runoff is medium, however, and the hazard of erosion is severe. If management is good and includes contour cultivation and terraces clean-tilled crops that leave a large amount of residue can be safely grown year after year on the less sloping areas. Conservation treatment needs to be intensified as slope increases.

This soil is used mainly for pasture or meadow (fig. 9). This soil is suited to such crops as soybeans, grain sorghum, winter small grains, and truck crops, and these are

Figure 9.—Young shortleaf pines are encroaching, by natural seeding, into a pasture of native grass, which is in excellent condition. The soil is Sallisaw loam, 3 to 8 percent slopes, which is well suited to trees.

grown in a few areas. Among the adapted pasture plants are bahiagrass, bermudagrass, tall fescue, white clover, sericea lespedeza, and annual lespedeza. Capability unit IIIe-1; woodland group 3o7; not in a range site.

Sallisaw stony loam, 1 to 8 percent slopes (SIC).—This soil is on stream terraces. Areas range from about 10 to 400 acres in size. This soil has a profile similar to the one described as representative for the series, except that the surface is stony and the soil contains as much as 30 percent coarse fragments. Included in mapping are a few spots of Barling, Cane, Leadvale, and Taft soils and a few small areas that have a loam surface layer.

This soil is poorly suited to cultivation, and it is only fairly suitable for improved pasture. Surface stones limit the use of farm equipment. The soil is better suited to native pasture, wildlife habitat, or woodland than to other uses. Most of this soil is in native pasture or woodland. Adapted pasture plants are bermudagrass, annual lespedeza, and sericea lespedeza. Capability unit IVs-2; woodland group 3o7; not in a range site.

Severn Series

The Severn series consists of well-drained, level and nearly level soils on natural levees along the Arkansas River. These soils formed in a loamy sediment of mixed origin that was brought in from the west by the Arkansas River. The native vegetation was mixed hardwood trees.

In a representative profile the surface layer is dark-brown silt loam about 6 inches thick. The upper 9 inches of the underlying material is brown silt loam; the next 16 inches is brown very fine sandy loam; and the next 19 inches is reddish-brown very fine sandy loam underlain by very pale brown and reddish-yellow sand and loamy fine sand.

Severn soils are high in natural fertility. Permeability is moderately rapid, and the available water capacity is high.

These soils are well suited to cultivated crops. Most of the acreage is cultivated, but a few areas are in alfalfa or improved pasture. These soils are subject to infrequent flooding in winter, but this does not seriously limit their use for farming. They respond well to fertilization. They are easy to till and can be cultivated throughout a wide range of moisture content.

Representative profile of Severn silt loam, in a moist meadow in the SW¼SW¼NE¼ sec. 25, T. 8 N., R. 31 W.:

Ap—0 to 6 inches, dark-brown (7.5YR 4/4) silt loam; weak, fine, granular structure; friable; many fine roots; few pores; moderately alkaline; calcareous; clear, smooth boundary.

C1—6 to 15 inches, brown (7.5YR 5/4) silt loam; weak, medium, subangular blocky structure; friable; common fine roots; few fine pores; common bedding planes; moderately alkaline; calcareous; gradual, smooth boundary.

C2—15 to 31 inches, brown (7.5YR 5/4) very fine sandy loam; weak, medium, subangular blocky structure; friable; common fine roots; few pores; common bedding planes; moderately alkaline; calcareous; gradual, smooth boundary.

Figure 10.—Field of soybeans on Severn silt loam.

C3—31 to 50 inches, reddish-brown (5YR 5/4) very fine sandy loam; medium to coarse, platy structure; friable; few fine roots; few pores; many bedding planes; moderately alkaline; calcareous; abrupt, wavy boundary.

C4—50 to 69 inches, very pale brown (10YR 7/4) sand; medium to coarse, platy structure; friable; few fine roots; common bedding planes; moderately alkaline; calcareous; clear, smooth boundary.

C5—69 to 80 inches, reddish-yellow (7.5YR 6/6) loamy fine sand; single grain; friable; few fine roots; moderately alkaline; calcareous.

The A horizon ranges from dark reddish brown to dark brown. The upper 30 to 50 inches of the C horizon is brown to reddish-brown silt loam or very fine sandy loam. The lower part of the C horizon is very pale brown to dark reddish-brown sand to very fine loam. Reaction is mildly alkaline to moderately alkaline and calcareous throughout.

Severn soils are associated with Crevasse, Iberia, and Norwood soils. They are less sandy than Crevasse soils. They contain more sand and silt and less clay than the poorly drained, clayey Iberia soils and the well-drained, loamy Norwood soils.

Severn silt loam (Sn).—This soil is on natural levees along the Arkansas River. Slope ranges from 0 to 3 percent. Some areas are gently undulating and have alternate swales and low ridges. Areas range from about 40 to 1,000 acres in size. Included with this soil in mapping are a few spots of Crevasse, Iberia, and Norwood soils.

This soil is well suited to cultivated crops and is easy to till (fig. 10). If management is good, clean-tilled crops that leave a large amount of residue can be safely grown year after year.

Most of the acreage of this soil is used for row crops, such as soybeans, truck crops, and grain sorghum. A few areas are in alfalfa or improved pasture. This soil is suited to winter small grains. Among the adapted pasture plants are bermudagrass, bahiagrass, tall fescue, and white clover. Capability unit I-1; woodland group 2o4; not in a range site.

Taft Series

The Taft series consists of somewhat poorly drained, level soils on old stream terraces in broad valleys. These soils formed in loamy alluvium washed from uplands of weathered sandstone and shale. The native vegetation was mixed hardwood trees and some pines.

In a representative profile the surface layer is dark grayish-brown silt loam about 12 inches thick. This layer contains yellowish-brown mottles in the lower 7 inches. The subsoil extends to a depth of 72 inches or more. The upper 8 inches of the subsoil is brown, mottled, friable silt loam; the next 6 inches is light brownish-gray, mottled, friable and slightly brittle silt loam; and the next 33 inches is a firm, brittle fragipan. The upper 16 inches of the fragipan is mottled light brownish-gray and yellowish-brown silty clay loam, and the lower 17 inches is yellowish-brown, mottled silty clay loam. Below the fragipan is about 13 inches of yellowish-brown, mottled, friable silty clay loam.

Taft soils are low in natural fertility. Permeability is slow, and the available water capacity is moderate. The firm, brittle layer in the subsoil restricts root penetration and slows the movement of water through the soil.

If drained and well managed, Taft soils are suited for most crops grown in the county. Most areas are used for pasture or meadow. These soils respond well to fertilization. They are easy to till, but they contain excess water for long periods after rain.

Representative profile of Taft silt loam, in a moist pasture in the SW¼NE¼NW¼ sec. 3, T. 7 N., R. 31 W.:

Ap—0 to 5 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, granular structure; friable; many fine roots; few pores; strongly acid; clear, smooth boundary.

A12—5 to 12 inches, dark grayish-brown (10YR 4/2) silt loam; few, fine, distinct, yellowish-brown mottles; weak, medium, subangular blocky structure; friable; many fine roots; few pores; strongly acid; clear, smooth boundary.

B2—12 to 20 inches, brown (10YR 5/3) silt loam; common, medium, faint, grayish-brown (10YR 5/2) and few, fine, faint, gray and yellowish-brown mottles; moderate, medium, subangular blocky structure; friable; common fine roots; common pores; very strongly acid; clear, wavy boundary.

A'2—20 to 26 inches, light-brownish-gray (10YR 6/2) silt loam; common, medium, prominent, yellowish-red (5YR 5/6) mottles and few, fine, distinct, yellowish-brown mottles; moderate, medium, subangular blocky structure; friable; slightly brittle; thick silt coats on faces of peds; few fine roots; common pores; many medium concretions coated with gray silt; very strongly acid; gradual, wavy boundary.

B'x1—26 to 42 inches, mottled light brownish-gray (10YR 6/2) and yellowish-brown (10YR 5/6) silty clay loam; moderate, medium, subangular blocky structure; firm, brittle; patchy clay films on faces of peds; few fine roots; common pores; many, medium, dark-colored concretions; common sandstone and shale fragments; very strongly acid; gradual, wavy boundary.

B'x2—42 to 59 inches, yellowish-brown (10YR 5/6) silty clay loam; common, coarse, distinct, grayish-brown (10YR 5/2) mottles; weak, medium, subangular blocky structure; firm, brittle; patchy clay films on faces of peds; few fine roots; common pores; common, fine and medium, dark-colored concretions; few sandstone and shale fragments; very strongly acid; gradual, wavy boundary.

B3—59 to 72 inches, yellowish-brown (10YR 5/6) silty clay loam; common, medium, faint, grayish-brown (10YR 5/2) mottles; weak, medium, subangular blocky structure; friable; few pores; very strongly acid.

The Ap or A1 horizon ranges from dark grayish brown to brown. The B2 horizon is brown or yellowish brown and is mottled with shades of gray and brown. The A'2 horizon is light brownish gray or light gray and is mottled with brown and red. Depth to the B'x horizon is 20 to 30 inches. The B3 horizon ranges from yellowish brown to red and is mottled with gray or brown. Reaction is medium acid or strongly acid in the A horizon and strongly acid or very strongly acid in the A'2 and B horizons.

Taft soils are associated with Barling, Leadvale, Sallisaw, Wing, and Wrightsville soils. They have a mottled, firm and brittle fragipan in the B horizon that is lacking in Barling, Sallisaw, and Wing soils. They are more poorly drained than Sallisaw, Barling, and Leadvale soils. Taft soils contain less clay in the B horizon than Wing and Wrightsville soils. They lack the high sodium content in the B horizon that is in Wing soils.

Taft silt loam (Tf).—This soil is on old stream terraces in broad valleys. Slope is less than 1 percent. Areas range from about 10 to 200 acres in size. Included with this soil in mapping are a few small areas that have low, rounded mounds and spots of Barling, Leadvale, Sallisaw, Wing, and Wrightsville soils.

This soil is suited to cultivated crops if it is drained and well managed. Runoff is slow, and excess water is a severe limitation. Farming is delayed several days after a rain unless surface drains are installed. If management is good and includes adequate drainage, clean-tilled crops that leave a large amount of residue can be safely grown year after year.

This soil is used mainly for pasture and meadow. Among the suitable crops are soybeans and grain sorghum. Winter small grains can be grown if surface drainage is adequate. Adapted pasture plants are bermudagrass, bahiagrass, tall fescue, white clover, annual lespedeza, and sericea lespedeza. Capability unit IIIw-2; woodland group 3w8; not in a range site.

Wing Series

The Wing series consists of somewhat poorly drained to moderately well drained, level soils in seep areas along foot slopes of hills and ridges and on old stream terraces in broad valleys. These soils formed in residuum, in colluvium, and in alluvium washed from uplands of weathered sandstone and shale. This material is loamy and clayey. The native vegetation is mainly scattered hardwood trees and an understory of grasses.

In a representatitve profile the surface layer is dark-brown silt loam about 6 inches thick. The subsoil is about 44 inches thick. The upper 10 inches of the subsoil is yellowish-brown silty clay; the next 13 inches is yellowish-brown, mottled silty clay; the next 5 inches is strong-brown, mottled silty clay; and the lower 16 inches is strong-brown, mottled silty clay loam. The underlying material is yellowish-brown silty clay loam about 10 inches thick. This is underlain by gray and brown, fractured shale bedrock.

Wing soils are low in natural fertility. Permeability is very slow, and the available water capacity is low. Surface runoff is slow, and there is excess water on the surface for several days following rain.

These soils have a high content of sodium in the subsoil. They are unsuitable for cultivation and are poorly suited to woodland. Most areas are idle or are used for native pasture and wildlife habitat. These soils respond poorly to fertilization.

Representative profile of Wing silt loam, in a moist pasture in the SW¼SE¼NE¼ sec. 35, T. 7 N., R. 32 W.:

Ap—0 to 6 inches, dark-brown (10YR 4/3) silt loam; weak, fine, granular structure; friable; many fine roots; medium acid; abrupt, smooth boundary.

B21t—6 to 16 inches, yellowish-brown (10YR 5/4) silty clay; weak, columnar parting to moderate, medium, angular blocky structure; very firm; few fine roots; moderately alkaline; clear, smooth boundary.

B22t—16 to 29 inches, yellowish-brown (10YR 5/8) silty clay; many, medium, prominent, light-gray (10YR 6/1) mottles; weak, columnar parting to moderate, medium, angular blocky structure; very firm; continuous clay films on faces of peds; few fine roots; moderately alkaline; gradual, smooth boundary.

B23t—29 to 34 inches, strong-brown (7.5YR 5/6) silty clay; common, medium, distinct, light-gray (10YR 6/1) mottles; weak, columnar structure parting to moderate, medium, angular blocky; firm; common patchy clay films on faces of peds; few pores; common dark-colored concretions; moderately alkaline; gradual, smooth boundary.

B24t—34 to 50 inches, strong-brown (7.5YR 5/6) silty clay loam; many, medium, prominent, light-gray (10YR 6/1) mottles; weak, columnar structure parting to moderate, medium, subangular blocky; firm; common patchy clay films on faces of peds; few pores; common black concretions; moderately alkaline; gradual, smooth boundary.

C—50 to 60 inches, yellowish-brown (10YR 5/6) silty clay loam; massive; firm; moderately alkaline; abrupt, smooth boundary.

R—60 inches, gray and brown, fractured shale.

The Ap or A1 horizon ranges from brown to dark grayish brown. The B2t horizon is yellowish brown or strong brown and contains light-gray or gray mottles within a depth of 20 inches. Depth to shale bedrock ranges from 42 to 84 inches. Reaction is slightly acid to medium acid in the A horizon and moderately alkaline to strongly alkaline in the B horizon.

Wing soils are associated with Leadvale, Taft, and Wrightsville soils. They have a high sodium content in the B horizon that all the associated soils lack. They lack the fragipan that Leadvale and Taft soils have, and they are more clayey in the B horizon than those soils. They are not so gray in the B horizon as Taft and Wrightsville soils.

Wing silt loam (Wg).—This soil is in broad valleys. Slope is less than 1 percent. Areas range from about 10 to 100 acres in size. Included with this soil in mapping are spots of Leadvale, Taft, and Wrightsville soils and spots that have slopes of as much as 3 percent.

This soil is better suited to native pasture and wildlife habitat than to other uses. It is not suited to cultivated crops and is only poorly suited to improved pasture, because of droughtiness and the high concentration of sodium throughout the subsoil.

Most areas of this soil are idle or are used for native pasture and wildlife habitat. Pasture plants more likely to survive on this soil are bermudagrass and annual lespedeza. Capability unit VIs-2; woodland group 5t0; Alkali Flats range site.

Wrightsville Series

The Wrightsville series consists of poorly drained, level to nearly level soils on old stream terraces in broad valleys. These soils formed in loamy and clayey alluvium, mainly brought in from the west by the Arkansas River. The native vegetation in most areas was tall grasses, but in some it was hardwood trees.

In a representative profile the surface layer is dark grayish-brown silt loam about 3 inches thick. The subsurface layer is light brownish-gray, mottled silt loam about 13 inches thick. The subsoil extends to a depth of 72 inches or more. The upper 7 inches of the subsoil is gray, mottled silty clay that has tongues of light-gray silt loam; the next 37 inches is light brownish-gray, mottled silty clay and clay; and the lower 12 inches is reddish-brown, mottled clay.

Wrightsville soils are low in natural fertility. Permeability is very slow, and the available water capacity is high.

If these soils are drained and well managed, they are suited to most crops grown in the county. Most areas are used for pasture or meadow. These soils respond fairly well to fertilization. They are easy to till, but they are wet for long periods after rains.

Representative profile of Wrightsville silt loam, in a moist wooded area in the SW¼SW¼SW¼ sec. 27, T. 8 N., R. 31 W.:

O1—½ inch to 0, matted twigs and leaves from hardwood trees.

A1—0 to 3 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; many fine and medium roots; common pores; strongly acid; clear, smooth boundary.

A2g—3 to 16 inches, light brownish-gray (10YR 6/2) silt loam; common, coarse, distinct, brownish-yellow (10YR 6/6) mottles; weak, fine, subangular blocky structure; friable; many fine and medium roots; common pores; very strongly acid; abrupt, irregular boundary.

B21tg—16 to 23 inches, gray (10YR 6/1) silty clay; common, distinct, yellowish-brown (10YR 5/6) mottles and common, medium, prominent, yellowish-red (5YR 5/6) mottles; moderate, medium, subangular blocky structure; firm; continuous clay films on faces of peds; common tongues of light-gray (10YR 7/1) silt loam, 1 to 2 inches in diameter, from the A2g horizon extend through this horizon; common fine roots; common pores; very strongly acid; clear, wavy boundary.

B22tg—23 to 33 inches, light brownish-gray (10YR 6/2) silty clay; few, fine, faint, light-gray mottles and few, medium, distinct, strong-brown (7.5YR 5/6) mottles; moderate, medium, subangular blocky structure; firm; continuous clay films on faces of peds; few fine roots; few pores; very strongly acid; gradual, smooth boundary.

B23tg—33 to 46 inches, light brownish-gray (10YR 6/2) clay; few, fine, faint, light-gray mottles and few, medium, distinct, strong-brown (7.5YR 5/8) mottles; moderate, medium, subangular blocky structure; firm; continuous clay films on faces of peds; few fine roots; few pores; very strongly acid; gradual, smooth boundary.

B3g—46 to 60 inches, light brownish-gray (10YR 6/2) silty clay; many, coarse, faint, light yellowish-brown (10YR 6/4) mottles and common, medium, prominent, reddish-brown (5YR 5/3) mottles; weak, medium, subangular blocky structure; firm; patchy clay films on faces of peds; few fine roots; few pores; few, fine, dark-brown concretions; strongly acid; gradual, wavy boundary.

IIB—60 to 72 inches, reddish-brown (5YR 5/4) clay; few, medium, prominent, gray (10YR 6/1) mottles; moderate, medium, subangular blocky structure; firm; continuous clay films on faces of most peds; few fine roots; few pores; silt coatings on some vertical ped surfaces; common black stains in upper few inches; neutral.

The Ap or A1 horizon ranges from very dark grayish brown to grayish brown, and the A2g horizon from light brownish gray to gray. The B2tg horizon is dark-gray to light brownish-gray or silty clay that is mottled with shades of brown, red, and yellow. The B3g horizon is clay or silty clay. The IIB horizon, where present, is reddish-brown to red silty clay or clay. Reaction ranges from strongly acid to very strongly acid in the A and Bt horizon, very strongly acid to moderately alkaline in the IIB horizon.

Wrightsville soils are associated with Leadvale, McKamie, Messer, Muskogee, Taft, and Wing soils. They are more poorly drained than any of the associated soils. They have more clay throughout the B horizon than Leadville and Taft soils. Wrightsville soils are grayer in the B horizon than McKamie soils. They are grayer than Messer and Muskogee soils and have more clay in the upper part of the B horizon. They are grayer than Wing soils and lack the high content of sodium that is in the B horizon of those soils.

Wrightsville silt loam (Wr).—This soil is on terraces along the Arkansas River. Slope is less than 1 percent. Areas range from about 20 to 200 acres in size. This soil has the profile described as representative for the series. Included in mapping are a few spots of Leadvale, McKamie, Messer, Muskogee, Taft, and Wing soils.

This soil is suited to cultivated crops if it is drained and well managed. Runoff is slow, however, and excess water is a severe limitation. Farming is delayed several days after a rain unless surface drains have been installed. If management is good and includes adequate drainage, clean-tilled crops that leave a large amount of residue can be safely grown year after year.

