

SOIL SURVEY

Stanton County, Kansas



UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
in cooperation with
KANSAS AGRICULTURAL EXPERIMENT STATION

HOW TO USE THE SOIL SURVEY REPORT

THIS SURVEY of Stanton County will help you plan the kind of farming that will protect your soils and produce good yields. It describes the soils, shows their location on a map, and tells what they will do under different kinds of management.

Find your farm on the map

In using this survey, start with the soil map which is in the back of this report. These sheets, if laid together, make a large photographic map of the county as it looks from an airplane. You can see fields, roads, streams, towns, and many other landmarks on this map.

To find your farm, use the index to map sheets. This is a small map of Stanton County on which numbered rectangles have been drawn to show the area covered by each sheet of the soil map.

When you have found the map of your farm, you will notice that boundaries of the soils have been outlined and that there is a symbol for each kind of soil. All areas marked with the same symbol are the same kind of soil, wherever the symbol appears on the map.

Suppose you have found on your farm an area marked with the symbol Rm. The map legend identifies this symbol as Richfield silt loam, 0 to 1 percent slopes.

Learn about the soils on your farm

The Richfield soil and all other soils mapped are described in the section "Descriptions of the Soils." Before soil scientists described and mapped the soils, they walked over the land; dug holes and examined surface soils and sub-soils; measured slopes with a hand level; noted differences in growth of crops, weeds, or brush; and, in fact, recorded all the things about the soils that they believed might affect their suitability for farming.

After they studied and mapped the soils, the scientists talked with farmers and others about the use and management each soil should have and then they placed it in a capability unit. A capability unit is a group of similar soils that need and respond to about the same kind of management.

Richfield silt loam, 0 to 1 percent slopes, is in capability unit IIIc-1 for dryland farming and in unit I-1 for irrigation farming. Turn to the section "Use and Management of the Soils" and read what is said about the soils of each of these capability units. You will want to study all the information given about how these soils can be managed and what to expect from them under good management when they are used for crops. The soils are also grouped in range sites, and good management of soils

used for range is discussed in the section "Range Management."

The "Guide to Mapping Units, Capability Units, and Range Sites," at the back of the report, will simplify the use of the map and the report.

Make a farm plan

Compare the management practices that you are now using for the soils on your farm with those suggested in this report. Look at your fields for signs of runoff and erosion. Then decide whether or not you need to change your methods of farming. The choice, of course, must be yours. This survey will aid you in planning new methods, but it is not a plan of management for your farm or any other farm in the county.

If you find that you need help in making plans for your farm, consult the local representative of the Soil Conservation Service or your county agricultural agent. Members of the staff of the Kansas Agricultural Experiment Station and others familiar with farming in your county will also be glad to help you.

Finding information

Few readers will be interested in all parts of the soil survey report, for it has special sections for different groups, as well as some sections of value to all. The section "General Nature of the County" discusses outstanding features of the survey area and will be of interest mainly to those not familiar with Stanton County.

Farmers and those who work with farmers will be interested mainly in the sections "General Soil Areas, Descriptions of the Soils, and Use and Management of the Soils." A study of these sections will aid them in identifying soils on a farm, in learning ways the soils can be managed, and in judging what yields can be expected.

Soil scientists and others who want to know about how the soils were formed and how they are classified will be interested in the section "Formation and Classification of the Soils."

Students, teachers, and other users will find information about soils and their management in various parts of the report, depending on their particular interest.

* * *

Fieldwork on this survey was completed in 1958. Unless otherwise indicated, all statements in the report refer to conditions at that time. The soil survey is part of the technical assistance furnished to the Stanton County Soil Conservation District.

Contents

	Page		Page
General soil areas	1	Descriptions of the soils—Continued	
Richfield-Ulysses soil association.....	1	Ulysses-Colby complex.....	17
Manter-Dalhart-Ulysses soil association.....	1	Ulysses-Colby complex, 1 to 3 percent slopes, eroded.....	17
Ulysses-Colby-Bridgeport soil association.....	3	Vona loamy fine sand.....	17
Ulysses-Manter-Richfield soil association.....	3	Vona loamy fine sand, 5 to 15 percent slopes.....	17
Ulysses-Colby soil association.....	4	Use and management of the soils	17
Climate	4	Capability classification.....	18
Effects of erosion	7	Management of dryland.....	19
Descriptions of the soils	8	Management by capability units (dryland).....	22
Bayard fine sandy loam.....	9	Estimated yields.....	24
Blown-out land.....	9	Irrigation farming.....	25
Bridgeport clay loam.....	10	Management by capability units (irrigated).....	27
Broken land.....	10	Range management.....	29
Colby series.....	10	Principles and practices of range management.....	29
Colby silt loam, 1 to 3 percent slopes.....	10	Range sites.....	31
Colby silt loam, 3 to 5 percent slopes.....	11	Woodland management.....	32
Colby silt loam, 5 to 15 percent slopes.....	11	Wildlife management.....	33
Dalhart series.....	11	Formation and classification of the soils	33
Dalhart fine sandy loam, 0 to 1 percent slopes.....	11	Factors of soil formation.....	33
Dalhart fine sandy loam, 1 to 3 percent slopes.....	11	Parent material.....	33
Goshen silt loam.....	11	Climate.....	35
Lincoln soils.....	12	Plant and animal life.....	35
Lofton clay loam.....	12	Relief.....	35
Mansker series.....	13	Time.....	35
Mansker clay loam, 0 to 3 percent slopes.....	13	Characteristics of the soils.....	35
Mansker clay loam, 3 to 5 percent slopes.....	13	Classification of the soils.....	36
Manter series.....	13	General nature of the county	36
Manter fine sandy loam, 1 to 3 percent slopes.....	13	Physiography, relief, and drainage.....	36
Manter fine sandy loam, 0 to 1 percent slopes.....	14	History.....	38
Manter fine sandy loam, 3 to 5 percent slopes.....	14	Agriculture.....	38
Otero-Manter fine sandy loams.....	14	Crops.....	38
Otero-Manter fine sandy loams, 1 to 5 percent slopes.....	14	Pasture.....	38
Richfield silt loam.....	15	Livestock.....	39
Richfield silt loam, 0 to 1 percent slopes.....	15	Farm equipment and labor.....	39
Tivoli loamy fine sand.....	15	Tenure and size of farms.....	39
Travessilla soils.....	16	Water supply.....	39
Ulysses series.....	16	Industries.....	40
Ulysses silt loam, 0 to 1 percent slopes.....	16	Transportation and markets.....	40
Ulysses silt loam, 1 to 3 percent slopes.....	17	Community facilities.....	40
Ulysses silt loam, 3 to 5 percent slopes.....	17	Glossary	40
		Guide to mapping units, capability units, and range sites	41



Growth Through Agricultural Progress

SOIL SURVEY OF STANTON COUNTY, KANSAS

BY EDWARD L. FLEMING, CHARLES W. McBEE, VERNON L. HAMILTON, AND KENNETH H. SALLEE, SOIL SCIENTISTS,
SOIL CONSERVATION SERVICE

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

STANTON COUNTY is in the southwestern part of Kansas (fig. 1). It is bordered on the west by Colorado and is in the second tier of counties north

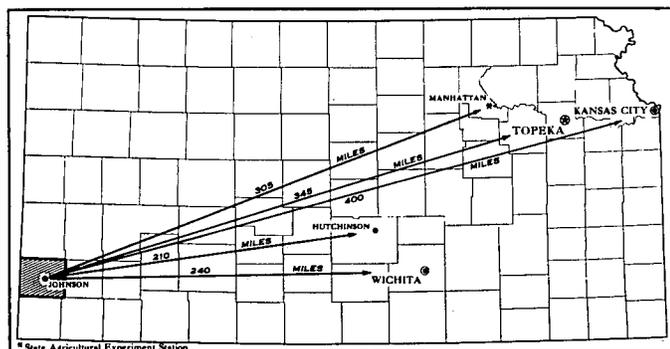


Figure 1.—Location of Stanton County in Kansas.

of the Oklahoma-Kansas State line. The county has an approximate area of 676 square miles, or 432,640 acres. It extends about 24 miles from north to south and 28 miles from east to west.

General Soil Areas

The colored map of general soil areas, in the back part of the report, shows general patterns of soils in the county. The map is useful for studying the soils in general but is not detailed enough to use for planning the management of a farm.

General soil areas are also called soil associations. Each association in the county consists of two or more different soils that occur in a characteristic pattern. The pattern is related to the shape of the land surface and to the kind of soil material.

Only the major soils are listed in the names of the soil associations of Stanton County. Each association, however, probably includes acreages of other soils. The colored map shows only broad, general areas, not individual soils. The detailed soil map is needed to find the individual soils on a particular farm or ranch.

Richfield-Ulysses Soil Association: Nearly Level to Gently Sloping Hardlands

This soil association is the most extensive in the county and makes up about 50 percent of the area. The soils

have developed in loess or similar silty sediments on nearly level to gently sloping topography.

Richfield silt loam makes up the major part of this soil association. It occupies broad, continuous, nearly level areas (fig. 2) that have ill-defined drainageways and contain a few, small, enclosed depressions or potholes. Lofton clay loam occupies the depressions.

Ulysses silt loams occupy gently sloping topography and low ridges. These soils also occur on the more convex slopes of the nearly level areas.

Most of the acreage of this association is used for wheat and grain sorghum. Wind erosion is a hazard on the nearly level areas, and both wind and water erosion are hazards on gently sloping areas. Conservation of water is needed for profitable production of crops on all soils in the association.

Manter-Dalhart-Ulysses Soil Association: Sandy Lands

This association occupies about 10 percent of the county. The soils occur mostly in two areas, as shown on the general soil map. They comprise the narrow belt of sandy soils (fig. 3) adjacent to and south of Bear Creek and Sand Arroyo. Relief ranges from nearly level to gently sloping and gently undulating.

Manter fine sandy loams are the most extensive and the most sandy soils of this association. They occur in areas with slopes of 0 to 5 percent.

Dalhart soils are less sandy than the Manter soils. They occur on nearly level and gently sloping areas throughout this association.

The soils become less sandy and more silty near the margins of the association areas. The silty, nearly level and gently sloping areas are generally occupied by Ulysses soils.

Tivoli, a minor soil in the county, also occurs in this association. It occupies dunelike topography mostly adjacent to Bear Creek and Sand Arroyo. There are small areas of Tivoli soil throughout this association.

Most of this soil association is used for crops. The main crops are sorghum and wheat. Some broomcorn (fig. 4) is produced in the southwestern part of the county. Wind erosion is a hazard on all the soils, particularly on the more sandy ones.