This soil is used mainly for pasture and meadow. Among the suitable crops are soybeans, cotton, and grain sorghum. Winter small grains can be grown where surface drainage is adequate. Adapted pasture plants are bermudagrass, bahiagrass, tall fescue, white clover, annual lespedeza, and sericea lespedeza. Capability unit IIIw-2; woodland group 3w9; Loamy Prairie range site.

Wrightsville complex, 0 to 2 percent slopes (WsA).—This complex is on old stream terraces in broad valleys. It is 65 to 80 percent Wrightsville soils and 10 to 25 percent soils that are similar to Wrightsville soils, except for having a higher content of sodium in the lower part of the subsoil. The rest is spots of Messer, Taft, Leadvale, and Wing soils. Areas of the complex range from about 20 to 1,000 acres in size.

The soils in this complex are suited to cultivated crops if they are well managed and if the level areas are drained. Runoff is slow, and excess water is a severe limitation. Farming is delayed several days after a rain unless surface drains have been installed. If management is good and includes adequate drainage, clean-tilled crops that leave a large amount of residue can be safely grown year after year.

This complex is used mainly for pasture and meadow of native or improved grasses and legumes. Among the suitable crops are soybeans, cotton, and grain sorghum. Winter small grains can be grown where surface drainage is adequate. Adapted pasture plants are bermudagrass, bahiagrass, tall fescue, white clover, annual lespedeza, and sericea lespedeza. Capability unit IIIw-2; woodland group 3w9; Loamy Prairie range site.

Wrightsville-Messer complex (Wr).—The soils in this complex are on old stream terraces in broad valleys. Slope ranges from 0 to 3 percent. The complex is 55 to 70 percent level Wrightsville soils, in areas between low mounds, and 20 to 35 percent Messer soils on rounded mounds that are 2 to 3 feet higher than the Wrightsville soils and are 60 to 80 feet in diameter. The rest of the complex is spots of Leadvale, Taft, and Wing soils. Areas range from about 40 to 1,000 acres in size. One of the Messer soils has the profile described as representative for the Messer series.

The soils in this complex are suited to cultivated crops, but excess water is a very severe limitation in the Wrightsville soils. Farming is delayed several days after a rain unless surface drains have been installed. The mounds limit the use of some kinds of farm equipment. If management is good and includes adequate drainage, clean-tilled crops that leave a large amount of residue can be safely grown year after year.

This complex is used for pasture and meadow of native or improved grasses and legumes. Among the suitable crops are soybeans and grain sorghum. Winter small grains can be grown where surface drainage is adequate. Adapted pasture plants are bermudagrass, bahiagrass, tall fescue, white clover, annual lespedeza, and sericea lespedeza. Capability unit IVw-1; woodland group 3w9; Loamy Prairie range site.

Use and Management of the Soils

This section discusses the use of the soils for crops and pasture and explains the capability grouping used by the Soil Conservation Service. Predicted average yields of the principal crops are given. Also discussed is the management of soils for wildlife habitat, for woodland, and for range. The properties and features affecting engineering and the limitations affecting town and country planning and recreational development are listed, mainly in tables.

Use of the Soils for Crops and Pasture [3]

Most of the cleared areas in the county are used for pasture. Some areas are used for such crops as soybeans, winter small grain, and truck crops. Other areas are idle.

Except for those on the Arkansas River flood plain, the soils in this county generally are low in nitrogen, potassium, phosphorus, calcium, and organic matter. Many of the soils suitable for cultivation are erodible. Poor surface or internal drainage and the susceptibility to flooding are limitations in places.

Contour cultivation, terraces, and vegetated waterways are needed on sloping soils that are used for clean-tilled crops. Row arrangement and suitable drainage are needed for dependable growth in wet areas.

Annual cover crops or grasses and legumes should be grown regularly in the cropping system if the hazard of erosion is severe or if the crops grown leave only a small amount of residue. Crop residue should be shredded and spread evenly to provide the soil a protective cover and active organic material.

The amount of fertilizer to be applied generally is determined by soil tests, the kinds of crops to be grown, and past experiences with fertilization and crops. Soil tests indicate that periodic applications of agricultural limestone are beneficial to most crops and generally are necessary for satisfactory production of such crops as alfalfa and white clover.

A plowpan commonly forms in loamy soils that are improperly tilled or are tilled frequently with heavy equipment. Keeping tillage to a minimum, varying the depth of tillage, and tilling when the content of soil moisture is favorable help to prevent formation of a plowpan. Growing deep-rooted grasses and legumes in the cropping system helps to break up a plowpan.

If left bare, many soils tend to crust and pack during periods of heavy rainfall. Growing cover crops and managing crop residue help preserve good tilth.

Perennial grasses or legumes, or mixtures of these, are grown for pasture and hay. The mixtures generally consist of either a summer or a winter perennial grass and a suitable legume.

Coastal bermudagrass, common bermudagrass, dallisgrass, and Pensacola bahiagrass are the summer perennials most commonly grown. Coastal bermudagrass and Pensacola bahiagrass are fairly new to this county, but both are highly satisfactory in production of good-quality forage. Johnsongrass is also suited to many of the soils in the county. Tall fescue, the main winter perennial

[3] W. WILSON FERGUSON, Soil Conservation Service, helped prepare this section.

grass now grown in the county, grows well only on soils that have a favorable soil-moisture relationship. All of these grasses respond well to fertilizer, particularly to nitrogen. White clover, crimson clover, annual lespedeza, and sericea lespedeza are the legumes most commonly grown.

Proper grazing is essential for the production of high-quality forage, stand survival, and erosion control. Other practices, such as brush and weed control, fertilization, and renovation of the pasture, are also important.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive land-forming 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. In class I are soils that have few limitations, the widest range of use, and the least risk of damage when they are used. In class VIII are soils and landforms so rough, so shallow, or otherwise so limited that they do not produce worthwhile yields of crops, forage, or wood products.

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, 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, IIIw-1. 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 paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

The placement of any mapping unit in the grouping class can be learned by turning to the "Guide to Mapping Units" at the back of this survey. Following is a descriptive outline of the system as it applies to Sebastian County:

Class I. Soils that have few limitations that restrict their use.

- Unit I-1.—Deep, level and nearly level, well-drained, loamy soils.

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

- Unit IIe-1.—Deep, nearly level, moderately well drained and well drained, loamy soils.
- Unit IIw-1.—Deep, level, moderately well drained and well drained, loamy soils subject to occasional flooding.
- Unit IIs-1.—Deep, level, well-drained, loamy soils that are somewhat difficult to till.

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

- Unit IIIe-1.—Moderately deep and deep, gently sloping, moderately well drained and well drained, loamy soils.
- Unit IIIe-2.—Deep, gently sloping, moderately well drained, loamy soils.
- Unit IIIw-1.—Deep, level, poorly drained, clayey soils.
- Unit IIIw-2.—Deep, level and nearly level, somewhat poorly drained and poorly drained, loamy soils.

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

- Unit IVe-1.—Deep, gently sloping, well-drained, loamy soils that are low in fertility.
- Unit IVe-2.—Deep, gently sloping, well-drained, loamy soils.
- Unit IVe-3.—Shallow, gently sloping and moderately sloping, well-drained, loamy soils.
- Unit IVw-1.—Deep, dominantly level and poorly drained, loamy soils that have a mounded surface.
- Unit IVs-1.—Deep, level and nearly level, excessively drained, sandy soils.
- Unit IVs-2.—Deep, nearly level and gently sloping, well-drained, stony soils.

Class V. Soils that are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife (none in Sebastian County).

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

Unit VIe-1.—Deep, moderately sloping, well-drained, loamy soils.

Unit VIs-1.—Shallow, gently sloping and moderately sloping, well-drained, stony soils.

Unit VIs-2.—Deep, level, somewhat poorly drained to moderately well drained, loamy soils that have a high content of sodium throughout the subsoil.

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

Unit VIIs-1.—Deep, dominantly moderately steep and steep, well-drained, mainly stony soils.

Unit VIIs-2.—Shallow, dominantly moderately steep and steep, well-drained, mainly stony soils.

Class VIII. Soils and landforms that have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife habitat, or water supply or to esthetic purposes (none in Sebastian County).

Predicted yields

Table 3 lists predicted average yields per acre of the principal crops grown in Sebastian County. The predictions are based on estimates made by farmers, soil scientists, and others who have knowledge of yields in the county and on information taken from research data. The predicted yields are average yields per acre that can be expected by commercial farmers who practice that level of management which tends to produce the highest economic return.

Crops other than those shown in table 3 are grown in the county, but their predicted yields are not given, because their acreage is small or reliable data on yields are not available.

The predicted yields given in table 3 can be expected if the following management practices are used:

1. Rainfall is effectively used and conserved.
2. Surface or subsurface drainage systems, or both, are installed.

TABLE 3.—*Predicted average yields per acre of principal crops under improved management*

[Absence of a figure indicates the crop is not suited to the soil or is not commonly grown on it]

Soil	Corn	Soybeans	Wheat	Pasture			
				Coastal bermudagrass	Common bermudagrass	Pensacola bahiagrass	Tall fescue
	Bu.	*Bu.*	*Bu.*	*A.U.M.*[1]	*A.U.M.*[1]	*A.U.M.*[1]	*A.U.M.*[1]
Barling silt loam	75	35	40	12.0	8.0	8.5	9.0
Cane fine sandy loam, 3 to 8 percent slopes	60	25	30	10.0	7.0	7.5	7.0
Cleora fine sandy loam	65	30	35	10.0	8.0	8.5	8.0
Crevasse soils		15	25	7.5	5.5	6.5	
Enders silt loam, 3 to 8 percent slopes			25		5.0	5.5	4.0
Enders silt loam, 8 to 12 percent slopes					5.0	5.5	4.0
Enders stony silt loam, 12 to 30 percent slopes					4.0		
Enders-Mountainburg association, rolling							
Enders-Mountainburg association, steep							
Iberia clay		35		9.0	7.0	7.0	9.0
Leadvale silt loam, 1 to 3 percent slopes	65	30	30	10.0	7.0	7.5	7.0
Leadvale silt loam, 3 to 8 percent slopes	60	25	30	10.0	7.0	7.5	7.0
Linker fine sandy loam, 3 to 8 percent slopes	50	20	30	9.0	6.0	7.0	6.0
McKamie silt loam, 3 to 8 percent slopes			25	8.0	5.0	6.0	5.0
Montevallo gravelly loam, 3 to 12 percent slopes					4.0	5.0	
Mountainburg sandy loam, 3 to 12 percent slopes					5.0	5.0	
Mountainburg stony sandy loam, 3 to 12 percent slopes					4.0		
Mountainburg stony sandy loam, 12 to 35 percent slopes							
Muskogee silt loam, 3 to 8 percent slopes	60	25	25	10.0	7.0	7.5	7.0
Norwood silty clay loam	85	40	45	12.0	8.0	8.5	8.0
Sallisaw loam, 1 to 3 percent slopes	65	30	35	10.0	7.5	7.5	7.0
Sallisaw loam, 3 to 8 percent slopes	60	25	30	10.0	7.5	7.5	7.0
Sallisaw stony loam, 1 to 8 percent slopes					7.0	7.0	6.5
Severn silt loam	80	40	45	12.0	8.0	8.5	8.0
Taft silt loam		25	25	8.0	6.0	6.0	7.0
Wing silt loam					3.0		
Wrightsville silt loam		25	25		7.0	7.5	7.0
Wrightsville complex, 0 to 2 percent slopes		25	25	10.0	7.0	7.5	7.0
Wrightsville-Messer complex		25	25	10.0	7.0	7.5	7.0

[1] A.U.M. means animal-unit-month. The figures represent the number of months that 1 acre will provide grazing for 1 animal unit (1,000 pounds live weight), or the number of months the pasture can be grazed without injury, multiplied by the number of animal units an area will support. An animal unit is equivalent to 1 cow or steer, 5 hogs, or 7 sheep.

3. Crop residue is managed to maintain soil tilth.
4. Minimum but timely tillage is used.
5. Insect, disease, and weed-control measures are consistently used.
6. Fertilizer is applied according to soil tests and crop needs.
7. Adapted crop varieties are used at appropriate seeding rates.

Use of the Soils for Wildlife Habitat [4]

Soils directly influence kinds and amounts of vegetation and amounts of water available and, in this way, indirectly influence the kinds of wildlife that can live in an area. Soil properties that affect the growth of wildlife habitat are: (1) thickness of soil useful to crops, (2) texture of the surface layer, (3) available water capacity to a depth of 40 inches, (4) wetness, (5) surface stoniness or rockiness, (6) the hazard of flooding, (7) slope, and (8) permeability of the soil to air and water.

In table 4 soils of this county are rated for producing eight elements of wildlife habitat and for three groups, or kinds, of wildlife. The ratings indicate relative suitability for various elements.

A rating of *well suited* means that the element of wildlife habitat and designated habitats generally are easily created, improved, and maintained. Few or no limitations affect management in this category, and satisfactory results are expected if the soil is used for the prescribed purpose.

A rating of *suited* means that the element of wildlife habitat and designated habitats can be created, improved, or maintained in most places. A moderate intensity of management and fairly frequent attention may be required for satisfactory results, however.

A rating of *poorly suited* means that the limitations for the element of wildlife habitat and designated use are severe. Habitats can be created, improved, or maintained in most places, but management is difficult and requires intensive effort.

A rating of *unsuited* means that the limitations for the elements of wildlife habitat are very severe and that unsatisfactory results are to be expected. It is either impossible or impractical to create, improve, or maintain habitats on soils in this category.

An explanation of each subheading in table 4 under "Elements of wildlife habitat" and "Kinds of wildlife" is given in the following paragraphs.

Habitat elements.—Each soil is rated in table 4 according to its suitability for producing various kinds of plants and other elements that make up wildlife habitats. The ratings take into account mainly the characteristics of the soil and closely related natural factors of the environment. They do not take into account climate, the present use of the soil, or the present distribution of wildlife and people on the soil. For this reason, selection of a site for development as a habitat for wildlife requires onsite inspection.

Grain and seed crops are annual plants, such as corn, sorghum, millet, and soybeans.

Grasses and legumes consist of domestic grasses and legumes that are established by planting. They provide food and cover for wildlife. Grasses include bahiagrass, ryegrass, and panicgrass; legumes include annual lespedeza, shrub lespedeza, and clovers.

Wild herbaceous upland plants are native or introduced perennial grasses, forbs, and weeds that provide food and cover for upland wildlife. Among plants generally found are beggarweed, perennial lespedeza, wild bean, pokeweed, and cheatgrass. On rangeland, such plants generally include bluestem grasses, grama grasses, and perennial forbs and legumes.

Hardwood trees, shrubs, and vines are nonconiferous trees, shrubs, and woody vines that produce wildlife food in the form of fruits, nuts, buds, catkins, or browse. Such plants commonly grow in their natural environment, but in places they are planted and developed through wildlife management programs. Among these plants are oak, hickory, beech, cherry, dogwood, maple, viburnum, grape, honeysuckle, greenbrier, and autumn-olive.

Low-growing, coniferous woody plants are cone-bearing trees and shrubs that provide cover and in many places furnish food in the form of browse, seeds, or fruitlike cones. They commonly grow in their natural environment on shallow soils, but they are planted and managed in places. These plants generally include cedars, pines, and ornamental trees and shrubs.

Wetland food and cover plants are annual and perennial herbaceous plants that grow wild on moist and wet sites. They furnish food and cover mostly for wetland wildlife. Among plants generally found are smartweed, wild millet, spikerush and other rushes, sedges, burreed, and tearthumb. Submerged and floating aquatics are not included in this category.

Shallow water developments are impoundments or excavations for controlling water and creating habitats suitable for waterfowl. They generally are not more than 5 feet deep. Some are designed to be drained, planted, and then flooded; others are permanent impoundments in which submerged aquatics grow.

Ponds are either dug-out ponds or a combination of dug-out ponds and low dikes or dams. They hold enough water of suitable quality and depth mainly to support fish production. They also serve as watering places for wildlife.

Kinds of wildlife.—Table 4 rates soils according to their suitability as habitat for the three kinds of wildlife in the county—openland, woodland, and wetland wildlife. These ratings are related to ratings made for the elements of habitat. For example, soils rated unsuited for shallow water developments are rated unsuited for wetland wildlife.

Openland wildlife are birds and mammals that normally live in meadows, pastures, and open areas where grasses, herbs, and shrubby plants grow. Among animals generally found are quail, doves, meadowlarks, field sparrows, cottontail rabbits, and foxes.

Woodland wildlife are birds and mammals that normally live in wooded areas of hardwoods, conifers, and shrubs. Among animals generally found are woodcocks, thrushes, wild turkeys, vireos, deer, squirrels, and raccoons.

Wetland wildlife are birds and mammals that normally live in wet areas, marshes, and swamps. Among

[4] ROY A. GRIZZELL, JR., biologist, Soil Conservation Service, helped prepare this section.