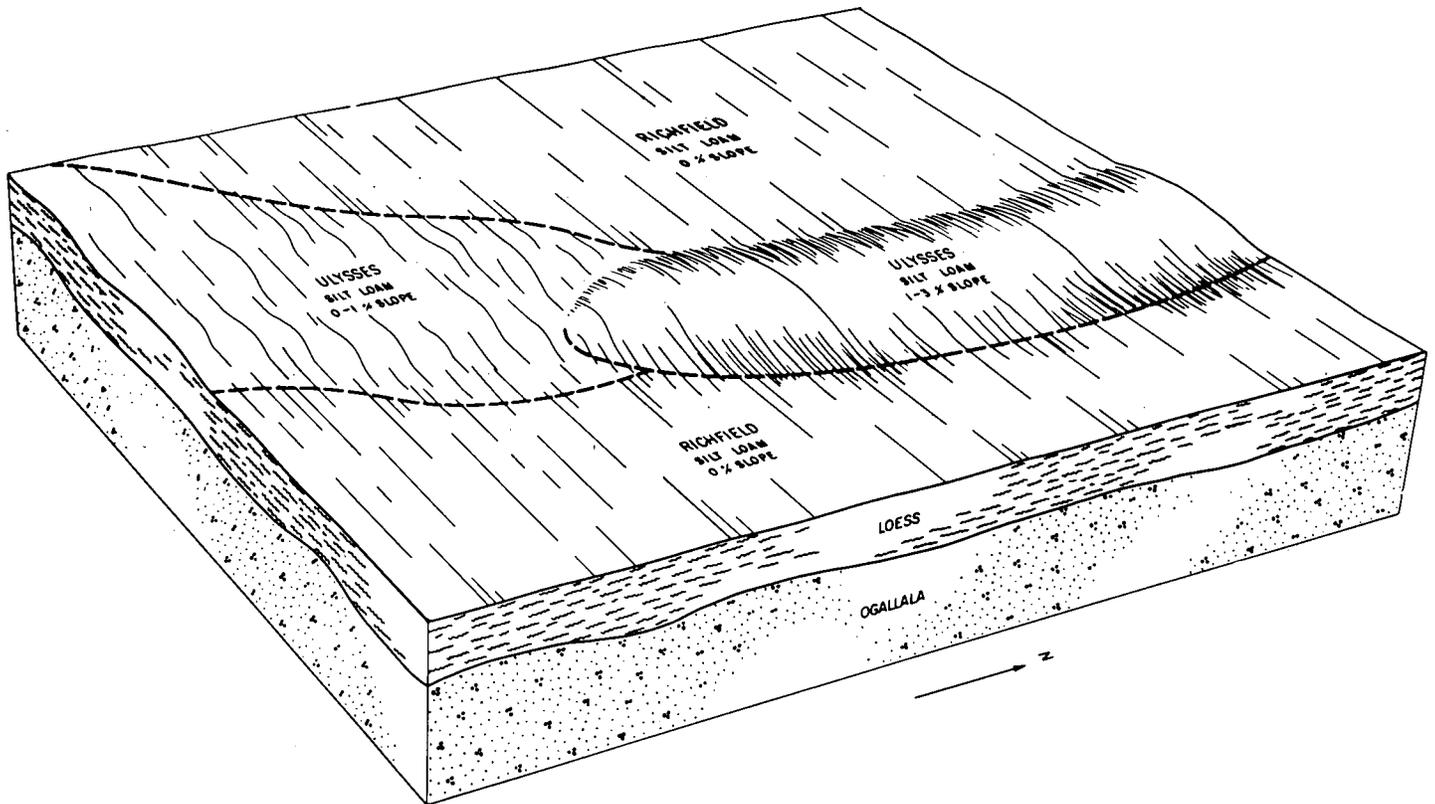


Figure 2.—Diagram of the Richfield-Ulysses soil association on the High Plains.

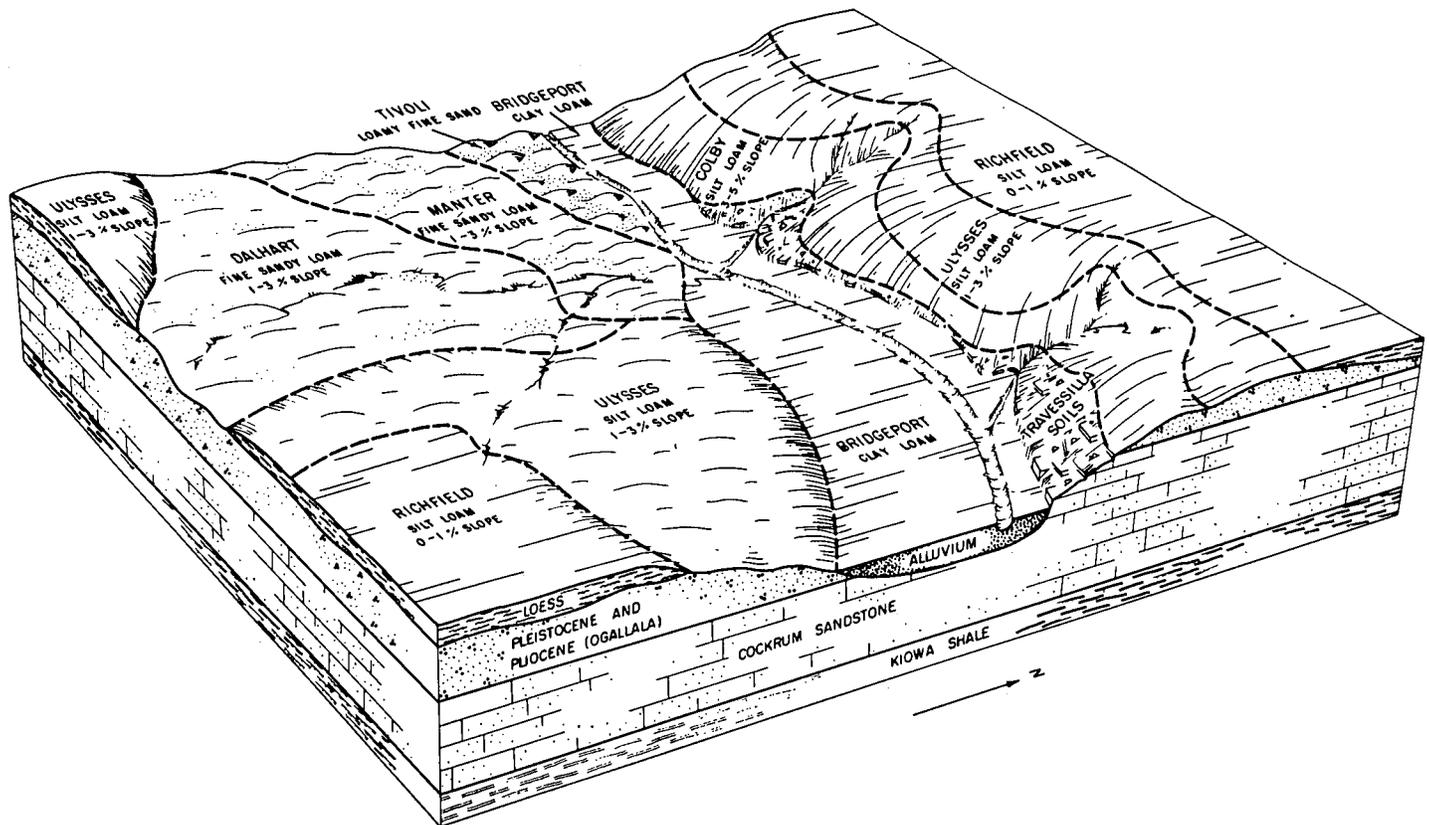


Figure 3.—Diagram of the Manter-Dalhart-Ulysses soil association in the valley of Bear Creek.

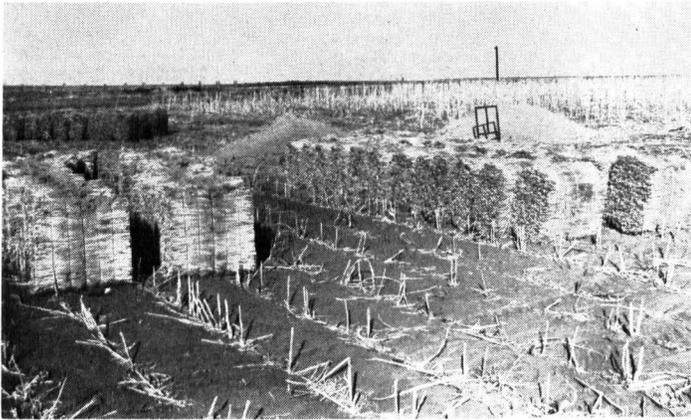


Figure 4.—Bales of broomcorn on Dalhart fine sandy loam, 1 to 3 percent slopes.

Ulysses-Colby-Bridgeport Soil Association: Sloping Hardlands and Nearly Level Alluvial Lands

This soil association occurs in the northeastern corner of the county in an area dominated by nearly level to gentle slopes and by erosional valleys that have moderately sloping sides.

Ulysses silt loams, the most extensive soils of this association, occur mostly on nearly level to gently sloping upland. Colby silt loams occupy the moderately sloping sides of drainageways of the upland. The upland drainageways empty into a broad, nearly level valley through which Bear Creek flows (fig. 5).

Bridgeport clay loam has developed in the alluvium that is filling the lower end of the valley of Bear Creek.

Inextensive areas of Goshen silt loam occur in this association. The Goshen soil has developed in the narrow, nearly level floors of intermittent drainageways of the upland; the drainageways have indefinite channels or no channels.

Most areas of the nearly level to gently sloping soils are cultivated. The main crops are wheat and sorghum. Wind and water erosion are serious hazards. The steeper and more broken areas remain in native grass and are used for grazing.

Ulysses-Manter-Richfield Soil Association: Nearly Level to Gently Sloping Hardlands and Sandy Lands

This association occurs in the northwestern part of Stanton County on nearly level to slightly undulating areas and on low ridges and knobs (fig. 6). Most of the soils have slopes of 1 to 3 percent, but some have slopes of less than 1 percent and slightly more than 3 percent.

Ulysses silt loams, the most extensive soils of the association, have developed in silty sediments. These soils occur mainly on silty ridges and knobs, but some of the acreage is on nearly level and gently sloping areas.

The Manter soils have developed in moderately sandy plains sediments that have been partially reworked by the wind. They are on slightly undulating areas and moderately sandy ridges and knobs.

Richfield silt loam, like the Ulysses silt loams, has developed in silty materials. This soil occurs on nearly level areas.