TABLE 4.—*Suitability of soils for elements*

Mapping unit	Elements of wildlife habitat			
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood trees, shrubs, and vines
Barling silt loam	Suited	Well suited	Well suited	Well suited
Cane fine sandy loam, 3 to 8 percent slopes	Suited	Well suited	Well suited	Well suited
Cleora fine sandy loam	Suited	Well suited	Well suited	Well suited
Crevasse soils	Poorly suited	Poorly suited	Suited to poorly suited.	Poorly suited
Enders silt loam, 3 to 8 percent slopes	Suited	Well suited	Well suited	Well suited
Enders silt loam, 8 to 12 percent slopes	Suited	Well suited	Well suited	Well suited
Enders stony silt loam, 12 to 30 percent slopes	Poorly suited to unsuited.	Suited	Well suited	Well suited
Enders-Mountainburg association, rolling:				
Enders soil	Poorly suited	Suited	Well suited	Well suited
Mountainburg soil	Unsuited	Poorly suited	Suited	Suited
Enders-Mountainburg association, steep:				
Enders soil	Unsuited	Poorly suited	Well suited	Well suited
Mountainburg soil	Unsuited	Poorly suited to unsuited.	Suited	Suited
Iberia clay	Suited	Suited	Suited	Well suited
Leadvale silt loam, 1 to 3 percent slopes	Suited	Well suited	Well suited	Well suited
Leadvale silt loam, 3 to 8 percent slopes	Suited	Well suited	Well suited	Well suited
Linker fine sandy loam, 3 to 8 percent slopes	Suited	Well suited	Well suited	Well suited
McKamie silt loam, 3 to 8 percent slopes	Suited	Well suited	Well suited	Well suited
Montevallo gravelly loam, 3 to 12 percent slopes	Poorly suited	Poorly suited	Suited	Suited
Mountainburg sandy loam, 3 to 12 percent slopes	Poorly suited	Poorly suited	Suited	Suited
Mountainburg stony sandy loam, 3 to 12 percent slopes.	Poorly suited to unsuited.	Poorly suited	Suited	Suited
Mountainburg stony sandy loam, 12 to 35 percent slopes.	Unsuited	Poorly suited to unsuited.	Suited	Suited
Muskogee silt loam, 3 to 8 percent slopes	Suited	Well suited	Well suited	Well suited
Norwood silty clay loam	Well suited	Well suited	Well suited	Well suited
Sallisaw loam, 1 to 3 percent slopes	Well suited	Well suited	Well suited	Well suited
Sallisaw loam, 3 to 8 percent slopes	Suited	Well suited	Well suited	Well suited
Sallisaw stony loam, 1 to 8 percent slopes	Poorly suited	Suited	Well suited	Well suited
Severn silt loam	Well suited	Well suited	Well suited	Well suited
Taft silt loam	Suited	Suited	Well suited	Well suited
Wing silt loam	Unsuited	Poorly suited	Poorly suited	Poorly suited
Wrightsville silt loam	Suited to poorly suited.	Suited	Suited	Well suited
Wrightsville complex, 0 to 2 percent slopes	Suited	Suited	Suited	Well suited
Wrightsville-Messer complex	Suited to poorly suited.	Suited	Suited	Well suited

of wildlife habitat and kinds of wildlife

Elements of wildlife habitat—Continued				Kinds of wildlife		
Low-growing coniferous woody plants	Wetland food and cover plants	Shallow water developments	Ponds	Openland	Woodland	Wetland
Poorly suited	Poorly suited	Poorly suited	Poorly suited	Well suited	Well suited	Poorly suited.
Poorly suited	Unsuited	Unsuited	Well suited	Well suited	Well suited	Unsuited.
Poorly suited	Unsuited	Unsuited	Unsuited	Well suited	Well suited	Unsuited.
Poorly suited	Unsuited	Unsuited	Unsuited	Poorly suited	Poorly suited	Unsuited.
Poorly suited	Unsuited	Unsuited	Well suited	Well suited	Well suited	Unsuited.
Poorly suited	Unsuited	Unsuited	Well suited	Well suited	Well suited	Unsuited.
Poorly suited	Unsuited	Unsuited	Suited	Suited	Well suited	Unsuited.
Poorly suited	Unsuited	Unsuited	Suited	Suited	Well suited	Unsuited.
Suited	Unsuited	Unsuited	Unsuited	Poorly suited	Suited	Unsuited.
Poorly suited	Unsuited	Unsuited	Poorly suited	Poorly suited	Well suited	Unsuited.
Suited	Unsuited	Unsuited	Unsuited	Poorly suited	Suited	Unsuited.
Poorly suited	Well suited	Well suited	Well suited	Suited	Well suited	Well suited.
Poorly suited	Poorly suited	Poorly suited	Well suited to suited.	Well suited	Well suited	Poorly suited.
Poorly suited	Unsuited	Unsuited	Well suited to suited.	Well suited	Well suited	Unsuited.
Poorly suited	Unsuited	Unsuited	Suited to poorly suited.	Well suited	Well suited	Unsuited.
Poorly suited	Unsuited	Unsuited	Well suited	Well suited	Well suited	Unsuited.
Suited	Unsuited	Unsuited	Poorly suited	Poorly suited	Suited	Unsuited.
Suited	Unsuited	Unsuited	Unsuited	Poorly suited	Suited	Unsuited.
Suited	Unsuited	Unsuited	Unsuited	Poorly suited	Suited	Unsuited.
Suited	Unsuited	Unsuited	Unsuited	Poorly suited	Suited	Unsuited.
Poorly suited	Unsuited	Unsuited	Well suited	Well suited	Well suited	Unsuited.
Poorly suited	Unsuited	Unsuited	Poorly suited	Well suited	Well suited	Unsuited.
Poorly suited	Unsuited	Unsuited	Suited	Well suited	Well suited	Unsuited.
Poorly suited	Unsuited	Unsuited	Suited	Well suited	Well suited	Unsuited.
Poorly suited	Unsuited	Unsuited	Poorly suited	Suited	Well suited	Unsuited.
Poorly suited	Unsuited	Unsuited	Poorly suited	Well suited	Well suited	Unsuited.
Poorly suited	Suited	Suited	Well suited	Suited	Well suited	Suited.
Poorly suited	Unsuited	Suited	Well suited	Poorly suited	Poorly suited	Poorly suited.
Poorly suited	Well suited	Well suited	Well suited	Suited	Well suited	Well suited.
Poorly suited	Suited	Well suited	Well suited	Suited	Well suited	Well suited.
Poorly suited	Suited	Well suited	Well suited	Suited	Well suited	Well suited.

animals generally found are ducks, geese, rails, shore birds, herons, mink, and muskrats.

Use of the Soils for Woodland[5]

Originally, Sebastian County was mainly wooded, but there were scattered prairie areas, such as Massard Prairie south of Ft. Smith. Now, trees cover about 39 percent of the county, of which about 46,600 acres is within the Ouachita National Forest and the Fort Chaffee Military Reservation.

Good to poor stands of commercial trees are produced in the woodlands of the county. Needleleaf forest types are most commonly found on the hills, and broadleaf types generally are dominant on the bottoms along the rivers and creeks.

The value of the wood products is substantial, although it is below its potential. Other values include grazing, wildlife, recreation, natural beauty, and conservation of soil and water. This section has been provided to explain how soils in the county affect tree growth and management. In table 5 potential productivity and management problems of the soils in Sebastian County are listed.

In the first column the soils are listed by series and map symbols. If the name of a mapping unit contains the name of two or more series and the unit is an association, the component soils are listed and evaluated separately under each series name.

The next column gives the woodland group. Each group is made up of soils that are suited to the same kinds of trees, that need about the same kind of management to produce these trees, and that have about the same potential productivity.

Each woodland group is identified by a three-part symbol. The first part of the symbol indicates the relative productivity of the soils: 1 is very high; 2 is high; 3 is moderately high; 4 is moderate; and 5 is low. The second part of the symbol, a letter, indicates the important soil property that imposes a moderate or severe hazard or limitation in managing the soils for wood production. The letter *x* shows that the main limitation is stoniness or rockiness; *w* shows that excessive water in or on the soil is the chief limitation; *t* shows that toxic substances in the soil are the chief limitation; *d* shows that the rooting depth is restricted; *c* shows that clay in the upper part of the soil is a limitation; *s* shows that the soils are sandy; *f* shows that the soils have large amounts of coarse fragments; *r* shows that the soils have steep slopes; and *o* shows that the soils have no significant restrictions or limitations for woodland use or management. The third element in the symbol indicates the degree of management problems and the general suitability of the soils for certain kinds of trees.

In the third column is a list of some of the commercially important trees that are adapted to the soil. These are the trees that woodland managers generally favor in intermediate or improvement cuttings. Given in the fourth column is the potential productivity of these trees in terms of site index. This is the average height of dominant trees, in feet, at age 30 for cottonwood; at age 35 for sycamore; at age 25 for planted pines; and at age 50 for all other species or types.

The important understory grasses, forbs, or low shrubs for a medium tree canopy class (36 to 55 percent canopy) are listed in the fifth column. Productivity is expressed in pounds of air-dry forage per acre. Where yield data are not available and estimates cannot be made, the species are listed in order of their productivity.

The management problems evaluated in table 5 are erosion hazard, equipment limitations, and seedling mortality. Erosion hazard measures the risk of soil losses in well-managed woodland. The hazard is slight if the expected soil loss is small, moderate if some measures to control erosion are needed in logging and construction, and severe if intensive treatment or special equipment and methods are needed to prevent excessive soil loss.

Ratings for equipment limitation evaluate soil conditions that restrict the use of equipment normally used in woodland management or harvesting. A rating of slight indicates that equipment use is not limited to the species of tree or the time of year. A rating of moderate indicates that a seasonal limitation or need for modification in methods or equipment exists. A rating of severe indicates that specialized equipment or operations are needed.

Ratings for seedling mortality indicate the degree of expected mortality of planted seedlings where plant competition is not a limiting factor. Normal rainfall, good planting stock, and proper planting are assumed. A rating of slight indicates that expected mortality is less than 25 percent. A rating of moderate indicates that expected mortality is 25 to 50 percent, and a rating of severe indicates that expected mortality is more than 50 percent.

In the last column is a list of trees suitable to plant for commercial wood production.

Use of the Soils for Range[6]

Soils vary in their capacity to produce grass and other plants for grazing. If the range is in similar condition, soils that produce about the same kinds and amounts of forage make up a range site.

Range sites are kinds of rangeland that differ in their ability to produce vegetation. The soils of any one range site produce about the same kind of climax vegetation. Climax vegetation is the stabilized plant community; it reproduces itself and does not change as long as the environment remains unchanged. Throughout the prairie and the plains, the climax vegetation consists of the plants that were growing there when the region was first settled. If cultivated crops are not grown, the most productive combination of forage plants on a range site generally is the climax vegetation.

Decreasers are plants in the climax vegetation that tend to decrease in relative amount under close grazing. They generally are the tallest and most productive perennial grasses and forbs and are the most palatable to livestock.

Increasers are plants in the climax vegetation that increase in relative amount as the more desirable decreaser plants are reduced by close grazing. They commonly are

[5] MAX D. BOLAR, woodland conservationist, and IVAN R. PORTER, range conservationist, Soil Conservation Service, helped prepare this section.

[6] IVAN R. PORTER, range conservationist, Soil Conservation Service, helped prepare this section.

shorter than decreasers and generally are less palatable to livestock.

Invaders are plants that cannot compete with plants in the climax plant community for moisture, nutrients, and light. Hence, invaders come in and grow along with increasers after the climax vegetation has been reduced by grazing. Many invaders are annual weeds, and some are shrubs that have some grazing value, but others have little value for grazing.

The condition of a range is judged according to standards that apply to the particular range site. It expresses the present kind and amount of vegetation in relation to the climax plant community for that site.

Four range condition classes are used to indicate the degree of departure from the potential, or climax, vegetation brought about by grazing or other uses. The classes show the present condition of the native vegetation on a range site in relation to the potential native vegetation.

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

Potential forage production depends on the range site. Current forage production depends on the range condition and the moisture available to plants during their growing season.

A primary objective of good range management is to keep rangeland in excellent or good condition. If this is done, water is conserved, yields are improved, and the soils are protected. But it may be difficult to recognize important changes in the kind of cover on a range site. These changes take place gradually and can be misinterpreted or overlooked. Growth encouraged by heavy rainfall may lead to the conclusion that the range is in good condition, when, in fact, the cover is weedy and the long-term trend is toward lower production. On the other hand, some rangeland that has been closely grazed for short periods under the supervision of a careful manager may have a degraded appearance that temporarily conceals its quality and ability to recover.

Descriptions of range sites

In the following pages, the range sites of Sebastian County are described and the climax plants and principal invaders on the sites are named. Also given is an estimate of the potential annual yield of air-dry herbage for each site when it is in excellent condition, both for years when moisture is favorable and for years when moisture is unfavorable. The soils in each site can be determined by referring to the "Guide to Mapping Units" at the back of this survey.

ALKALI FLATS RANGE SITE

The only soil in this site is Wing silt loam. This soil is level, dominantly alkaline, somewhat poorly drained to moderately well drained, and very slowly permeable. The surface layer is silt loam, and the subsoil is silty clay and silty clay loam. Because this soil has large amounts of sodium and magnesium in the subsoil, the root zone is shallow and the available water capacity is low.

In excellent condition this site produces moderately small amounts of switchgrass, Canada wildrye, indiangrass, little bluestem, and low paspalum. As the condition of the site deteriorates, these plants are replaced by spike tridens, sedges, and low, brushy, woody plants. Annual three-awns and dropseed, lanceleaf ragweed, sumpweed, and croton are the main invaders.

If this site is in excellent condition, the estimated annual yield of forage ranges from 2,500 pounds in years when moisture is favorable to 1,500 pounds in years when moisture is unfavorable.

CLAY BREAK, SHALE RANGE SITE

The soils in this site are deep, gently sloping to steep, well drained, and very slowly permeable. The surface layer is silt loam that is gravelly or stony in many areas. The subsoil is mainly silty clay. Available water capacity is high, but runoff is medium to rapid. The content of plant nutrients is low.

In excellent condition this site produces open stands of oak, hickory, and winged elm. These make up about 35 to 45 percent of the cover, and the rest is grasses, legumes, and forbs. Little bluestem, indiangrass, Canada wildrye, and big bluestem are the main decreasers, and Virginia tephrosia, native lespedezas, and catclaw sensitivebriar are the main legumes. As the condition of the site deteriorates, pine and hardwood trees, broomsedge, ragweed, white snakeroot, and annual three-awns invade and increase.

If this site is in excellent condition, the estimated annual yield of forage ranges from about 5,000 pounds in years when moisture is favorable to about 2,500 pounds in years when moisture is unfavorable.

LOAMY PRAIRIE RANGE SITE

The soils in this site are deep, dominantly level to nearly level, poorly drained, and very slowly permeable. The surface and subsurface layers are silt loam, and the subsoil is silty clay and clay. Available water capacity is high, and the root zone is deep.

In excellent condition this site produces such decreasers as big bluestem, little bluestem, indiangrass, and switchgrass. These make up 80 percent of the forage. Between 5 and 10 percent is such legumes and perennial forbs as bobsroot scurfpea, brownhair tephrosia, ashy sunflower, gayfeather, and leadplant. About 10 to 15 percent is such increasers as meadow dropseed, jointtail purpletop, wild indigo, heath aster, low panicums, and goldenrod. As the condition of the site deteriorates, decreaser plants are replaced by dropseed and three-awns, broomsedge, ragweed, ironweed, and white snakeroot. Such woody species as persimmon and hawthorn invade the intermound areas, and sassafras and sumac invade the mound areas.

If the site is in excellent condition, the estimated annual yield of forage ranges from 6,000 pounds in years when moisture is favorable to 4,200 pounds in years when moisture is unfavorable.

LOAMY UPLAND RANGE SITE

The only soil in this site is Linker fine sandy loam, 3 to 8 percent slopes. This soil is gently sloping, well drained, and moderately permeable. The surface layer is fine sandy loam, and the subsoil is loam and sandy clay loam. Available water capacity is moderate, the root zone is 24 to 40 inches thick over sandstone bedrock, and the content of plant nutrients is low.

TABLE 5.—*Woodland groups and*

Soil series and map symbols	Woodland group	Potential productivity		
		Important trees	Site index [1]	Important understory plants (medium canopy)
Barling: Ba	2o7	Loblolly pine Shortleaf pine Sweetgum Shumard oak Cottonwood Sycamore Black walnut	90 80 90 90 95 [2] [2]	Big bluestem, eastern gamagrass, Virginia wildrye, switchgrass, switchcane, and beaked panicum.
Cane: CaC	3o7	Loblolly pine Shortleaf pine Red oaks White oaks Black walnut Black cherry Redcedar	80 70 70 60 [2] [2] 50	Little bluestem, big bluestem, plumegrass, switchgrass, Virginia wildrye, and low panicums.
Cleora: Cr	2o7	Loblolly pine Shortleaf pine Sweetgum Shumard oak Cottonwood Sycamore Black walnut	90 80 90 90 [2] [2] [2]	Big bluestem, eastern gamagrass, Virginia wildrye, switchgrass, switchcane, and beaked panicum.
Crevasse: Cv	3s6	Cottonwood Sycamore Pecan Silver maple Hackberry Sugarberry	90 [2] [2] [2] [2] [2]	Switchgrass, Virginia wildrye, switchcane, sedges, and low panicums.
Enders:				
EdC, EdD	4o1	Shortleaf pine Red oaks Loblolly pine Redcedar	60 60 [2] [2]	Little bluestem, big bluestem, indiangrass, Canada wildrye, catclaw sensitivebriar, Virginia tephrosia, and native lespedezas.
EeE, EmC For Mountainburg part of EmC, see Mountainburg series, group 5x3.	4x2	Shortleaf pine Red oaks Loblolly pine Redcedar	60 60 [2] [2]	Little bluestem, big bluestem, indiangrass, Canada wildrye, catclaw sensitivebriar, Virginia tephrosia, and native lespedezas.
EmE For Mountainburg part of this unit, see Mountainburg series, group 5x3.	5r3	Shortleaf pine Redcedar	50 30	Little bluestem, big bluestem, indiangrass, Canada wildrye, catclaw sensitivebriar, Virginia tephrosia, and native lespedezas.
Iberia: Ib	2w6	Cottonwood Sycamore Sweetgum Red oaks Water oaks	95 [2] 90 80 90	Virginia wildrye, big bluestem, plumegrass, switchgrass, and low panicums.
Leadvale: LeB, LeC	3o7	Loblolly pine Shortleaf pine Red oaks White oaks Black walnut Black cherry Redcedar	80 70 70 60 [2] [2] 50	Little bluestem, big bluestem, plumegrass, switchgrass, Virginia wildrye, and low panicums.
Linker: LnC	4o1	Shortleaf pine Redcedar	60 40	Little bluestem, big bluestem, indiangrass, beaked panicum, perennial sunflowers, and native lespedeans.

See footnotes at end of table.

factors affecting management

Potential productivity—Con.		Management problems			Preferred trees for planting
Total yield of understory plants in—		Erosion hazard	Equipment limitations	Seedling mortality	
Favorable years	Unfavorable years				
Lb. per acre 3, 500	*Lb. per acre* 1, 500	Slight	Slight	Slight	Black walnut, loblolly pine, shortleaf pine, cottonwood, sycamore, Shumard oak, cherrybark oak, black locust, and black cherry.
3, 500	1, 000	Slight	Slight	Slight	Loblolly pine, shortleaf pine, redcedar, red oaks, black locust, black walnut, and black cherry.
3, 500	1, 500	Slight	Slight	Slight	Black walnut, loblolly pine, shortleaf pine, cottonwood, sycamore, Shumard oak, cherrybark oak. black locust, and black cherry.
3, 500	1, 500	Slight	Moderate	Severe	Cottonwood, sycamore, and sweetgum.
3, 000	1, 000	Slight	Slight	Slight	Loblolly pine, redcedar, and shortleaf pine.
3, 000	1, 000	Moderate	Moderate	Slight to moderate.	Loblolly pine, redcedar, and shortleaf pine.
3, 000	1, 000	Moderate to severe.	Severe	Moderate to severe.	Loblolly pine, redcedar, and shortleaf pine.
3, 500	1, 500	Slight	Severe	Severe	Cottonwood, sycamore, sweetgum, water oaks, willow oak, cherrybark oak, swamp chestnut oak, and Nuttall oak.
3, 500	1, 000	Slight	Slight	Slight	Loblolly pine, shortleaf pine, redcedar, red oaks, black locust, black walnut, and black cherry.
3, 000	1, 200	Slight	Slight	Slight	Loblolly pine, shortleaf pine, and redcedar.

TABLE 5.—*Woodland groups and*

Soil series and map symbols	Woodland group	Potential productivity		
		Important trees	Site index [1]	Important understory plants (medium canopy)
McKamie: MkC	3c2	Loblolly pine Shortleaf pine	80 70	Switchgrass, switchcane, Virginia wildrye, beaked panicum, and broadleaf uniola.
Montevallo: MlD	5d3	Loblolly pine Shortleaf pine Redcedar	60 50 30	Little bluestem, big bluestem, indiangrass, Canada wildrye, catclaw sensitivebriar, and native lespedezas.
Mountainburg:				
MmD	5d3	Loblolly pine Shortleaf pine Redcedar	60 50 30	Little bluestem, big bluestem, indiangrass, Canada wildrye, switchgrass, low panicums, Virginia tephrosia, native lespedezas, and perennial sunflowers.
MnD, MnE	5x3	Loblolly pine Shortleaf pine Redcedar	60 50 30	Little bluestem, big bluestem, indiangrass, Canada wildrye, switchgrass, low panicums, Virginia tephrosia, native lespedezas, and perennial sunflowers.
Muskogee: MuC	3o7	Shortleaf pine Sweetgum Loblolly pine Water oaks Red oaks	70 80 (2) (2) (2)	Virginia wildrye, little bluestem, big bluestem, plumegrass, switchgrass, and low panicums.
Norwood: No	2o4	Cottonwood Sweetgum Southern red oak Water oaks Sycamore	100 90 80 90 (2)	Big bluestem, eastern gamagrass, Virginia wildrye, broadleaf uniola, switchgrass, switchcane, and beaked panicum.
Sallisaw: SaB, SaC, SlC	3o7	Shortleaf pine Redcedar Red oaks Loblolly pine Black walnut Shumard oak Sweetgum Black locust	70 50 70 (2) (2) (2) (2) (2)	Little bluestem, big bluestem, plumegrass, switchgrass, Virginia wildrye, and low panicums.
Severn: Sn	2o4	Cottonwood Sweetgum Southern red oak Water oaks Sycamore	100 90 80 90 (2)	Big bluestem, eastern gamagrass, Virginia wildrye broadleaf uniola, switchgrass, switchcane, and beaked panicum.
Taft: Tf	3w8	Water oaks Sweetgum Loblolly pine Shortleaf pine	70 70 70 60	Switchgrass, eastern gamagrass, Florida paspalum, plumegrass, longspike tridens, beaked panicum, and broadleaf uniola.
Wing: Wg Soil not suitable for production of timber of commercial quality. For grazing potential, see the Alkali Flats range site.	5t0			
Wrightsville: Wr, WsA, Wt	3w9	Loblolly pine Sweetgum Water oaks	80 70 70	Big bluestem, little bluestem, switchgrass, indiangrass, ashy sunflower, bobsroot scurfpea, and gayfeather.