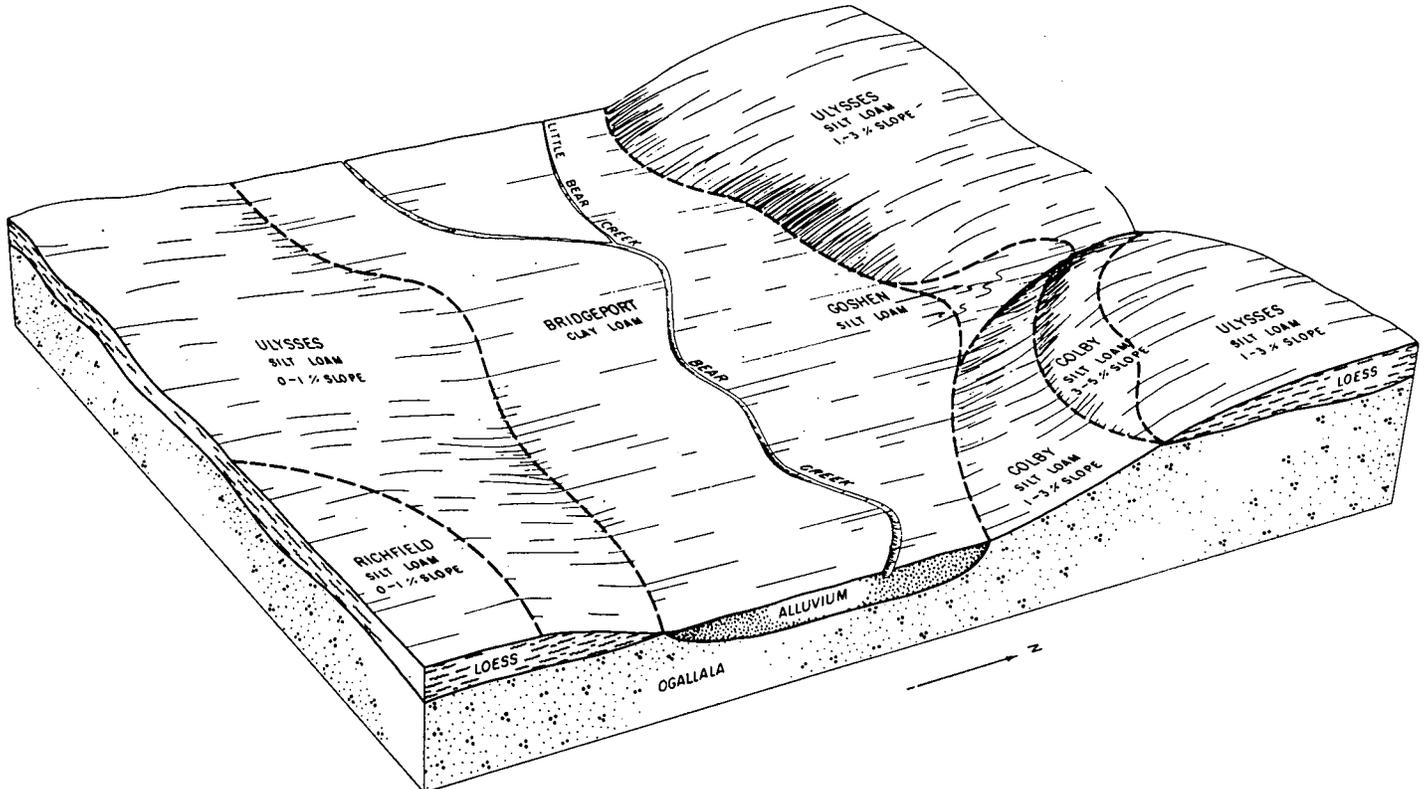


Figure 5.—Pattern of soils of the upland in northeastern Stanton County and cross section of part of the valley of Bear Creek.

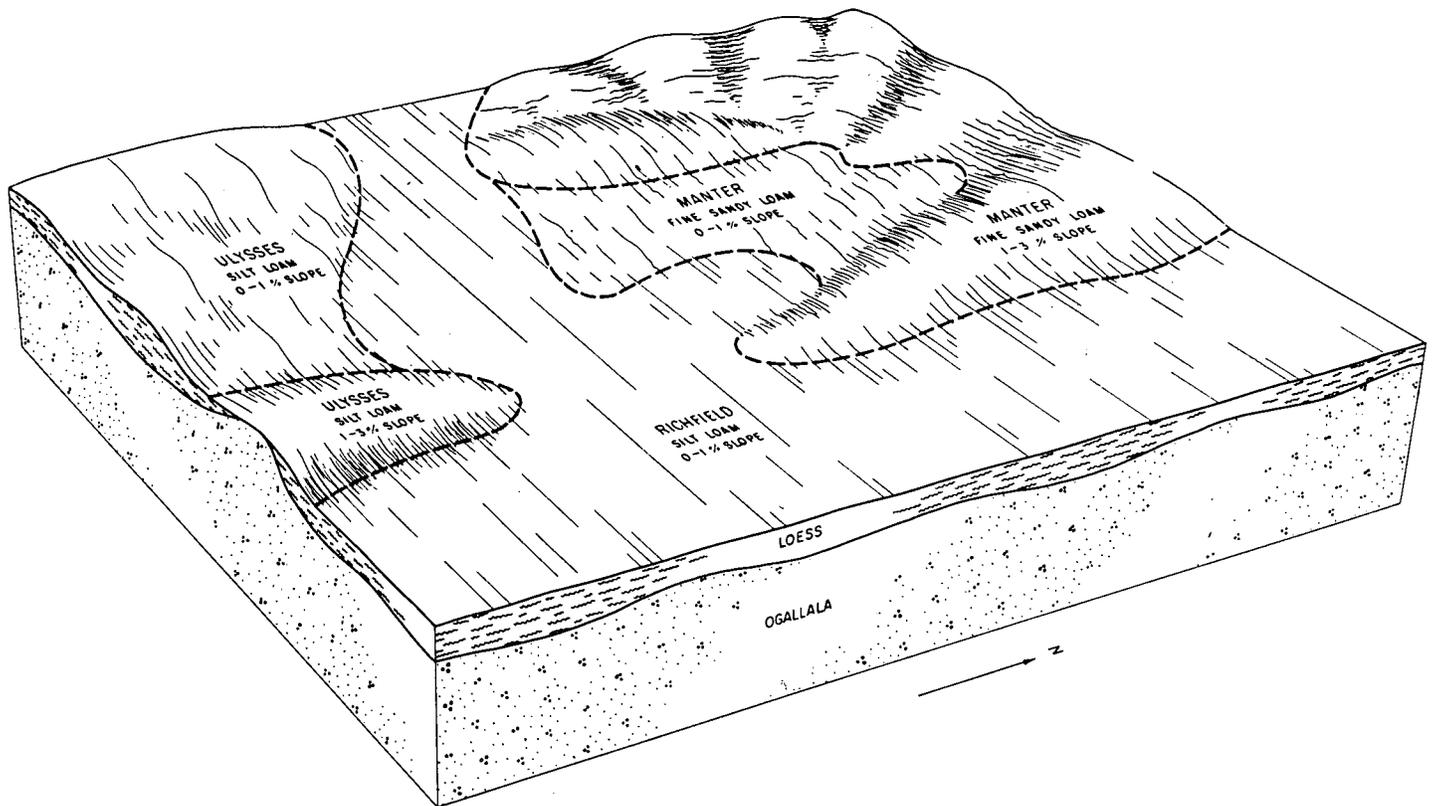


Figure 6.—Diagram of the Ulysses-Manter-Richfield soil association in the northwestern part of Stanton County.

Most of the soils of this association are used for crops. Wind erosion is a hazard, particularly on the more sandy areas. Water erosion is a hazard on the more sloping soils.

Ulysses-Colby Soil Association: Sloping Hardlands

The two areas of this soil association are west and southwest of Johnson. They occur adjacent to and north of Bear Creek and Sand Arroyo. These areas are dominated by gentle to moderate slopes. Some of the deeper erosional valleys have steep side slopes.

Ulysses and Colby soils occupy most of the association; the Ulysses soils are predominant. These soils have developed in loess or other silty materials that mantle most of the slopes.

Ulysses and Colby soils occupy all the gently and moderately sloping areas. The more strongly sloping areas are generally occupied by Colby soils. There are some inextensive, nearly level areas of Ulysses silt loams.

Minor areas of Travessilla soils and Mansker clay loams occur in this soil association. Travessilla soils are shallow over sandstone and generally occupy steep and broken slopes that have outcrops and ledges of rock. Mansker clay loams make up a minor but important part of this association. They are moderately deep over well-defined layers of accumulated lime. Slopes range from 0 to 5 percent but are mostly 0 to 3 percent.

Most areas of gently to moderately sloping soils are cultivated. The main crops are wheat and sorghum. Wind and water erosion are serious hazards. Conserva-

tion of water is necessary for successful production of crops. The steeper and more broken areas remain in native grass and are used for grazing.

Climate¹

Stanton County is in the extreme southwest part of Kansas and receives an uncertain amount of rainfall because of its location (1) on the lea, or "rain shadow," side of the Rocky Mountains and (2) west of the principal northward flow of moisture from the Gulf of Mexico. The sun-controlled weather on the open High Plains produces a wide daily and annual range in temperature.

Means and extremes in temperatures at Johnson, Kans., are given in figure 7.² Averages and means only partly describe climate, however. Other data indicated in figure 7 are as follows: (1) July is the warmest month and January is the coldest; (2) temperatures of 100° F. or higher have occurred from May 9 to September 27; (3) temperatures below 32° have been recorded as early as September 26 and as late as May 27; (4) temperatures of 0° or lower have occurred from November 13 through March 31; and (5) March has the greatest absolute range in temperature (111°), and August has the least absolute range (only 67°).

As shown by figure 8, which gives average monthly precipitation, the month of May has the greatest amount

¹ By ANDREW D. ROBB, State climatologist, U.S. Weather Bureau, Topeka, Kans.

² Unless otherwise indicated, climatic data are taken from records at the U.S. Weather Bureau Station, Johnson, Kans.