[1] Site class ratings adapted from data gathered in soil-site studies by the Soil Conversation Service and the Forest Service (*13, 14, 16, 17*).

factors affecting management—Continued

Potential productivity—Con.		Management problems			
Total yield of understory plants in—					
Favorable years	Unfavorable years	Erosion hazard	Equipment limitations	Seedling mortality	Preferred trees for planting
Lb. per acre 4,000	*Lb. per acre* 1,800	Slight	Moderate	Slight to moderate.	Loblolly pine and shortleaf pine.
2,000	800	Moderate to severe.	Moderate to severe.	Moderate to severe.	Loblolly pine, shortleaf pine, and redcedar.
2,500	1,000	Moderate to severe.	Moderate to severe.	Moderate to severe.	Loblolly pine, shortleaf pine, and redcedar.
2,500	1,000	Moderate to severe.	Severe	Moderate to severe.	Loblolly pine, shortleaf pine, and redcedar.
3,000	1,500	Slight	Slight	Slight	Loblolly pine, shortleaf pine, redcedar, Shumard oak, water oaks, and sweetgum.
3,500	1,500	Slight	Slight	Slight	Cottonwood, sycamore, sweetgum, red oaks, black walnut, and water oaks.
3,000	1,500	Slight	Slight	Slight	Loblolly pine, shortleaf pine, black walnut, sweetgum, cherrybark oak, Shumard oak, redcedar, and black locust.
3,500	1,500	Slight	Slight	Slight	Cottonwood, sycamore, sweetgum, red oaks, black walnut, and water oaks.
3,500	1,800	Slight	Moderate	Slight	Loblolly pine, sweetgum, and water oaks.
3,500	1,800	Slight	Severe	Moderate to severe.	Loblolly pine, Shumard oak, water oaks, and sweetgum.

[1] The tree is known to grow well on the soil, but soil-woodland site data were not available upon which to base an estimate of site index.

In excellent condition this site produces white oak, post oak, red oak, hickories, and shortleaf pine. These make up about 40 to 50 percent of the cover, and the rest is tall grasses, legumes, and forbs. The main forage plants are little bluestem, big bluestem, indiangrass, beaked panicum, native lespedezas, and perennial sunflowers. As the condition of the site deteriorates, the decreaser plants are replaced by broomsedge, annual three-awns, ragweed, white snakeroot, ironweed, and tree seedlings; or the canopy is filled by shortleaf pine and hardwoods and there are but few palatable understory plants.

If the site is in excellent condition, the estimated annual yield of forage ranges from 5,500 pounds in years when moisture is favorable to 3,000 pounds in years when moisture is unfavorable.

SANDSTONE RIDGE RANGE SITE

The soils in this site are shallow, gently sloping to steep, well drained, and moderately rapidly permeable. The surface layer is sandy loam that is gravelly or stony in most areas. The subsoil is dominantly gravelly or stony fine sandy loam. Available water capacity is low, the content of plant nutrients is low, and the root zone is less than 20 inches thick over sandstone bedrock.

In excellent condition this site produces open stands of scrubby post oak, blackjack oak, and hickories, and these make up about 25 to 35 percent of the canopy. The rest is grasses, legumes, and forbs. Little bluestem makes up most of the understory; indiangrass, big bluestem, Canada wildrye, and switchgrass are other decreasers. The main forbs and legumes are perennial sunflower, native lespedeza, Virginia tephrosia, and tickclovers. Two important shrubs are New Jersey tea and skunkbush sumac. As the site deteriorates the decreaser grasses are replaced by oak seedlings and sprouts and such plants as hidden dropeed, Carolina jointtail, three-awns, pricklypear cactus, and ragweed; or the canopy is filled by shortleaf pine and hardwoods and there are but few palatable understory plants.

If the site is in excellent condition, the estimated annual yield of forage ranges from 4,800 pounds in years when moisture is favorable to 2,000 pounds in years when moisture is unfavorable.

SHALE BREAK RANGE SITE

The only soil in this site is Montevallo gravelly loam, 3 to 12 percent slopes. This soil is gently sloping to moderately sloping, well drained, and moderately permeable. The surface layer is gravelly and shaly loam and silt loam, and the subsoil is shaly silty clay loam. The available water capacity is low, and content of plant nutrients is low. The root zone is less than 20 inches thick over acid shale.

In excellent condition this site produces open stands of scrubby oaks and hickories that make up about 25 to 35 percent of the cover. Grasses, legumes, and forbs make up the rest. Little bluestem is the dominant grass. Big bluestem, indiangrass, Canada wildrye, starved panicum, catclaw sensitivebriar, and native lespedeza are important forage plants. As the condition of the site deteriorates, these plants are replaced by three-awns, dropseed, broomsedge, ragweed, white snakeroot, ironweed, and pricklypear cactus; or the canopy is invaded by shortleaf pine and hardwoods and there are but few palatable understory plants.

If this site is in excellent condition, the estimated annual yield of forage ranges from 3,200 pounds in years when moisture is favorable to 1,500 pounds in years when moisture is unfavorable.

Engineering Uses of the Soils [7]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, soil drainage condition, shrink-swell potential, grain-size distributon, plastcity, and reaction. Also important are depth to the water table, depth to bedrock, and slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 6, 7, and 8, which show, respectively, several estimated soil properties significant to engineering; interpretations for various engineering uses; and the results of engineering laboratory tests of soil samples.

This information, along with the soil map and other parts of this survey, can be used to make interpretations in addition to those given in tables 6 and 7; and it can also be used to make other useful maps.

This information, however, does not eliminate the need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally depths greater than 72 inches. Also, inspection of sites, especially small ones, is needed because many delineated areas of a given soil mapping unit contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities

[7] CHARLES E. CHILDRESS, civil engineer, Soil Conservation Service, helped prepare this section.

or limitations for soil engineering. Specific values should not be assigned to the ratings of bearing strength given in table 7.

Some of the terms used in this soil survey have special meaning in soil science that is different from that in engineering. The Glossary defines many of these terms as they are commonly used in soil science.

Engineering classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified Soil Classification system (*18*) used by the Soil Conservation Service, the Department of Defense, and others and the AASHO system adopted by the American Association of State Highway Officials (*1*).

In the Unified system soils are classified according to particle-size distribution, plasticity, liquid limit, and organic-matter content. Soils are grouped into 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes, for example, ML-CL.

The AASHO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A-1 are gravelly soils of high bearing strength, the best soils for subgrade (foundation). At the other extreme, in group A-7, are clay soils that have low strength when wet, the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A-1, A-2, and A-7 groups are divided as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHO classification for tested soils, with group index numbers in parentheses, is shown in table 8; the estimated classification, without group index numbers, is given in table 6 for all soils mapped in the county.

Soil properties significant to engineering

Several estimated soil properties significant to engineering are given in table 6. These estimates are made for representative profiles, by layers sufficiently different to have a different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Explanations of some of the columns in table 6 follow.

Depth to bedrock is the distance from the surface of the soil to the upper surface of the rock layer.

Depth to seasonal high water table is the distance from the surface of the soil to the highest level that ground water reaches in the soil in most years. The depth given in table 6 is the depth to a seasonal perched water table that is separated from the permanent water table by an impervious layer or a dry zone.

Soil texture is described in table 6 in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loamy sand." "Sand," "silt," "clay," and other terms used in the USDA textural classification system are defined in the Glossary of this survey.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil increases from a dry state, the material changes from a semisolid to a plastic. If the moisture content is further increased, the material changes from a plastic to a liquid. The plastic limit is the moisture content at which the soil material changes from a semisolid to a plastic, and the liquid limit is the moisture content at which the soil material changes from a plastic to a liquid. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic. Liquid limit and plasticity index are estimated in table 6, but in table 8 the data on liquid limit and plasticity index are based on tests of soil samples.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on the basis of soil characteristics observed in the field, particularly structure and texture. The estimates in table 6 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts. These estimates should not be confused with the coefficient "K" used by engineers.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed in pH values. The pH value and terms used to describe soil reaction are explained in the Glossary.

Shrink-swell potential is the relative change in volume to be expected of soil material with changes in moisture content, that is, the extent to which the soil shrinks as it dries or swells when wet. Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A high shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material having this rating.

Corrosivity, as used in table 6, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such soil properties as drainage, texture, total acidity, and electrical conductivity of the soil material. Corrosivity for concrete is influenced mainly by the content of sodium or magnesium sulfate, but also by soil texture and acidity. Installations of uncoated steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely in one

TABLE 6.—*Estimated properties*

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

Soil series and map symbols	Depth to—		Depth from surface	Classification			Coarse fraction greater than 3 inches
	Bedrock	Seasonal high water table		USDA texture	Unified	AASHO	
	Inches	*Feet*	*Inches*				
Barling: Ba	>72	1½–2	0–36	Silt loam	ML	A-4	
			36–72	Silt loam	ML or CL	A-4 or A-6	
Cane: CaC	>72	2	0–5	Fine sandy loam	ML	A-4	
			5–9	Loam	ML or CL	A-4	
			9–25	Clay loam	CL	A-6	
			25–72	Clay loam	CL	A-6	
Cleora: Cr	>72	>6	0–72	Fine sandy loam	ML	A-4	
Crevasse: Cv	>72	>6	0–8	Loamy fine sand	SM	A-2	
			8–35	Fine sand	SP-SM or SM	A-2	
			35–72	Sand	SP-SM or SP	A-3	
*Enders: EdC, EdD	42–96	>6	0–7	Silt loam	ML or CL	A-4	
			7–72	Silty clay	CH or MH	A-7	
EeE, EmC, EmE. For Mountainburg part of EmC and EmE, see units MnD and MnE under the Mountainburg series.	42–96	>6	0–7	Stony silt loam	ML or CL	A-4	20–45
			7–72	Silty clay	CH or MH	A-7	
Iberia: Ib	>72	0–½	0–72	Clay	CH	A-7	
Leadvale: LeB, LeC	>72	2	0–10	Silt loam	ML or CL	A-4	
			10–25	Silty clay loam	CL	A-6	
			25–72	Silty clay loam	CL	A-4 or A-6	
Linker: LnC	24–40	>3½	0–5	Fine sandy loam	SM or ML	A-4	
			5–8	Loam	ML or CL	A-4 or A-6	
			8–24	Clay loam	ML or CL	A-6	
			24–36	Sandy clay loam	SM, SC, ML, or CL	A-4 or A-6	
McKamie: MkC	>72	>6	0–4	Silt loam	ML	A-4	
			4–8	Silty clay loam	CL	A-6	
			8–36	Clay	CH	A-7	
			36–47	Clay	CH	A-7	
			47–66	Sandy clay loam	CL	A-6	

See footnotes at end of table.

of soils significant to engineering

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

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability [1]	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to—	
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)							Uncoated steel	Concrete
						Inches per hour	*Inches per inch of soil*	*pH*			
--------	100	95–100	70–90	--------	[2] NP	0.6–2.0	0.16–0.24	5.1–6.5	Low	Moderate	Low to moderate.
--------	100	95–100	70–90	<30	NP–15	0.6–2.0	0.16–0.24	5.1–6.5	Low	Moderate	Low to moderate.
--------	100	95–100	55–70	--------	NP	0.6–2.0	0.11–0.15	5.1–6.0	Low	Moderate	Moderate.
--------	100	95–100	65–80	20–40	<10	0.6–2.0	0.15–0.20	5.1–6.0	Low	Moderate	Moderate.
--------	100	95–100	65–80	30–40	15–25	0.2–0.6	0.15–0.20	4.5–5.5	Low	High	Moderate to high.
--------	100	95–100	70–90	30–40	20–30	0.06–0.2	0.07–0.10	4.5–5.5	Low	High	Moderate to high.
--------	100	95–100	60–75	--------	NP	2.0–6.0	0.11–0.15	5.1–6.0	Low	Low	Moderate.
--------	100	90–100	25–35	--------	NP	>6.0	0.07–0.11	6.1–8.4	Low	Low	Low to moderate.
--------	100	90–100	10–25	--------	NP	>6.0	0.05–0.08	6.1–8.4	Low	Low	Low to moderate.
--------	100	70–90	0–10	--------	NP	>6.0	0.02–0.06	6.1–8.4	Low	Low	Low to moderate.
90–100	90–100	80–95	75–90	25–35	7–10	0.6–2.0	0.16–0.24	4.5–5.5	Low	Low	Moderate to high.
90–100	90–100	85–100	80–95	65–80	35–45	<0.06	0.14–0.18	4.5–5.5	Moderate to high.	High	Moderate to high.
70–80	65–80	60–75	55–70	25–35	7–10	0.6–2.0	0.12–0.18	4.5–5.5	Low	Low	Moderate to high.
90–100	90–100	85–100	80–95	65–80	35–45	<0.06	0.14–0.18	4.5–5.5	Moderate to high.	High	Moderate to high.
--------	100	95–100	95–100	55–70	40–60	<0.06	0.12–0.18	6.1–8.4	High	High	Low.
100	95–100	90–100	65–95	<30	NP–10	0.6–2.0	0.16–0.24	5.1–6.0	Low	Moderate	Moderate.
95–100	95–100	90–100	90–100	25–40	12–20	0.6–2.0	0.18–0.22	4.5–5.5	Low	High	Moderate to high.
95–100	95–100	85–95	80–90	25–40	8–20	0.2–0.6	0.09–0.11	4.5–5.5	Low	High	Moderate to high.
90–100	90–100	70–95	40–70	<35	NP–10	0.6–2.0	0.11–0.15	5.1–6.0	Low	Low	Moderate.
90–100	90–100	75–100	55–80	15–35	<15	0.6–2.0	0.15–0.20	4.5–5.5	Low	Low	Moderate to high.
90–100	90–100	75–100	55–80	20–40	10–20	0.6–2.0	0.15–0.20	4.5–5.5	Low	Moderate	Moderate to high.
80–100	80–100	75–100	40–60	20–40	7–20	0.6–2.0	0.12–0.17	4.5–5.5	Low	Moderate	Moderate to high.
--------	100	95–100	90–100	--------	NP	0.6–2.0	0.16–0.24	5.1–6.0	Low	Low	Moderate.
--------	100	95–100	90–100	25–40	15–30	0.2–0.6	0.18–0.22	4.5–5.5	Moderate	Moderate	Moderate to high.
--------	100	95–100	95–100	55–70	35–50	<0.06	0.12–0.18	4.5–5.5	High	High	Moderate to high.
--------	100	95–100	95–100	55–70	35–50	<0.06	0.12–0.18	5.6–7.8	High	High	Moderate to low.
--------	100	90–100	80–95	25–40	15–30	0.2–0.6	0.12–0.17	5.6–7.8	Moderate	Moderate	Moderate to low.

TABLE 6.—*Estimated properties*

Soil series and map symbols	Depth to—		Depth from surface	Classification			Coarse fraction greater than 3 inches
	Bedrock	Seasonal high water table		USDA texture	Unified	AASHO	
	Inches	*Feet*	*Inches*				
Messor	>72	3-4	0-39	Silt loam	ML or CL-ML	A-4	----------
Mapped only in a complex with Wrightsville soils.			39-58	Silty clay loam	CL	A-6	----------
			58-72	Silty clay	CH	A-7	----------
Montevallo: MlD	10-20	>1½	0-3	Gravelly loam	ML	A-4	----------
			3-8	Shaly silt loam	ML or CL-ML	A-4 or A-6	----------
			8-16	Shaly silty clay loam.	GC	A-2 or A-6	----------
Mountainburg:							
MmD	12-20	>1½	0-9	Sandy loam	SM	A-2	0-5
			9-18	Gravelly fine sandy loam.	GM-GP or GM	A-1	10-25
MnD, MnE	12-20	>1½	0-9	Stony sandy loam	GM	A-1 or A-2	30-65
			9-18	Gravelly fine sandy loam.	GM-GP or GM	A-1	15-40
Muskogee: MuC	>72	>6	0-17	Silt loam	ML or CL	A-4	----------
			17-27	Silty clay loam	CL	A-6	----------
			27-72	Silty clay	CH	A-7	----------
Norwood: No	>72	>6	0-8	Silty clay loam	CL	A-6 or A-7	----------
			8-26	Silt loam	ML or CL	A-4 or A-6	----------
			26-30	Very fine sandy loam	ML or CL-ML	A-4	----------
			30-38	Silty clay loam	CL	A-6 or A-7	----------
			38-59	Clay	CH	A-7	----------
			59-72	Silt loam and loamy fine sand.	ML or SM	A-2 or A-4	----------
Sallisaw:							
SaB, SaC	>72	>6	0-13	Loam	ML or CL	A-4	----------
			13-33	Loam	ML or CL	A-4	----------
			33-59	Loam	ML or CL	A-4	----------
			59-72	Sandy clay loam	CL	A-6	----------
SlC	>72	>6	0-13	Stony loam	ML or CL	A-4	25-40
			13-33	Stony loam	ML or CL	A-4	20-30
			33-59	Gravelly loam	ML or CL	A-4	10-20
			59-72	Gravelly sandy clay loam.	GC or CL	A-6	10-20
Severn: Sn	>72	>6	0-15	Silt loam	ML or CL-ML	A-4	----------
			15-50	Very fine sandy loam.	ML or CL-ML	A-4	----------
			50-69	Sand	SP or SM-SP	A-1 or A-3	----------
			69-80	Loamy fine sand	SM	A-2 or A-4	----------
Taft: Tf	>72	2	0-12	Silt loam	ML or CL	A-4	----------
			12-26	Silt loam	CL	A-4 or A-6	----------
			26-59	Silty clay loam	CL	A-6 or A-7	----------
			59-72	Silty clay loam	CL	A-6 or A-7	----------

See footnotes at end of table.