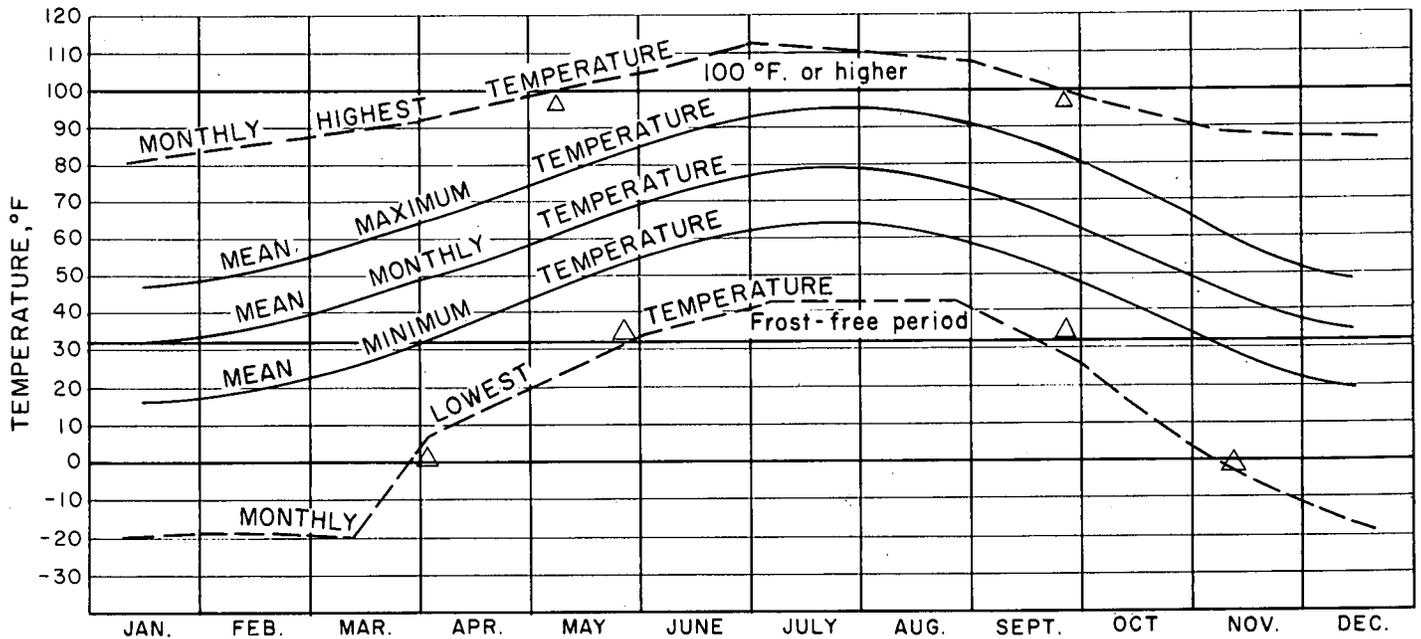


Figure 7.—Means and extremes in temperatures, as recorded at the U.S. Weather Bureau Station, Johnson, Kans.

of rainfall. The average precipitation in May is about five to eight times greater than that of each month from November through February. On the average, June has less rainfall than May, July, or August. Each of the months March, September, and October has about 50 percent of the average precipitation of each of the months May, June, July, and August.

In southwestern Kansas, precipitation, as well as temperature, generally does not conform to the averages. The lack and irregularity of rainfall are of prime importance to agriculture. Only 4.77 inches of precipitation were recorded at Johnson in 1956—the lowest annual precipitation recorded at any station in Kansas. In that year, no measurable precipitation occurred in September, November, and December and only 2 months had more than 1 inch. June was the wettest month, with 1.26 inches of rainfall. In contrast, each of the 7 months from April through October in 1941 had more than 2 inches of rainfall. The greatest monthly total was 7.99 inches in July 1941. The least amount of precipitation in any month of 1941 was 0.19 inch in December. In 1956, a dry year, 6 different months each had less than this amount.

Except for May, July, and August, all months have received in 1 or more years less than a measurable amount of precipitation during the period from 1917 through 1958. Each month from April through August has had a total of at least 5 inches of precipitation in 1 or more years.

The precipitation during the growing season (March through August) is, of course, most important for summer row crops and for the storage of soil moisture for fall-seeded wheat. Figure 9 shows the annual and growing season (March through August) precipitation from 1917 through 1958. From 1934 through 1940 the precipitation during the growing season was particularly low (10 inches or less each year). In contrast, from 1917 through 1925 it was less than 10 inches in only 1 year.

In only 3 consecutive years, 1949, 1950, and 1951, has there been more than 15 inches of precipitation during the growing season. The precipitation in 35 percent of the growing seasons was less than 9 inches; in 50 percent, less than 10.75 inches, and in 85 percent, less than 15 inches.

The distribution of rainfall during the growing season is also important to the growth of crops. It is irregular in Stanton County; in only 5 of 42 summers has there been an inch or more of precipitation in each month from March through August. In 6 years from 1/3 to about 1/2 of the total precipitation occurred in one of the months from March through August.

The average annual snowfall varies greatly in Stanton County. In 3 seasons there have been 48 inches or more of snowfall, but in 2 seasons there have been less than 5 inches. In 1918-19, the total snowfall exceeded 66 inches, whereas in 1949-50, the total was 1.5 inches. Snow-

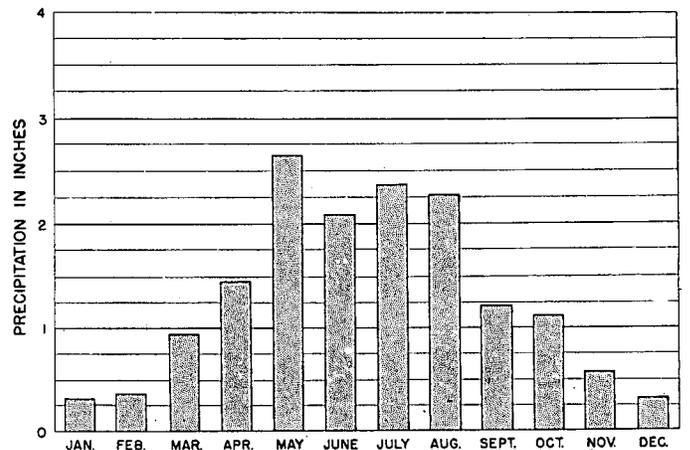


Figure 8.—Average monthly precipitation, as recorded at the U.S. Weather Bureau Station, Johnson, Kans.