of soils significant to engineering—Continued

Percentage less than 3 inches passing sieve— No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Liquid limit	Plasticity index	Permeability [1]	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to— Uncoated steel	Concrete
						Inches per hour	*Inches per inch of soil*	*pH*			
	100	90-100	80-95	<20	NP-7	0.6-2.0	0.16-0.24	4.5-6.0	Low	Moderate	Moderate to high.
	100	95-100	85-95	25-35	12-30	0.2-0.6	0.18-0.22	5.1-7.3	Low to moderate.	High	Moderate to low.
	100	95-100	85-95	50-70	25-45	0.06-0.2	0.14-0.18	5.1-7.3	High	High	Moderate to low.
60-75	55-75	55-70	55-70		NP	0.6-2.0	0.10-0.15	4.5-5.5	Low	Low	Moderate to high.
60-75	55-75	55-75	55-70	<30	NP-15	0.6-2.0	0.12-0.20	4.5-5.5	Low	Low	Moderate to high.
35-45	30-45	30-45	25-40	20-35	11-15	0.6-2.0	0.09-0.15	4.5-5.5	Low	Moderate	Moderate to high.
85-95	85-95	65-80	15-30		NP	2.0-6.0	0.08-0.12	5.1-6.0	Low	Low	Moderate.
30-50	25-50	20-40	10-25	<25	NP-5	2.0-6.0	0.05-0.10	4.5-5.5	Low	Low	Moderate to high.
40-50	30-50	25-40	15-30		NP	2.0-6.0	0.05-0.10	5.1-6.0	Low	Low	Moderate.
30-50	25-50	20-40	10-25	<25	NP-5	2.0-6.0	0.05-0.10	4.5-5.5	Low	Low	Moderate to high.
	100	95-100	85-95	15-35	5-15	0.6-2.0	0.16-0.24	5.1-6.0	Low	Moderate	Moderate.
	100	95-100	90-100	20-45	15-30	0.2-0.6	0.18-0.22	5.1-6.0	Moderate	High	Moderate.
	100	95-100	90-100	55-70	35-50	0.06-0.2	0.14-0.18	5.1-7.3	High	High	Moderate to low.
		100	90-100	30-45	20-30	0.6-2.0	0.18-0.22	6.6-7.8	Moderate	Moderate	Low.
		100	90-100	30-40	10-20	0.6-2.0	0.16-0.24	6.6-7.8	Low	Low	Low.
		100	85-95	<20	NP-7	0.6-2.0	0.13-0.20	6.6-7.8	Low	Low	Low.
		100	90-100	30-45	20-30	0.6-2.0	0.18-0.22	6.6-7.8	Moderate	Moderate	Low.
		100	95-100	55-70	40-60	0.06-0.2	0.12-0.18	6.6-7.8	High	High	Low.
	100	95-100	30-60		NP	0.6-2.0	0.13-0.20	6-6.7.8	Low	Low	Low.
90-100	90-100	90-100	60-80	20-30	<10	0.6-2.0	0.15-0.20	5.6-7.3	Low	Low	Moderate to low.
90-100	90-100	90-100	60-80	20-30	<10	0.6-2.0	0.15-0.20	5.1-6.5	Low	Low	Moderate to low.
90-100	90-100	90-100	60-80	20-30	<10	0.6-2.0	0.15-0.20	5.1-6.0	Low	Low	Moderate.
90-100	90-100	90-100	60-80	25-40	15-30	0.6-2.0	0.12-0.17	5.1-6.0	Low	Low	Moderate.
85-95	80-95	75-90	55-75	20-30	<10	0.6-2.0	0.10-0.15	5.6-6.5	Low	Low	Moderate to low.
80-90	80-90	75-90	55-75	20-30	<10	0.6-2.0	0.10-0.15	5.1-6.0	Low	Low	Moderate.
70-80	70-80	65-80	55-70	20-30	<10	0.6-2.0	0.10-0.15	5-1-6.0	Low	Low	Moderate.
70-80	70-80	60-75	40-60	25-40	15-30	0.6-2.0	0.08-0.12	5.1-6.0	Low	Low	Moderate.
	100	95-100	70-90	<35	NP-10	2.0-6.0	0.16-0.24	7.4-8.4	Low	Low	Low.
	100	95-100	65-90	<25	NP-7	2.0-6.0	0.13-0.20	7.4-8.4	Low	Low	Low.
	100	40-70	0-10		NP	>6.0	0.02-0.06	7.4-8.4	Low	Low	Low.
	100	95-100	25-45		NP	2.0-6.0	0.07-0.11	7.4-8.4	Low	Low	Low.
	100	95-100	85-95	<30	<10	0.2-0.6	0.16-0.24	5.1-6.0	Low	High	Moderate.
	100	95-100	85-95	20-30	10-15	0.2-0.6	0.16-0.24	4.5-5.5	Low	High	Moderate to high.
90-100	90-100	85-100	80-95	25-45	11-20	0.06-0.2	0.9-0.11	4.5-5.5	Low	High	Moderate to high.
90-100	90-100	85-100	80-95	25-45	11-20	0.2-0.6	0.18-0.22	4.5-5.5	Low	High	Moderate to high.

TABLE 6.—*Estimated properties*

Soil series and map symbols	Depth to—		Depth from surface	Classification			Coarse fraction greater than 3 inches
	Bed-rock	Seasonal high water table		USDA texture	Unified	AASHO	
	Inches	*Feet*	*Inches*				
Wing: Wg	42-84	>6	0-6	Silt loam	ML or CL	A-4 or A-6	
			6-34	Silty clay	CH	A-7	
			34-60	Silty clay loam	CH or CL	A-7	
*Wrightsville: Wr, WsA, Wt. For Messer part of Wt, refer to Messer series.	>72	0-½	0-16	Silt loam	ML	A-4	
			16-33	Silty clay	CH or MH	A-7	
			33-46	Clay	CH	A-7	
			46-60	Silty clay	CH	A-7	
			60-72	Clay	CH	A-7	

[1] These values should not be confused with the coefficient "K" used by engineers.

kind of soil or in one soil horizon. A corrosivity rating of *low* means that there is a low probability of soil-induced corrosion damage. A rating of *high* means that there is a high probability of damage, so that protective measures for steel and more resistant concrete should be used to avoid or minimize damage.

Engineering interpretations of soils

The interpretations in table 7 are based on the estimated engineering properties of soils shown in table 6, on test data for soils in this county and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of Sebastian County. In table 7, ratings are used to summarize limitations or suitability of the soils for all listed purposes other than for drainage of cropland and pasture; irrigation; pond reservoir areas; embankments, dikes, and levees; and terraces and diversions. For these particular uses, table 7 lists those soil features not to be overlooked in planning, installation, and maintenance.

Following are explanations of some of the columns in table 7:

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as for preparing a seedbed; natural fertility of the material, or the response of plants to fertilizer; and absence of substance toxic to plants. Texture of the soil material and its content of stone fragments are characteristics that affect suitability, but also considered in the rating is damage that results at the area from which topsoil is taken.

Road fill is soil material used in embankments for roads. The suitability ratings reflect (1) the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and (2) the relative ease of excavating the material at borrow areas.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to permeability and depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees are low structures designed to impound or divert water. They require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of stones or organic material in a soil are among factors that are unfavorable.

Drainage of cropland and pasture is affected by such soil properties as permeability, texture, and structure; depth to claypan, rock, or other layers that influence rate of water movement; depth to the water table; slope; stability in ditchbanks; susceptibility to stream overflow; salinity or alkalinity; and availability of outlets for drainage.

Irrigation is affected by such features as slope; susceptibility to stream overflow, water erosion, or soil blowing; soil texture; content of stones; accumulations of salts and alkali; depth of root zone; rate of water intake at the surface; permeability of soil layers below the surface layer and in a fragipan or other layer that restricts movement of water; amount of water held available to plants; and need for drainage or depth to water table or bedrock.

Terraces and diversions are embankments, or ridges, constructed across the slope to intercept runoff so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock or *of soils significant to engineering*—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability [1]	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to—	
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)							Uncoated steel	Concrete
						Inches per hour	*Inches per inch of soil*	*pH*			
--------	100	90–100	85–95	<40	NP–15	0.06–0.2	0.16–0.24	5.6–6.5	Low	High	Low.
--------	100	90–100	85–95	50–70	30–45	<0.06	0.02–0.06	7.9–9.0	Moderate to high.	High	Low.
--------	100	90–100	85–95	41–60	20–40	<0.06	------------	7.9–9.0	Moderate	High	Low.
100	95–100	90–100	85–95	-------	NP	0.2–0.6	0.16–0.24	4.5–5.5	Low	High	Moderate to high.
100	95–100	95–100	95–100	50–70	20–40	<0.06	0.14–0.18	4.5–5.5	High	High	Moderate to high.
100	95–100	95–100	95–100	50–70	30–50	<0.06	0.12–0.18	4.5–5.5	High	High	Moderate to high.
100	95–100	95–100	95–100	50–70	30–50	<0.06	0.14–0.18	4.5–6.0	High	High	Moderate to high.
100	95–100	95–100	95–100	50–70	30–50	<0.06	0.12–0.18	6.1–8.4	High	High	Low.

[2] NP means nonplastic.

other unfavorable material; presence of stones; permeability; and resistance to water erosion, soil slipping, and soil blowing. A soil suitable for these structures provides outlets for runoff and is not difficult to vegetate.

Features not listed in table 7, but affecting engineering practices, are discussed in the following paragraphs.

Except for a narrow strip of thick alluvium along the Arkansas River, Sebastian County is an area of hilly uplands. On uplands, sandstone bedrock is at a depth of 12 to 20 inches in Mountainburg soils and is at a depth of 24 to 40 inches in Linker soils. This bedrock is a severe limitation to the design and construction of engineering works.

Near the town of Bloomer, the sandstone bedrock underlying the soils is thin bedded and has desirable characteristics for use as building stone.

Shale that can be dug with relatively light equipment underlies Enders and Montevallo soils on uplands and most soils in valleys. Shale pits in some areas of Montevallo soils are mined for material for surfacing county and private roads. Shale from beneath an area of Enders soils near Fort Smith is mined for material to manufacture bricks.

Enders soils are highly susceptible to sloughing and sliding if undercut or graded.

Many open pits in the county are strip mined. Some are excavated as deep as 50 feet, and many are filled by water. These pits and the associated spoil banks are a major obstruction in design and construction of engineering works. An area near the towns of Hackett, Midland, and Huntington is honeycombed by underground coal mine shafts and tunnels that are caving. This causes depressions and pits in the ground surface and is a hazard to engineering works in the area.

Iberia, Wrightsville, McKamie, and Muskogee soils have a clayey subsoil that has a high shrink-swell potential. The shrinking and swelling cause severe limitations because of instability of structures built on or with this material.

The Crevasse soils are a potential source of aggregate-quality sand, if it is washed and screened. The Arkansas River is a source of sand and gravel suitable for aggregate.

Water from the Arkansas River has a high content of salt and is generally poorly suited for irrigation water.

Additional interpretations of engineering uses of soils are given in the sections "Town and Country Planning" and "Use of the Soils for Recreational Development."

Soil test data

Table 8 contains engineering test data for some of the major soil series in Sebastian County. These tests were made to help evaluate the soils for engineering purposes. The engineering classifications given are based on data obtained by mechanical analyses and by tests to determine liquid limits and plastic limits. The mechanical analyses were made by combined sieve and hydrometer methods.

Moisture-density (or compaction) data are important in earthwork. If a soil material is compacted at successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material increases until the *optimum moisture content* is reached. After that, density decreases with increase in moisture content. The highest dry density obtained in the compactive test is termed *maximum dry density.*

Tests to determine liquid limit and plastic limit measure the effect of water on the consistence of soil material, as has been explained for table 6.

TABLE 7.—*Engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in for referring to other series that appear

Soil series and map symbols	Suitability as a source of—		Soil features affecting—
	Topsoil	Road fill	Pond reservoir areas
Barling: Ba	Good	Fair: moderate traffic-supporting capacity.	Moderate permeability
Cane: CaC	Fair: fair workability; material below a depth of 25 inches is difficult to reclaim.	Fair to poor: moderate to low traffic-supporting capacity.	Features generally favorable; slow permeability.
Cleora: Cr	Good	Fair: moderate traffic-supporting capacity.	Moderately rapid permeability
Crevasse: Cv	Poor: sandy material	Good	Rapid permeability
*Enders: EdC, EdD	Poor: less than 8 inches of suitable material; underlying material is difficult to reclaim.	Poor: low traffic-supporting capacity; moderate to high shrink-swell potential.	Features generally favorable; very slow permeability.
EeE, EmC, EmE. For Mountainburg part of EmC and EmE, see units MnD and MnE under the Mountainburg series.	Poor: unsuitable material; surface stones; underlying material is difficult to reclaim.	Poor: low traffic-supporting capacity; moderate to high shrink-swell potential; surface stones; slope.	Very slow permeability; slopes limit storage capacity.
Iberia: Ib	Poor: plastic, clayey material; high shrink-swell potential; poorly drained.	Poor: low traffic-supporting capacity; high shrink-swell potential; poorly drained.	Features generally favorable; very slow permeability.
Leadvale: LeB, LeC	Fair: fair workability; material below a depth of 25 inches is difficult to reclaim.	Fair to poor: moderate to low traffic-supporting capacity.	Moderately slow permeability
Linker: LnC	Fair: fair workability; few to common coarse fragments; sandstone bedrock within a depth of 40 inches; excavated material is difficult to reclaim in places.	Fair to poor: moderate traffic-supporting capacity; sandstone bedrock within a depth of 40 inches.	Moderate permeability; sandstone bedrock within a depth of 40 inches.
McKamie: MkC	Poor: less than 8 inches of suitable material; plastic, clayey subsoil.	Poor: low traffic-supporting capacity; high shrink-swell potential.	Features generally favorable; very slow permeability.
Messer. Mapped only in a complex with Wrightsville soils.	Good	Fair: moderate traffic-supporting capacity to a depth of 58 inches; low traffic-supporting capacity and high shrink-swell potential below a depth of 58 inches.	Moderately slow permeability; slow permeability below a depth of 58 inches.

interpretations of soils

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions in the first column of this table]

Soil features affecting—Continued			
Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Terraces and diversions
Poor to fair stability and compaction characteristics; medium to low permeability where compacted; medium to high compressibility; poor resistance to piping.	Moderately well drained	Moderate intake rate; high available water capacity.	Practice not applicable; level soil on flood plain.
Fair to good stability and compaction characteristics; medium to high compressibility.	Moderately well drained; sloping.	Slow intake rate; moderate available water capacity; medium runoff; erodible.	Features generally favorable.
Poor stability and compaction characteristics; medium permeability where compacted; poor resistance to piping.	Well drained	Moderately rapid intake rate; moderate available water capacity.	Practice not applicable; level soil on flood plain.
Poor to fair stability and compaction characteristics; medium to high permeability where compacted; poor resistance to piping.	Excessively drained	Rapid intake rate; low available water capacity.	Practice not applicable; dominantly level soil on flood plain.
Fair to poor stability and compaction characteristics; high compressibility.	Well drained; sloping	Very slow intake rate; high available water capacity; rapid runoff; high erodibility; low fertility.	Clayey subsoil; construction difficult; excessive slope in EdD.
Fair to poor stability and compaction characteristics; high compressibility.	Well drained; moderately steep and steep.	Practice not applicable; generally nonarable soil.	Practice not applicable; generally nonarable soil; surface stones; moderately steep and steep.
Fair to poor stability and compaction characteristics; high compressibility.	Poorly drained; very slow permeability; seasonal high water table.	Very slow intake rate; high available water capacity; poorly drained; seasonal high water table; rapid intake rate when dry and cracked.	Practice not applicable; level soil on flood plain.
Fair to good stability and compaction characteristics; medium to high compressibility.	Moderately well drained; sloping.	Slow intake rate; moderate available water capacity; medium runoff; erodible.	Features generally favorable.
Fair to good stability and compaction characteristics; medium to high compressibility.	Well drained; sloping	Moderate intake rate; moderate available water capacity; medium runoff; erodible.	Features generally favorable; sandstone bedrock within a depth of 40 inches.
Fair to poor stability and compaction characteristics; high compressibility.	Well drained; sloping	Very slow intake rate; high available water capacity; rapid runoff; high erodibility.	Clayey subsoil; difficult to construct; subsoil material cracks when dry and this is likely to cause failure of terraces.
Fair to good stability and compaction characteristics to a depth of 58 inches; fair to poor below that depth; medium to high compressibility.	Moderately well drained; sloping.	Moderately slow intake rate; high available water capacity; slow runoff; erodible.	Practice not applicable; short, irregular slopes.

TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as a source of—		Soil features affecting—
	Topsoil	Road fill	Pond reservoir areas
Montevallo: MlD	Poor: coarse fragments throughout; shale bedrock within a depth of 20 inches; difficult or impossible to reclaim.	Poor: moderate traffic-supporting capacity; shale bedrock within a depth of 20 inches.	Moderate permeability; shale bedrock within a depth of 20 inches.
Mountainburg: MmD, MnD, MnE.	Poor: coarse fragments; sandstone bedrock within a depth of 20 inches; difficult or impossible to reclaim.	Poor: high to moderate traffic-supporting capacity; sandstone bedrock within a depth of 20 inches.	Moderately rapid permeability; sandstone bedrock within a depth of 20 inches.
Muskogee: MuC	Good	Poor: low traffic-supporting capacity; high shrink-swell potential below a depth of 27 inches.	Features generally favorable; slow permeability.
Norwood: No	Fair to a depth of 8 inches: fair workability; good to a depth of 30 inches.	Fair: moderate traffic-supporting capacity; stratified material that contains thin layers having high shrink-swell potential.	Moderate permeability
Sallisaw:			
SaB, SaC	Good	Fair: moderate traffic-supporting capacity.	Moderate permeability
SlC	Poor: coarse fragments throughout.	Fair: moderate traffic-supporting capacity.	Moderate permeability
Severn: Sn	Good	Fair: moderate traffic-supporting capacity.	Moderately rapid permeability
Taft: Tf	Fair: material below a depth of 26 inches is difficult to reclaim.	Fair: moderate traffic-supporting capacity; somewhat poorly drained.	Features generally favorable; slow permeability.
Wing: Wg	Poor: high content of sodium within a depth of 6 inches.	Poor: low traffic-supporting capacity; moderate to high shrink-swell potential; high content of sodium; material is highly dispersed and difficult to stabilize.	Features generally favorable; very slow permeability.
*Wrightsville: Wr, WsA, Wt. For Messer part of Wt, see Messer series.	Poor: 16 inches of suitable material; poorly drained; underlying material is difficult to reclaim.	Poor: low traffic-supporting capacity; high shrink-swell potential below a depth of 16 inches; poorly drained.	Features generally favorable; very slow permeability.

interpretations of soils—Continued

Soil features affecting—Continued			
Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Terraces and diversions
Poor to fair stability and compaction characteristics; medium to low permeability where compacted; medium to high compressibility; poor to fair resistance to piping.	Well drained; sloping	Practice not applicable; generally nonarable soil.	Generally nonarable soil; shale bedrock within a depth of 20 inches; excessive slopes in places.
Fair to good stability and compaction characteristics; medium permeability where compacted; poor resistance to piping.	Well drained; sloping to steep	Practice not applicable; generally nonarable soil.	Generally nonarable soil; sandstone bedrock within a depth of 20 inches; excessive slopes in places.
Fair to poor stability and compaction characteristics; medium to high compressibility.	Moderately well drained; sloping.	Moderate to slow intake rate; high available water capacity; medium runoff; erodible.	Features generally favorable.
Fair to good stability and compaction characteristics; medium to high compressibility.	Well drained	Moderate intake rate; high available water capacity.	Practice not applicable; level soil on flood plain.
Fair to good stability and compaction characteristics; medium to high compressibility; fair to poor resistance to piping.	Well drained; sloping	Moderate intake rate; high available water capacity; slow to medium runoff; erodible.	Features generally favorable.
Fair to good stability and compaction characteristics; low to medium compressibility; stony and gravelly throughout.	Well drained; sloping	Practice not applicable; generally nonarable.	Stony and gravelly throughout; difficult to construct; generally nonarable soil.
Poor to fair stability and compaction characteristics; medium permeability where compacted; poor resistance to piping and erosion.	Well drained	Moderate intake rate; high available water capacity.	Practice not applicable; level soil on flood plain.
Fair stability and compaction characteristics; medium to high compressibility.	Somewhat poorly drained; seasonal high water table; slow permeability.	Slow intake rate; moderate available water capacity; somewhat poorly drained; seasonal high water table.	Practice not applicable; level soil.
Dispersed material that has a high content of sodium; poor stability and compaction characteristics; high compressibility; difficult to vegetate.	Nonarable soil; high content of sodium; very slow permeability; somewhat poorly drained to moderately well drained.	Practice not applicable; nonarable soil; high content of sodium.	Nonarable, generally level soil; high content of sodium; difficult to construct and maintain on dispersed material.
Fair to poor stability and compaction characteristics; high compressibility.	Poorly drained; very slow permeability; slopes up to 2 percent in WsA; low mounds of Messer soil create a complex pattern of surface drainage in Wt.	Slow intake rate; high available water capacity; WsA has slopes up to 2 percent and slow runoff and is erodible; Wt has low mounds of Messer soil.	Practice not applicable in Wr and Wt; slopes are long and up to 2 percent in WsA.

TABLE 8.—*Engineering*

[Tests performed by Arkansas State Highway

Soil name and location	Parent material	Arkansas SCS report No. S69-Ark-66	Depth from surface
			Inches
Leadvale silt loam (modal): SW¼SW¼NE¼ sec. 21, T. 7 N., R. 31 W	Loamy material on stream terraces and in valley fill washed from sandstone and shale on uplands.	10-2	2-6
		10-4	10-25
		10-6	34-53
Linker fine sandy loam (modal): NW¼NW¼NE¼ sec. 7, T. 7 N., R. 31 W	Loamy material weathered from sandstone on uplands.	8-1	0-5
		8-3	8-24
		8-4	24-36
Sallisaw loam (modal): SE¼SW¼NE¼ sec. 6, 7 N., R. 30 W	Loamy material on stream terraces washed from sandstone and shale on uplands.	16-4	20-33
		16-6	46-59
Wrightsville silt loam (modal): SW¼SW¼SW¼ sec. 27, T. 8 N., R. 31 W	Loamy and clayey sediments.	3-2	3-16
		3-3	16-23
		3-5	33-46
SE¼NE¼SE¼ sec. 25, T. 7 N., R. 32 W	Loamy and clayey sediments.	21-1	0-8
		21-3	12-26
		21-5	40-59

[1] Based on AASHO Designation: T 99-57, Method A (*1*).
[2] Mechanical analyses according to AASHO Designation: T 88-57 (*1*). Results by this procedure may differ somewhat from the results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the various grain-size fractions are calculated on the basis of all material up to and including that 3 inches in diameter. In the SCS and the University of Arkansas soil survey procedure, the material coarser than 2 millimeters in diameter is excluded from the calculations of grain-size fractions. The mechanical analyses data in this table are not intended for use in naming textural classes of soil.

Town and Country Planning

Table 9 gives the degree and kind of limitation of the soils of Sebastian County for selected nonfarm uses. The degree of limitation reflects all the features of the given soil, to a depth of about 6 feet, or to bedrock, that affect a particular use.

A rating of slight means that soils have properties favorable for the specified use. Limitations are so minor that they can be easily overcome. Good performance and low maintenance can be expected from these soils. A rating of moderate means that soils have properties moderately favorable for the specified use. Limitations can be overcome or modified with planning, design, or special maintenance. A rating of severe means that soils have one or more properties unfavorable for the specified use. Limitations are difficult and costly to modify or overcome and require major soil reclamation, special design, or intensive maintenance.

The properties considered in evaluating the limitations for the uses listed in table 9 are given in the paragraphs that follow. Specific values should not be applied to the rating of bearing strength in table 9.

Following are explanations of some of the columns in table 9:

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material between depths of 18 and 72 inches is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table or rock, and susceptibility to flooding. Slope is a soil property that affects difficulty of layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. A lagoon has a nearly level floor, and sides, or embankments, of compacted soil material. The assumption is made that the embankment is compacted to medium density and the pond is protected from flooding. Properties are considered that affect the pond floor and the embankment. Those that affect the pond floor are permeability, content of organic matter, and slope; and, if the floor needs to be leveled, depth to bedrock. The soil properties that affect the embankment are the engineering properties of the embankment material, as interpreted from the Unified classification, and the amounts of stones, if any, that influence the ease of excavation and compaction of the embankment material. Requirements for the embankment are the same as for other embankments given in table 7.

Shallow excavations are those that require digging or trenching to a depth of 6 feet or less, as for example, excavations for pipelines, sewer lines, phone and power transmission lines, basements, open ditches, and ceme-

test data

Department, Division of Materials and Tests]

Moisture density [1]		Mechanical analysis [2]			Liquid limit [3]	Plasticity index [4]	Classification	
		Percentage passing sieve—						
Maximum dry density	Optimum moisture	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)			AASHO [5]	Unified [6]
Lb. per cu. ft.	*Percent*							
108	14	[7] 97	94	67	------	[8] NP	A-4(1)	ML
113	16	[7] 98	97	98	30	13	A-6(10	CL
114	16	100	86	85	27	9	A-4(6)	CL
111	13	[7] 98	95	62	------	NP	A-4(1)	ML
107	19	[7] 98	96	77	38	12	A-6(9)	ML-CL
113	16	[7] 99	99	49	29	7	A-4(1)	SM-SC
117	17	[7] 99	97	72	26	8	A-4(4)	CL
118	17	[7] 99	98	64	26	9	A-4(3)	CL
113	13	[7] 98	94	90	------	NP	A-4(4)	ML
99	23	100	99	97	53	25	A-7-6(29)	CH-MH
96	26	100	99	98	57	33	A-7-6(37)	CH
103	18	[7] 97	92	88	------	NP	A-4(3)	ML
96	24	100	99	97	62	38	A-7-6(42)	CH
98	25	[7] 99	98	95	65	42	A-7-6(45)	CH

[3] Based on AASHO Designation: T 89-60 (*1*).
[4] Based on AASHO Designation: T 90-56 and AASHO Designation: T 91-54 (*1*).
[5] Based on AASHO Designation: M 145-66 I (*2*).
[6] Based on ASTM Designation: D 2487-66 T (*3*).
[7] 100 percent passed the No. 4 sieve.
[8] NP means nonplastic.

teries. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrops or large stones, and freedom from flooding or a high water table.

Dwellings, as rated in table 9, are not more than three stories high and are supported by foundation footings placed in undisturbed soil. The features that affect the rating of a soil for dwellings are those that relate to capacity to support load and resist settlement under load, and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Sanitary landfill is a method of disposing of refuse in dug trenches. The waste is spread in thin layers, compacted, and covered with soil throughout the disposal period. Landfill areas are subject to heavy vehicular traffic. Some soil properties that affect suitability for landfill are ease of excavation, hazard of polluting ground water, and trafficability. The best soils have moderately slow permeability, withstand heavy traffic, and are friable and easy to excavate. Unless otherwise stated, the ratings in table 9 apply only to a depth of about 6 feet, and therefore limitation ratings of slight or moderate may not be valid if trenches are to be much deeper than that. For some soils, reliable predictions can be made to a depth of 10 or 15 feet, but regardless of that, a site should be investigated before it is selected. For information about the use of the soils for area-type sanitary landfills, contact the local Soil Conservation Service office.

Local roads and streets, as rated in table 9, have an all-weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base consisting of gravel, crushed rock, or soil material 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. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep. Soil properties that most affect design and construction of roads and streets are load-supporting capacity, stability of the subgrade, and the workability and quantity of cut and fill material available. The AASHO and Unified classifications of the soil material, and also the shrink-swell potential, indicate load-supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

Ratings for light industry are for the undisturbed soils that are used to support building foundations. Emphasis is on foundations, ease of excavation for underground utilities, and corrosion potential of uncoated steel pipe. The undisturbed soil is rated for spread footing foundations for buildings less than three stories high or foundation loads not in excess of that weight. Properties affect-

TABLE 9.—*Degree and kind of soil limitations*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in for referring to other series that

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons [1]	Shallow excavations
Barling: Ba	Severe: seasonal high water table; subject to flooding.	Severe: moderate permeability; subject to flooding.	Severe: seasonal high water table; subject to flooding.
Cane: CaC	Severe: slow permeability; seasonal high water table.	Moderate: slope. Severe where slope is more than 7 percent.	Moderate to severe: moderately well drained; seasonal high water table; fair workability and sidewall stability; difficult to dig with handtools.
Cleora: Cr	Severe: subject to flooding	Severe: moderately rapid permeability; subject to flooding.	Severe: subject to flooding
Crevasse: Cv	Severe: subject to flooding	Severe: rapid permeability; subject to flooding.	Severe: poor sidewall stability; subject to flooding.
*Enders: EdC, EdD	Severe: very slow permeability.	Moderate: slope. Severe where slope is more than 7 percent.	Severe: poor workability and sidewall stability.
EeE, EmC, EmE. For Mountainburg part of EmC and EmE, see units MnD and MnE under the Mountainburg series.	Severe: very slow permeability; slope.	Severe: slope; stones on surface.	Severe: slope; poor workability and sidewall stability; stones on surface.
Iberia: Ib	Severe: very slow permeability; seasonal high water table; subject to flooding.	Severe: subject to flooding	Severe: poorly drained; seasonal high water table; subject to flooding.
Leadvale: LeB, LeC	Severe: moderately slow permeability; seasonal high water table.	Moderate: slope. Severe where slope is more than 7 percent.	Moderate to severe: moderately well drained; seasonal high water table; fair workability and sidewall stability; difficult to dig with handtools.
Linker: LnC	Severe: sandstone bedrock within a depth of 40 inches.	Severe: sandstone bedrock within a depth of 40 inches.	Severe: sandstone bedrock within a depth of 40 inches.
McKamie: MkC	Severe: very slow permeability.	Moderate: slope. Severe where slope is more than 7 percent.	Severe: dominantly clayey material of poor workability; poor sidewall stability.
Messer. Mapped only in a complex with Wrightsville soils.	Severe: slow permeability; seasonal high water table.	Slight to moderate: slope; fair to good material for reservoir sites.	Moderate: moderately well drained; seasonal high water table; fair to poor workability and sidewall stability.
Montevallo: MlD	Severe: shale bedrock within a depth of 20 inches.	Severe: shale bedrock within a depth of 20 inches; slope is more than 7 percent in places.	Moderate to severe: shale bedrock within a depth of 20 inches; difficult to dig with light equipment.
Mountainburg: MmD, MnD, MnE.	Severe: sandstone bedrock within a depth of 20 inches.	Severe: sandstone bedrock within a depth of 20 inches.	Severe: sandstone bedrock within a depth of 20 inches; stones on surface in many areas; slope is more than 15 percent in places.

See footnotes at end of table.

that affect town and country planning

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions appear in the first column of this table]

Dwellings without basements [3]	Sanitary landfill, trench type [3]	Local roads and streets	Light industry [3]
Severe: subject to flooding; moderate bearing strength.	Severe: seasonal high water table; subject to flooding.	Severe: subject to flooding; moderate traffic-supporting capacity.	Severe: subject to flooding; moderate bearing strength.
Moderate: moderate bearing strength.	Moderate: fair workability	Moderate to severe: moderate to low traffic-supporting capacity.	Moderate: slope; high corrosivity to uncoated steel; moderate bearing strength.
Severe: subject to flooding; moderate bearing strength.	Severe: moderately rapid permeability; subject to flooding.	Severe: subject to flooding; moderate traffic-supporting capacity.	Severe: subject to flooding; moderate bearing strength.
Severe: subject to flooding	Severe: rapid permeability; subject to flooding.	Moderate: subject to flooding	Severe: subject to flooding.
Severe: low bearing strength; moderate to high shrink-swell potential.	Severe: dominantly clayey material of poor workability; rippable shale bedrock generally within a depth of 96 inches.	Severe: low traffic-supporting capacity; moderate to high shrink-swell potential.	Severe: low bearing strength; moderate to high shrink-swell potential; high corrosivity to uncoated steel; slope.
Severe: low bearing strength; moderate to high shrink-swell potential; slope; stones on surface.	Severe: dominantly clayey material of poor workability; rippable shale bedrock generally within a depth of 96 inches; stones on surface; slope.	Severe: low traffic-supporting capacity; moderate to high shrink-swell potential; slope.	Severe: low bearing strength; moderate to high shrink-swell potential; high corrosivity to uncoated steel; slope.
Severe: poorly drained; seasonal high water table; low bearing strength; high shrink-swell potential; subject to flooding.	Severe: poorly drained; seasonal high water table; clayey material of poor workability; subject to flooding.	Severe: poorly drained; subject to flooding; low traffic-supporting capacity; high shrink-swell potential.	Severe: poorly drained; seasonal high water table; low bearing strength; high shrink-swell potential; high corrosivity to uncoated steel; subject to flooding.
Moderate: moderate bearing strength.	Moderate: fair workability	Moderate to severe: moderate to low traffic-supporting capacity.	Moderate: slope; high corrosivity to uncoated steel; moderate bearing strength.
Moderate: sandstone bedrock within a depth of 40 inches.	Severe: sandstone bedrock within a depth of 40 inches.	Moderate: sandstone bedrock within a depth of 40 inches.	Severe: sandstone bedrock within a depth of 40 inches; slope.
Severe: high shrink-swell potential; low bearing strength.	Severe: dominantly clayey material of poor workability.	Severe: low traffic-supporting capacity; high shrink-swell potential.	Severe: high shrink-swell potential; low bearing strength.
Moderate: moderate bearing strength to a depth of 58 inches; high shrink-swell potential and low bearing strength below a depth of 58 inches.	Severe: moderately well drained; seasonal high water table; fair workability to a depth of 58 inches, poor below.	Moderate: moderate traffic-supporting capacity to a depth of 58 inches; low traffic-supporting capacity and high shrink-swell potential below a depth of 58 inches.	Moderate to severe: moderately well drained; moderate bearing strength to a depth of 58 inches; low bearing strength and high shrink-swell potential below a depth of 58 inches.
Moderate to severe: shale bedrock within a depth of 20 inches; difficult to dig with light equipment.	Severe: shale bedrock within a depth of 20 inches.	Moderate: shale bedrock within a depth of 20 inches.	Severe: shale bedrock within a depth of 20 inches; slope.
Severe: sandstone bedrock within a depth of 20 inches; stones on surface in many areas; slope is more than 15 percent in places.	Severe: sandstone bedrock within a depth of 20 inches; slope is more than 25 percent in places.	Severe: sandstone bedrock within a depth of 20 inches; slope is more than 15 percent in places.	Severe: sandstone bedrock within a depth of 20 inches; slope; stones on surface in many areas.

TABLE 9.—*Degree and kind of soil limitations*

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons [1]	Shallow excavations
Muskogee: MuC	Severe: slow permeability	Moderate: fair to good material for reservoir sites; slope. Severe where slope is more than 7 percent.	Moderate to severe: moderately well drained; poor workability and sidewall stability below a depth of 27 inches.
Norwood: No	Severe: subject to flooding	Severe: subject to flooding; fair material for reservoir sites; moderate permeability.	Severe: subject to flooding
Sallisaw: SaB, SaC, SlC	Slight	Moderate: moderate permeability; slope. Severe where slope is more than 7 percent. Coarse fragments throughout SLC.	Slight. Moderate in SLC: coarse fragments throughout.
Severn: Sn	Severe: subject to flooding	Severe: moderately rapid permeability; subject to flooding.	Severe: subject to flooding
Taft: Tf	Severe: slow permeability; seasonal high water table.	Moderate: fair material for reservoir sites.	Severe: somewhat poorly drained; seasonal high water table.
Wing: Wg	Severe: very slow permeability; seasonal high water table.	Moderate to severe: fair to poor material for reservoir sites; material highly dispersed; difficult to stabilize; difficult to vegetate embankments.	Moderate to severe: somewhat poorly drained to moderately well drained; seasonal high water table; poor workability and sidewall stability.
*Wrightsville: Wr, WsA, Wt. For Messer part of Wt, see Messer series.	Severe: very slow permeability; seasonal high water table.	Slight to moderate: fair to good material for reservoir sites.	Severe: poorly drained; seasonal high water table; poor workability and sidewall stability.

[1] For information about material for lagoon embankments, see "Embankments, dikes, and levees" in table 7.
[2] Engineers and others should not apply specific values to the estimates given for bearing strength of soil.

Dwellings without basements [2]	Sanitary landfill, trench type [3]	Local roads and streets	Light industry [2]
Severe: high shrink-swell potential and low bearing strength below a depth of 27 inches.	Severe: clayey material of poor workability below a depth of 27 inches.	Severe: low traffic-supporting capacity; high shrink-swell potential below a depth of 27 inches.	Severe: high shrink-swell potential and low bearing strength below a depth of 27 inches.
Severe: subject to flooding; moderate bearing strength.	Severe: subject to flooding; rapidly permeable sandy material below a depth of 72 inches in some areas.	Moderate: moderate traffic-supporting capacity; subject to flooding.	Severe: subject to flooding moderate bearing strength.
Moderate: moderate bearing strength; stones on surface in SLC.	Generally slight, but moderate in SLC: coarse fragments throughout.	Moderate: moderate traffic-supporting capacity.	Moderate: moderate bearing strength; slope is more than 4 percent in places.
Severe: subject to flooding; moderate bearing strength.	Severe: subject to flooding; rapidly permeable sandy material below a depth of 72 inches in some areas.	Moderate: moderate traffic-supporting capacity; subject to flooding.	Severe: subject to flooding; moderate bearing strength.
Moderate: somewhat poorly drained; seasonal high water table; moderate bearing strength.	Severe: seasonal high water table; somewhat poorly drained.	Moderate to severe: somewhat poorly drained; ponding; moderate traffic-supporting capacity.	Moderate: somewhat poorly drained; seasonal high water table; moderate bearing strength; high corrosivity to uncoated steel.
Severe: seasonal high water table; low bearing strength; moderate to high shrink-swell potential.	Severe: dominantly clayey material of poor workability; seasonal high water table; shale bedrock within a depth of 72 inches in most areas; material high in content of sodium; difficult to vegetate.	Severe: low traffic-supporting capacity; material highly dispersed.	Severe: seasonal high water table; low bearing strength; moderate to high shrink-swell potential; high corrosivity to uncoated steel.
Severe: poorly drained; seasonal high water table; high shrink-swell potential; low bearing strength.	Severe: seasonal high water table; poorly drained; dominantly clayey material of poor workability.	Severe: poorly drained; low traffic-supporting capacity; high shrink-swell potential.	Severe: poorly drained; seasonal high water table; high shrink-swell potential; low bearing strength; high corrosivity to uncoated steel.

[3] Onsite deep studies of the underlying strata, water tables, and hazards of aquifer pollution and drainage into ground water need to be made for landfills deeper than 5 or 6 feet.

ing load-supporting capacity and settlement under load are wetness, flooding, texture, plasticity, density, and shrink-swell potential. Properties affecting excavation are wetness, flooding, slope, and depth to bedrock. Properties affecting corrosion of buried uncoated steel pipe are wetness, texture, total acidity, and electrical resistivity.

The information in table 9 and the detailed soil map are guides for evaluating areas for the specific uses. They do not eliminate the need for detailed onsite investigations before a final determination is made.

Additional information that may be useful in town and country planning is given in the section "Engineering Uses of the Soils."

Use of the Soils for Recreational Development

Knowledge of soils is necessary in planning, developing, and maintaining areas used for recreation. In table 10 the soils of Sebastian County are rated according to limitations that affect their suitability for camp areas, picnic areas, and playgrounds.

In table 10 the soils are rated as having slight, moderate, or severe limitations for the specified uses. For all of these ratings, it is assumed that a good cover of vegetation can be established and maintained. A rating of slight means that soil properties are generally favorable and limitations are so minor that they easily can be over-

TABLE 10.—*Degree and kind of limitations for selected recreational uses*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. 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
Barling: Ba	Slight to moderate: subject to occasional flooding.	Slight	Slight to moderate: subject to occasional flooding.
Cane: CaC	Slight	Slight	Moderate: slow permeability; slope. Severe where slope is more than 6 percent.
Cleora: Cr	Slight to moderate: subject to occasional flooding.	Slight	Slight to moderate: subject to occasional flooding.
Crevasse: Cv	Moderate: poor trafficability because of sandy surface layer; difficult to maintain vegetative cover.	Moderate: poor trafficability because of sandy surface layer; difficult to maintain vegetative cover.	Moderate: poor trafficability because of sandy surface layer; difficult to maintain vegetative cover.
*Enders: EdC, EdD	Moderate: very slow permeability; slope is more than 8 percent in EdD.	Slight in EdC. Moderate in EdD: slope.	Moderate: very slow permeability. Severe where slope is more than 6 percent: plastic, clayey material exposed if graded.
EeE, EmC, EmE For Mountainburg part of EmC and EmE, see units MnD and MnE under the Mountainburg series.	Severe: very slow permeability; slope; stones on surface.	Moderate to severe: slope is more than 15 percent in most places; stones on surface.	Severe: very slow permeability; slope; stones on surface.
Iberia: Ib	Severe: poorly drained; seasonal high water table; very slow permeability; poor trafficability because of clayey surface layer.	Severe: poorly drained; seasonal high water table; poor trafficability because of clayey surface layer.	Severe: poorly drained; seasona high water table; very slow permeability; poor trafficability because of clayey surface layer.
Leadvale: LeB, LeC	Slight	Slight	Slight where slope is less than 2 percent. Moderate where slope is 2 to 6 percent. Severe where slope is more than 6 percent.
Linker: LnC	Slight	Slight	Moderate where slope is less than 6 percent. Severe where slope is more than 6 percent: bedrock within a depth of 40 inches.

TABLE 10.—*Degree and kind of limitations for selected recreational uses*—Continued

Soil series and map symbols	Camp areas	Picnic areas	Playgrounds
McKamie: MkC	Moderate: very slow permeability.	Slight	Moderate where slope is less than 6 percent. Severe where slope is more than 6 percent: plastic, clayey material exposed if graded.
Messer. Mapped only in a complex with Wrightsville soils.	Moderate: moderately well drained; seasonal high water table; slow permeability; occurs as small spots within areas that have severe limitations.	Moderate: moderately well drained; seasonal high water table; occurs as small spots within areas that have severe limitations.	Moderate: moderately well drained; seasonal high water table; slow permeability; slope is more than 2 percent in places; occurs as small spots within areas that have severe limitations.
Montevallo: MlD	Moderate: coarse fragments on surface; slope is more than 8 percent in places; difficult to maintain vegetative cover.	Moderate: coarse fragments on surface; slope is more than 8 percent in places; difficult to maintain vegetative cover.	Severe: slope is more than 6 percent in most places; bedrock within a depth of 20 inches; coarse fragments on surface; difficult to maintain vegetative cover.
Mountainburg:			
MmD	Moderate: slope is more than 8 percent in places; difficult to maintain vegetative cover.	Moderate: slope is more than 8 percent in places; difficult to maintain vegetative cover.	Severe: slope is more than 6 percent in most places; bedrock within a depth of 20 inches; difficult to maintain vegetative cover.
MnD, MnE	Severe: slope is more than 8 percent in most places; stones on surface; difficult to maintain vegetative cover.	Severe: slope is more than 8 percent in most places; stones on surface; difficult to maintain vegetative cover.	Severe: slope is more than 6 percent in most places; bedrock within a depth of 20 inches; stones on surface; difficult to maintain vegetative cover.
Muskogee: MuC	Moderate: slow permeability	Slight	Moderate: slow permeability; slope. Severe where slope is more than 6 percent.
Norwood: No	Moderate: moderate trafficability because of sticky surface layer.	Moderate: moderate trafficability because of sticky surface layer.	Moderate: moderate trafficability because of sticky surface layer.
Sallisaw:			
SaB, SaC	Slight	Slight	Slight where slope is less than 2 percent. Moderate where slope is 2 to 6 percent. Severe where slope is more than 6 percent.
SlC	Slight to moderate: stones on surface.	Slight to moderate: stones on surface.	Moderate: coarse fragments throughout; slope. Severe where slope is more than 6 percent.
Severn: Sn	Slight	Slight	Slight.
Taft: Tf	Moderate to severe: somewhat poorly drained; seasonal high water table; slow permeability.	Moderate: somewhat poorly drained; seasonal high water table.	Severe: somewhat poorly drained; seasonal high water table; slow permeability.
Wing: Wg	Severe: seasonal high water table; very slow permeability; difficult or impossible to maintain vegetative cover.	Severe: seasonal high water table; difficult or impossible to maintain vegetative cover.	Severe: seasonal high water table; very slow permeability; difficult or impossible to maintain vegetative cover.
*Wrightsville: Wr, WsA, Wt. For Messer part of Wt, see Messer series.	Severe: poorly drained; seasonal high water table; very slow permeability.	Severe: poorly drained; seasonal high water table.	Severe: poorly drained; seasonal high water table; very slow permeability.

come. A rating of moderate means that the limitation can be overcome or modified by planning, by design, or by special maintenance. A rating of severe means that costly soil reclamation, special design, intensive maintenance, or a combination of these, is required.

Camp areas are used intensively for tents and small camp trailers and the accompanying activities of outdoor living. Little preparation of the site is required, other than shaping and leveling for tent and parking areas. Camp areas are subject to heavy foot traffic and limited vehicular traffic. The best soils have mild slopes, good drainage, a surface free of rocks and coarse fragments, freedom from flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry.

Picnic areas are attractive natural or landscaped tracts used primarily for preparing meals and eating outdoors. These areas are subject to heavy foot traffic. Most of the vehicular traffic, however, is confined to access roads. The best soils are firm when wet but not dusty when dry, are free of flooding during the season of use, and do not have slopes or stoniness that greatly increase cost of leveling sites or of building access roads.

Playgrounds are areas used intensively for baseball, football, badminton, and similar organized games. Soils suitable for this use need to withstand intensive foot traffic. The best soils have a nearly level surface free of coarse fragments and rock outcrops, good drainage, freedom from flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry. If grading and leveling are required, depth to rock is important.

Formation and Classification of the Soils

In this section the factors that affect soil formation in Sebastian County and the processes of horizon differentiation are discussed. The current system of soil classification is explained, and the soil series are placed in some of the higher categories of that system. Physical and chemical analyses are given for representative profiles of selected soils.

Factors of Soil Formation

Soil is formed by weathering and other processes that act upon the soil. The characteristics of the soil at any given point depend upon climate, living organisms, parent material, relief, and time. Each factor acts on the soil and modifies the effect of the other four. When climate, living organisms, or any other one of the five factors is varied to a significant extent, a different soil may be formed (*11*).

Climate and living organisms are the active forces in soil formation. Relief modifies the effects of climate and living organisms, mainly by its influence on temperature and runoff. Because climate, vegetation, parent material, and relief interact over a period of time, time is the fifth factor of soil formation. The effect of time is also reflected in the soil characteristics.

The interaction of the five factors of soil formation is more complex for some soils than for others. The five factors and how they interact to form some of the soils in the county are discussed in the following paragraphs.

Climate

The climate of Sebastian County is characterized by mild winters, warm or hot summers, and generally abundant rainfall. The generally warm temperatures and high precipitation probably are similar to the climate under which the soils in the county formed. The average daily maximum temperature at Forth Smith in July is nearly 94° F. and in January is about 50°. The total annual rainfall is about 42 inches at Fort Smith and is distributed fairly uniformly throughout the year. For additional information about the climate, refer to the section "General Nature of the County."

The warm, moist climate promotes rapid soil formation, and the warm temperature encourages rapid chemical reactions. The large amount of water that moves through the soil is instrumental in removing dissolved or suspended materials. Because remains of plants decompose rapidly, the organic acids thus formed hasten the removal of carbonates and the formation of clay minerals. Because the soil is frozen only to shallow depths, and only for short periods, soil formation continues almost the year round. The climate throughout the county is relatively uniform, but its effect is modified locally by runoff. Climate alone does not account for differences in the soils of the county.

Living organisms

The higher plants and animals, as well as insects, bacteria, and fungi, are important in the formation of soils. Among the changes they cause are gains in organic matter and nitrogen in the soil, gains or losses in plant nutrients, and changes in structure and porosity.

Before Sebastian County was settled, the native vegetation had more influence on soil formation than did animal activity. Hardwood forests covered some of the lowland part of the county. Other lowlands were prairies of mainly tall bunchgrasses and a sparse growth of oak and locust trees and hardwoods along stream courses. The upland part of the county was covered by mixed pines and hardwoods on the deeper soils. On the shallower soils were savannas of scattered, stunted hardwoods, redcedar, and pines and an understory of tall grasses similar to those on the prairies.

The native vegetation in most of the mountainous and hilly areas of the county consisted of forests of upland oaks, hickory, redcedar, and shortleaf pine. Only the upper few inches of the soils in these areas has a significant accumulation of organic matter and is dark colored. Cane, Enders, Leadvale, Linker, Montevallo, Mountainburg, and Sallisaw soils formed on these uplands. These soils differ chiefly in age and degree of weathering, in relief, and in the kind of parent material.

The prairie areas in Sebastian County supported a luxuriant growth of tall bunchgrasses, legumes, and forbs and scattered hardwood trees. The soils, mainly the Messer, Taft, Wing, and Wrightsville soils, do not have the thick, dark-colored surface layer that is commonly associated with soils formed under prairie vegetation. Apparently, their characteristics were influenced more by parent material, climate, and relief than by vegetation. It is possible that relatively recent changes in the climate or other environmental factors caused a change in the vegetative type recently enough so that the prairie vegetation has not had enough time to significantly change the character of the soils. For example, Wrightsville soils are in both wooded and prairie areas.

In the alluvial areas, the native vegetation consisted of cottonwood, black willow, hackberry, elm, sycamore, ash, oak, and hickory. Barling, Cleora, Crevasse, Iberia, Norwood, and Severn soils formed in these areas. Their differences are chiefly caused by the effects of parent material and age.

The differences in native vegetation on the uplands seem to be related mainly to variations in the available water capacity of the soils, whereas on the lowlands, the differences seem to be related mainly to variations in drainage. For example, Iberia soils formed in swampy places and have a thick, dark surface layer caused by an accumulation of organic debris in the swamps. Adjacent, well-drained soils do not have a dark surface layer. Only major differences in the original vegetation are reflected to any extent by the characteristics of the soils.

Man is important to the future rate and direction of soil formation. He clears the forest, cultivates the soils, and introduces new kinds of plants. He adds fertilizer and lime and chemicals for insect, disease, and weed control. Building levees and dams for flood control, improving drainage, and grading the surface layer also affect the future development of soils. Some results of these changes will not be evident for many centuries. Nevertheless, the complex of living organisms affecting soil formation in this county has been drastically changed by man. Thus, man has become the most important organism affecting soil formation.

Parent material

The acid sandstone ana shale that cover most of Sebastian County [8] were deposited in marine waters during the Pennsylvanian geologic period (*6*). These sedimentary rocks are of various textures. They range from rather coarse-grained sandstone to shaly sandstone and from sandy shale to clay shale. There are six different formations. The Atoka Formation is the oldest and is also the most extensive and thickest. It consists of interbedded shale and thin-bedded sandstone, and shale is dominant. It weathers into materials in which are formed such residual soils as the Enders and Montevallo soils and, where the sandstone caps the ridges, Mountainburg and Linker soils.

The Hartshorne Formation rests on the Atoka Formation in the areas of its occurrence. It consists of sandstone and sandy shale. It weathers into material from which Mountainburg and Linker soils are formed. The sandstone is generally brown or yellowish brown, but in some places it is almost white. It is chiefly medium grained and well cemented but locally is saccharoidal and poorly cemented. The Spadra Shale rests on the Hartshorne Formation. It consists of fine-grained, blue-black or gray clay shale that contains some lenses of sandstone. It crops out on the sides of some of the hills and in some of the valley floors. Where it crops out on hillsides, Enders and Montevallo soils formed in its weathered material.

The Fort Smith Formation overlies the Spadra Shale and consists principally of sandstone and sandy shale. Most of the beds are ripple marked. The weathered material generally is yellowish to reddish and is sandy. Mountainburg and Linker soils are the main residual soils formed. The Fort Smith Formation commonly crops out in the northern half of the county, along the western side, and on the slopes of Poteau and Sugar Loaf Mountains in the southern part. In some places the sandstone is thin bedded and is quarried for building stone.

The Paris Shale overlies the Fort Smith Formation. It is composed of clay shale, sandy shale, and minor amounts of sandstone. It is exposed on the slopes of Poteau and Sugar Loaf Mountains and also in a small area on the east-central border of the county. where it forms the western closure of the Paris Basin. It is lighter colored and more sandy than the Spadra Formation. It is gray, brown, yellow, or black and is somewhat harder than the Spadra. Residual soils formed in the weathered material are Montevallo, Enders, Mountainburg, and Linker soils.

The Savanna Formation overlies the Paris Shale and is the youngest of the Pennsylvanian Formations in Arkansas. Only the base of the formation occurs as the cap rocks on Poteau and Sugar Loaf Mountains. These beds are thick sandstone and are brown or grayish brown. Mountainburg and Linker soils formed in the weathered material.

Soils on the flood plains of upland drainageways are mainly those of the Barling, Cleora, and Taft series. All these soils formed in loamy sediment washed from local uplands. The soils differ in age and degree of development and in particle-size gradation of the parent material. Cleora soils are generally adjacent to streams, contain less silt and clay, and have little horizon development. Barling soils contain more silt than Cleora soils, and the parent material has been in place long enough that horizon development is evident. Taft soils are the most distant from the stream or are along drainageways where little fresh sediment is deposited. These soils contain much less sand and have well-expressed horizons. Taft soils extend onto low terraces that merge with higher, loamy terraces and valley fill where such soils as the Sallisaw, Leadvale, and Cane formed. These soils have well-developed horizons that formed in loamy local sediment.

Soils on the Arkansas River flood plain formed in poorly graded, well-sorted alluvial sediment deposited by flood water. The Crevasse soils formed in sandy sediment deposited along or near the river as natural levees (*20*). The McKamie, Muskogee, Wrightsville, and Iberia soils formed in dominantly clayey sediment deposited by slack water on flats and flood bays at places farther from the river. The Severn and Norwood soils formed in the loamy sediment deposited between the areas of sandy sediment and clayey sediment.

Relief

Relief, or inequalities in elevation, in Sebastian County has been brought about chiefly by faulting, folding, and the subsequent entrenchment of drainage channels into the land surface. The highest elevation in the county,

[8] BRANNER, GEORGE C., and OTHERS, GEOLOGIC MAP OF ARKANSAS. 1929.

about 2,670 feet above sea level, is in the southernmost part of the county, within the boundary of the Ouachita National Forest. The lowest elevation, about 370 feet above sea level, is in the northern part of the county at the Arkansas River.

Some of the greatest differences in the soils of Sebastian County are caused by differences in relief through its effect on drainage, runoff, erosion, and percolation of water through the soil. Relief ranges from near vertical bluffs to broad flats.

Generally, the steeper soils and those on narrow ridges are shallow because they have lost so much soil material through geologic erosion. Examples are Mountainburg and Montevallo soils. In contrast, broad areas of the level or gently sloping soils have lost little soil material, and the soils are moderately deep or deep. Examples are Linker, Leadvale, and Cane soils.

In coves and on foot slopes are deep accumulations of material that partly weathered from shale and partly washed or slid down from adjoining areas of steep soils. The Enders soils occur in these places. Enders soils have a clayey subsoil derived from shale and a loamy surface layer that formed in the material from adjoining steep soils. In places where rock has broken off sandstone ledges and rolled downslope, the soils are stony.

The prairies in Sebastian County appear to be drained lakebeds. They are generally level and are surrounded by hills, or at least by a higher border. Surface drainage is slow or ponded, and the soils are poorly drained to somewhat poorly drained and slowly permeable to very slowly permeable. These soils are gray or have gray mottles because of the reduction of iron, and they have a seasonal high, or perched, water table. Leaching of cations is not so advanced in some of these soils as in many of the well-drained soils on uplands and terraces. Taft, Messer, Wing, and Wrightsville soils occur in these depressional areas.

The flood plain of the Arkansas River is level to nearly level and was subject to frequent flooding before flood control dams were built on the river and its tributaries. The floodwater, loaded with soil particles, moved at different speeds, depending partly on the topography. Rapidly moving water deposited the sandy sediment in which the Crevasse soils formed. The less rapidly moving water deposited the mixed sediments that were high in silt, and in which the Severn and Norwood soils formed. The slack or still water trapped in flood bays and on broad flats deposited the clayey sediment in which the Iberia soils formed.

Time

The length of time required for soil formation depends largely on other facts of soil formation. Less time generally is required if the climate is warm and humid and the vegetation luxuriant. If other factors are equal, less time is also required if the parent material is loamy than if it is clayey.

In terms of geological time, most of the soils of Sebastian County are old, regardless of whether they are on mountaintops, mountainsides, or stream terraces. The young soils formed in alluvium along streams or in residual material weathered from bedrock, where geologic erosion has nearly kept pace with weathering.

Some of the soils on the uplands are examples of old soils. They formed in material weathered from rocks and shale of Pennsylvania Age. Most are old enough that nearly all of the cations have been leached out, the reaction is strongly acid or very strongly acid, there has been considerable weathering and translocation of clay, and the horizons are clearly expressed. Iron as well as clay has been translocated from the A horizon to the B horizon and then oxidized, causing the B horizon to have stronger red, brown, and yellow colors than the A horizon. Enders and Linker soils clearly show the impact of time, acting with other soil-forming factors, on parent material.

The Norwood and Severn soils are examples of very young soils. They formed in recent alluvium on the flood plain of the Arkansas River. No definite horizons have formed below the A horizon. Instead, these soils still have the depositional rock structure, or bedding planes, and little or no soil structure. Base saturation is high, and the reaction is neutral to moderately alkaline, which indicates that leaching has been slight. The organic-matter content decreases irregularly with increasing depth. Except for the slight mechanical changes caused by worms and roots, there is little evidence of soil-forming activity.

Processes of Soil Formation

In this subsection a brief definition of the horizon nomenclature and processes responsible for soil formation are given.

The marks that the soil-forming factors leave on the soil are recorded in the soil profile, which is a succession of layers, or horizons, from the surface to the parent rock. The horizons differ in one or more properties, such as color, texture, structure, consistency, and porosity.

Most soil profiles contain three major horizons, called A, B, and C. Very young soils do not have a B horizon.

The A horizon can be the horizon of maximum accumulation of organic matter, called the A1 horizon or the surface layer, or it can be the horizon of maximum leaching of dissolved or suspended materials, called the A2 horizon or the subsurface layer.

The B horizon is immediately beneath the A horizon and is commonly called the subsoil (*19*). It is a horizon of maximum accumulation of suspended materials, such as clay and iron. The B horizon commonly has blocky structure and is firmer than the horizons immediately above and below it.

Beneath the B horizon is the C horizon. It has been little affected by the soil-forming processes, but the C horizon can be materially modified by weathering. In some young soils, the C horizon immediately underlies the A horizon and has been slightly modified by living organisms, as well as by weathering.

Several processes have been active in the formation of soil horizons in Sebastian County. Among these processes are: (1) the accumulation of organic matter; (2) the leaching of bases; (3) the oxidation, or reduction and transfer of iron; and (4) the formation and translocation of silicate clay minerals. In most of the soils of the county, more than one of these processes has been active in soil formation.

Physical weathering of rocks, through heating and cooling and wetting and drying, slowly breaks them into small pieces. These pieces form the parent material for the residual soils in the county. This is most evident in Linker and Mountainburg soils.

Accumulation of organic matter in the upper part of the profile to form an A1 horizon has been an important process of soil formation. The A1 horizon is evident in profiles that have a light-colored subsurface layer from which organic matter, clay, and iron oxides have been removed. These processes are readily evident in Wrightsville soils.

Leaching of bases has occurred to some degree in nearly all the soils of Sebastian County. Among soil scientists, it is generally accepted that bases are leached downward in soils before silicate clay minerals begin to move. Most of the soils in the county are moderately leached, an important factor in horizon development. Some soils, such as the Norwood and Severn, are only slightly leached. Others, such as the Enders, Linker, and Mountainburg soils, are strongly leached.

Oxidation of iron is evident in the moderately well drained and well drained soils in the county. Oxidation of iron is indicated by the red and brown colors in the B horizon of such soils as the Linker, Mountainburg, and Enders on uplands and the Cane and Sallisaw soils on lowlands.

Reduction and transfer of iron has occurred to a significant degree in the poorly drained and somewhat poorly drained soils of the lowlands. In the naturally wet soils, this process is called gleying. Gray colors in the horizons below the surface indicate the reduction and loss of iron. Some horizons contain reddish or yellowish mottles and concretions derived from segregated iron. Gleying is most pronounced in the Iberia and Wrightsville soils.

Translocation of silicate clay minerals has contributed to horizon development in most of the soils in the county. In cultivated areas most of the eluviated A2 horizon has been destroyed, but where the horizon occurs, the structure is blocky or platy; clay content is less than in the lower horizons where it has accumulated; and the horizon is lighter in color. Clay films generally have accumulated in pores and on the surface of peds in the B horizon. The soils were probably leached of carbonates and soluble salts to a great extent before translocation of silicate clay occurred, even though the content of bases is still high in some of the soils on lowlands.

Leaching of bases and translocation of silicate clay are among the most important processes in horizon differentiation in the soils of Sebastian County.

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 (*4*) and revised later (*10*). The system currently used by the National Cooperative Soil Survey was developed in the early sixties (*15*) and was adopted in 1965 (*9*). It is under continual study.

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 12 shows the classification of each soil series of Sebastian County by family, subgroup, and order, according to the current system.

Order.—Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The three exceptions to this, the Entisols, Inceptisols, and Histosols, occur in many different climates. Each order is named with a word of three or four syllables ending in *sol*.

Suborder.—Each order is subdivided into suborders that are based primarily on those soil characteristics that seem to produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect the presence or absence of water-logging or soil differences resulting from the climate or vegetation. The names of suborders have two syllables. The last syllable indicates the order.

Great group.—Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus has accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and a thick, dark-colored surface horizon. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark-red and dark-brown colors associated with basic rocks, and the like. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder.

Subgroup.—Great groups are subdivided into subgroups, one representing the central (typic) segment of the group and others called intergrades that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups are also made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group.

Family.—Soil families are separated within a subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the

TABLE 11.—*Physical and chemical*

[Analyses made by the University of Arkansas, Fayetteville. Dashes indicate that no

Soil, sample number, and depth	Horizon	Particle-size distribution					
		Very coarse sand to medium sand (2.0–0.25 mm.)	Fine sand (0.25–0.10 mm.)	Very fine sand (0.10–0.05 mm.)	Total sand (2.0–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (<0.002 mm.)
		Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Barling silt loam:							
S69-Ark-66-12							
0 to 5 inches	Ap	----------	11	23	34	56	10
5 to 11 inches	A12	----------	12	24	36	54	10
11 to 19 inches	B1	----------	6	19	25	64	11
19 to 26 inches	B21	----------	4	17	21	67	12
26 to 36 inches	B22	----------	3	17	20	68	12
36 to 54 inches	B23	----------	1	9	10	69	21
54 to 72 inches	B24	----------	11	19	30	54	16
Cane fine sandy loam:							
S69-Ark-66-11							
0 to 5 inches	Ap	2	23	26	51	43	6
5 to 9 inches	B1	1	15	17	33	49	18
9 to 25 inches	B2t	1	16	17	34	40	26
25 to 40 inches	Bx1	1	13	17	31	45	24
40 to 56 inches	Bx2	3	9	15	27	41	32
56 to 72 inches	Bx3	1	9	16	26	44	30
Crevasse loamy fine sand:							
S69-Ark-66-18							
0 to 8 inches	Ap	16	42	17	75	22	3
8 to 20 inches	C1	20	67	10	97	3	----------
20 to 28 inches	C2	3	71	25	99	1	----------
28 to 35 inches	C3	3	47	40	90	9	1
35 to 72 inches	C4	59	34	4	97	3	----------
Messer silt loam:							
S69-Ark-66-20							
0 to 5 inches	A11	7	5	11	23	66	11
5 to 16 inches	A12	9	5	11	25	63	12
16 to 32 inches	B1	7	4	12	23	62	15
32 to 39 inches	B&A	5	4	13	22	66	12
39 to 58 inches	B21t	4	3	9	16	63	21
58 to 72 inches	IIB22t	2	2	6	10	46	44
Sallisaw loam:							
S69-Ark-66-16							
0 to 6 inches	Ap	2	23	22	47	44	9
6 to 13 inches	B1	2	18	17	37	49	14
13 to 20 inches	B21t	1	17	17	35	47	18
20 to 33 inches	B22t	1	17	17	35	42	23
33 to 46 inches	B23t	1	18	18	37	41	22
46 to 59 inches	B24t	1	22	19	42	38	20
59 to 72 inches	B3	1	27	20	48	28	24
Severn silt loam:							
S69-Ark-66-7							
0 to 6 inches	Ap	----------	3	36	39	52	9
6 to 15 inches	C1	----------	2	41	43	50	7
15 to 31 inches	C2	----------	1	44	45	48	7
31 to 50 inches	C3	----------	6	61	67	28	5
50 to 69 inches	C4	69	26	3	98	2	--------
69 to 80 inches	C5	1	42	37	80	14	6

[1] Contains calcium carbonate.

analyses of selected soils

analysis was made or that data resulting from the analysis were insignificant]

Extractable bases: Calcium	Extractable bases: Magnesium	Extractable bases: Sodium	Extractable bases: Potassium	Extractable acidity	Base saturation	Reaction (soil-water ratio of 1:1)	Organic-matter content	Available phosphorus
Meq. per 100 gm. of soil	*Meq. per 100 gm. of soil*	*Meq. per 100 gm. of soil*	*Meq. per 100 gm. of soil*	*Meq. per 100 gm. of soil*	*Pct.*	*pH*	*Pct.*	*p.p.m.*
2.9	1.1	0.2	0.1	5.9	42	5.4	2.3	4
3.7	.7	.1	.1	5.2	47	6.0	1.6	3
5.2	.6	.2	.1	4.6	57	6.2	1.7	4
4.0	.6	.2	.1	3.4	59	6.1	1.2	5
2.6	.9	.2	.1	3.3	54	5.9	.5	4
4.3	1.3	.2	.1	6.4	48	5.5	.6	5
3.7	1.3	.2	.1	4.9	52	5.6	.4	9
1.4	.6	.1	.2	2.8	45	5.9	1.1	5
2.1	1.4	.2	.1	4.5	46	5.8	.7	2
1.7	2.1	.2	.2	6.2	40	5.1	.4	3
.9	1.6	.2	.2	6.7	30	5.3	.3	3
1.0	1.8	.2	.2	8.7	27	5.3	.3	3
.6	1.4	.2	.1	9.3	20	5.1	.3	3
[1]	.4	.2	.1	.4	[1]	8.2	.6	6
[1]	.2	.1	------	.6	[1]	8.2	.2	4
[1]	.2	.1	------	.3	[1]	8.3	.1	3
[1]	.4	.2	.1	------	[1]	8.3	.2	5
[1]	.2	.1	------	.4	[1]	8.1	.1	3
1.8	.9	.1	.1	8.2	26	5.4	2.4	4
1.5	.9	.2	.1	7.5	26	5.5	2.0	5
.3	.3	.2	.1	7.7	10	5.1	.8	5
.6	.6	.3	.1	4.9	25	5.7	.4	3
2.7	2.9	.9	.2	4.5	60	6.2	.4	2
5.6	6.4	1.9	.3	7.0	67	6.3	.5	3
1.9	.8	.2	.2	2.5	55	6.2	1.4	4
2.4	1.4	.2	.2	2.8	60	6.6	.8	3
3.1	1.5	.1	.2	3.2	60	6.5	.5	2
3.6	1.6	.2	.2	3.9	59	6.2	.4	3
3.1	1.7	.2	.2	4.1	56	5.7	.3	2
2.5	1.7	.2	.1	4.6	49	5.7	.3	2
2.8	2.6	.2	.2	4.1	59	5.8	.3	2
[1]	.9	.2	.2	.8	[1]	7.9	.9	6
[1]	.7	.1	.1	.6	[1]	8.1	.5	5
[1]	.7	.2	.1	.7	[1]	8.1	.4	4
[1]	.6	.1	.1	.7	[1]	8.3	.2	4
[1]	.3	.1	------	.5	[1]	8.1	.2	4
[1]	.7	.2	.1	.7	[1]	7.9	.8	7

subgroup name. The adjectives are the class names for texture, mineralogy, and so on, that are used to differentiate families, as shown in table 12.

Physical and Chemical Analyses

Physical and chemical data resulting from laboratory analyses can be useful to the soil scientist in classifying soils. These data are helpful in estimating available water capacity, acidity, base-exchange capacity, mineralogical composition, organic-matter content, and other soil characteristics that affect management needs. The data are also helpful in developing concepts of soil formation. More recently, laboratory data have proved helpful in rating soils for nonfarm uses, that is, for residential, industrial, recreational, or transportational use.

Several factors are involved in selecting soils for laboratory analyses. Soils that are extensive and most important in the survey area are considered first. A review of available laboratory data is made to determine the need for additional information on these particular soils. Generally, priority is given to soils for which little or no laboratory data are available.

In Sebastian County, soils representing six soil series were selected for laboratory analyses. Profiles of these soils are described in the section "Descriptions of the Soils." The analyses were made by the University of Arkansas in Fayetteville. Table 11 shows the results.

Particle-size distribution was determined by the hydrometer method (*7*).

The organic carbon was determined by the Walkley-Black method of digestion with potassium dichromate-sulfuric acid (*8*). The percentage of organic matter was then calculated. Percent organic carbon x 1.72 equals percent organic matter.

Soil reaction was determined on mixtures of soil and water at a 1:1 ratio, using a Beckman pH meter. Available phosphorus was extracted by the Bray No. 1 solution (0.03 N ammonium fluoride in 0.025 N hydrochloric acid) and determined colorimetrically.

The bases were extracted with 1N ammonium acetate at a pH of 7. Magnesium was determined colorimetrically (*8*). The other bases were determined by flame-photometry. The extractible acidity was determined by the barium chloride-triethanolamine method (*5*).

The total of extractible calcium, potassium, magnesium, sodium, and extractible acidity is an approximation of the cation-exchange capacity of the soil. The base saturation percentage was determined by dividing this total into the sum of calcium, potassium, magnesium, and sodium, and multiplying by 100.

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Table 12.—*Soil series classified into higher categories*

Series	Family	Subgroup	Order
Barling	Coarse-silty, mixed, thermic	Fluvaquentic Dystrochrepts	Inceptisols.
Cane	Fine-loamy, siliceous, thermic	Typic Fragiudults	Ultisols.
Cleora [1]	Coarse-loamy, mixed, thermic	Fluventic Hapludolls	Mollisols.
Crevasse	Mixed, thermic	Typic Udipsamments	Entisols.
Enders	Clayey, mixed, thermic	Typic Hapludults	Ultisols.
Iberia [1]	Fine, montmorillonitic, thermic	Vertic Haplaquolls	Mollisols.
Leadvale	Fine-silty, siliceous, thermic	Typic Fragiudults	Ultisols.
Linker	Fine-loamy, siliceous, thermic	Typic Hapludults	Ultisols.
McKamie	Fine, mixed, thermic	Vertic Hapludalfs	Alfisols.
Messer	Coarse-silty, siliceous, thermic	Haplic Glossudalfs	Alfisols.
Montevallo	Loamy-skeletal, mixed, thermic, shallow	Typic Dystrochrepts	Inceptisols.
Mountainburg	Loamy-skeletal, siliceous, thermic	Lithic Hapludults	Ultisols.
Muskogee	Fine-silty, mixed, thermic	Aquic Paledalfs	Alfisols.
Norwood	Fine-silty, mixed (calcareous), thermic	Typic Udifluvents	Entisols.
Sallisaw	Fine-loamy, mixed, thermic	Typic Paleudalfs	Alfisols.
Severn	Coarse-silty, mixed (calcareous), thermic	Typic Udifluvents	Entisols.
Taft	Fine-silty, siliceous, thermic	Glossaquic Fragiudults	Ultisols.
Wing	Fine, mixed, thermic	Aquic Natrustalfs	Alfisols.
Wrightsville	Fine, mixed, thermic	Typic Glossaqualfs	Alfisols.

[1] In this county the following soils are taxadjuncts to the series for which they are named. Cleora soils have a slightly thinner mollic epipedon than is defined for the series. Iberia soils have a slightly thicker mollic epipedon than is defined for the series.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coating.

Claypan. A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent 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.

Drainage class (natural). Drainage that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and are rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A horizon and upper part of the B horizons and have mottling in the lower part of the B horizon and in the C horizon.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods; they are light gray and generally mottled from the surface downward, but some have few or no mottles.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Eluviation. The movement of material from one place to another within the soil, in either true solution or colloidal suspension. Soil horizons that have lost material through eluviation are said to be eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

Gleyed soil. A soil in which waterlogging and lack of oxygen have caused the material in one or more horizons to be neutral gray in color. The term "gleyed' is applied to soil horizons with yellow and gray mottling caused by intermittent waterlogging.

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 at 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 of 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 colors 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.

Illuviation. The accumulation of material in a soil horizon through the deposition of suspended material and organic matter removed from the horizons above. Since part of the fine clay in the B horizon (or subsoil) of many soils has moved into the B horizon from the A horizon above, the B horizon is called an illuvial horizon.

Mottling, soil. 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 requirements 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.

Plowpan. A compacted layer formed in the soil immediately below the plowed layer.

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. In words the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Sand. As a soil separate, individual rock or mineral fragments that range from 0.05 to 2.0 millimeters in diameter. Most sand grains consist of quartz, but the sand may be of any mineral composition. As a textural class soil that is 85 percent or more sand and not more than 10 percent clay.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slope classes. The slope classes used in this survey are:

	Percent of slope		*Percent of slope*
Level	0 to 1	Moderately steep	12 to 20
Nearly level	1 to 3	Rolling	8 to 20
Gently sloping	3 to 8	Steep	20 to 40
Moderately sloping	8 to 12		

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.

Soil separates. Mineral particles, less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very coarse sand* (2.0 to 1.0 millimeters); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter) and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeters); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

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 either *single grain* (each grain by itself, as in dune sand) or *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.

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

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.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Wilting point (or permanent wilting point). The moisture content of soil, on an oven-dry basis, at which plants (specifically sunflower) wilt so much that they do not recover when placed in a dark, humid atmosphere.

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GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. In referring to a capability unit, a woodland group, or a range site, read the introduction to the section it is in for general information about its management. A discussion of the capability grouping begins on page 27. Other information is given in tables as follows:

Acreage and extent, table 2, page 8.
Predicted yields, table 3, page 28.
Wildlife habitat, table 4, page 30.
Woodland groups, table 5, page 34.
Engineering uses of the soils, tables 6, 7, and 8, pages 40 through 51.
Town and country planning, table 9, page 52.
Recreational development, table 10, page 56.

Map symbol	Mapping unit	Described on page	Capability unit	Woodland group	Range site	
			Symbol	Symbol	Name	Page
Ba	Barling silt loam	9	IIw-1	2o7	--------	--
CaC	Cane fine sandy loam, 3 to 8 percent slopes	9	IIIe-1	3o7	--------	--
Cr	Cleora fine sandy loam	11	IIw-1	2o7	--------	--
Cv	Crevasse soils	11	IVs-1	3s6	--------	--
EdC	Enders silt loam, 3 to 8 percent slopes	12	IVe-1	4o1	Clay Break, Shale	33
EdD	Enders silt loam, 8 to 12 percent slopes	12	VIe-1	4o1	Clay Break, Shale	33
EeE	Enders stony silt loam, 12 to 30 percent slopes	13	VIIs-1	4x2	Clay Break, Shale	33
EmC	Enders-Mountainburg association, rolling	13	-----	---	--------	--
	Enders soil	--	VIIs-1	4x2	Clay Break, Shale	33
	Mountainburg soil	--	VIIs-2	5x3	Sandstone Ridge	38
EmE	Enders-Mountainburg association, steep	13	-----	---	--------	--
	Enders soil	--	VIIs-1	5r3	Clay Break, Shale	33
	Mountainburg soil	--	VIIs-2	5x3	Sandstone Ridge	38
Ib	Iberia clay	14	IIIw-1	2w6	--------	--
LeB	Leadvale silt loam, 1 to 3 percent slopes	15	IIe-1	3o7	--------	--
LeC	Leadvale silt loam, 3 to 8 percent slopes	15	IIIe-1	3o7	--------	--
LnC	Linker fine sandy loam, 3 to 8 percent slopes	15	IIIe-1	4o1	Loamy Upland	33
MkC	McKamie silt loam, 3 to 8 percent slopes	17	IVe-2	3c2	--------	--
MlD	Montevallo gravelly loam, 3 to 12 percent slopes	18	IVe-3	5d3	Shale Break	38
MmD	Mountainburg sandy loam, 3 to 12 percent slopes	18	IVe-3	5d3	Sandstone Ridge	38
MnD	Mountainburg stony sandy loam, 3 to 12 percent slopes	18	VIs-1	5x3	Sandstone Ridge	38
MnE	Mountainburg stony sandy loam, 12 to 35 percent slopes	19	VIIs-2	5x3	Sandstone Ridge	38
MuC	Muskogee silt loam, 3 to 8 percent slopes	20	IIIe-2	3o7	--------	--
No	Norwood silty clay loam	21	IIs-1	2o4	--------	--
SaB	Sallisaw loam, 1 to 3 percent slopes	21	IIe-1	3o7	--------	--
SaC	Sallisaw loam, 3 to 8 percent slopes	21	IIIe-1	3o7	--------	--
SlC	Sallisaw stony loam, 1 to 8 percent slopes	22	IVs-2	3o7	--------	--
Sn	Severn silt loam	23	I-1	2o4	--------	--
Tf	Taft silt loam	24	IIIw-2	3w8	--------	--
Wg	Wing silt loam	25	VIs-2	5t0	Alkali Flats	33
Wr	Wrightsville silt loam	25	IIIw-2	3w9	Loamy Prairie	33
WsA	Wrightsville complex, 0 to 2 percent slopes	26	IIIw-2	3w9	Loamy Prairie	33
Wt	Wrightsville-Messer complex	26	IVw-1	3w9	Loamy Prairie	33