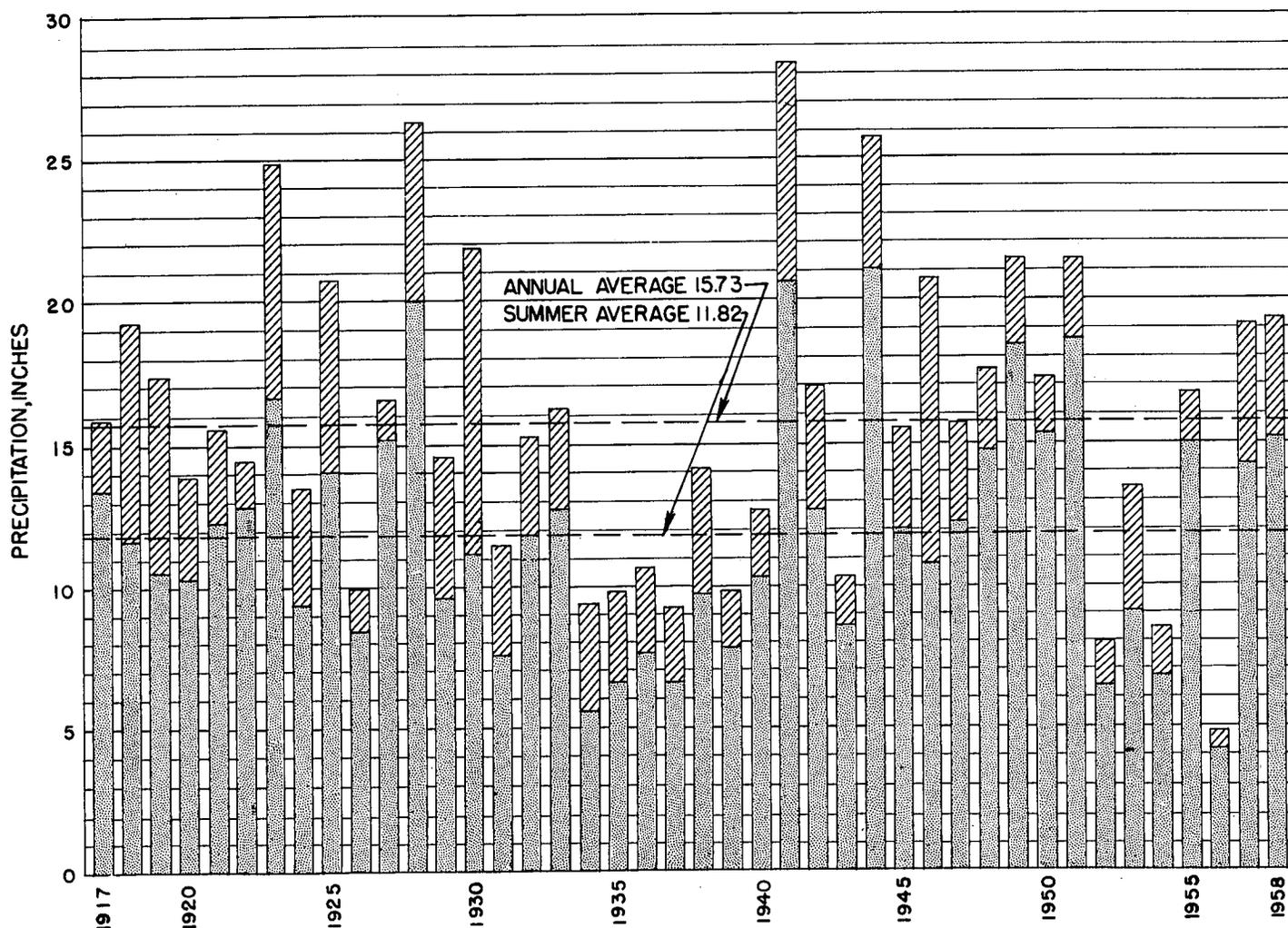


Figure 9.—Annual precipitation, as recorded at the U.S. Weather Bureau Station, Johnson, Kans., 1917–1958. The shaded part of each bar shows precipitation during the summer, or growing season (March through August); the hatched part of each bar shows precipitation from September through February.

fall may occur from the last part of September to the early part of May. The average monthly snowfall is greatest in March—4.6 inches.

Irregularities in precipitation have a much greater effect on the economy of this county than fluctuations in temperature. Few native crops or other crops currently suited to the county are injured by temperature alone.

The absolute range of temperature is from -20° F. (recorded on January 5, 1942 and March 11, 1948) to 113° (recorded on June 30, 1933). There were 50 days in 1934 and 51 days in 1936 with temperatures of 100° or higher. But in each of 3 hot years, 1952, 1953, and 1954, temperatures rose to 100° or above on only 33 to 37 days. Every summer of record has had at least 1 day with a temperature of 100° or above.

The heat of summer is generally tempered by wind and relatively low humidity. Occasionally, there is an exceptionally hot day when the wind seems to burn the skin. Nights are seldom uncomfortably hot. The annual mean maximum temperatures in July have ranged from 103° in 1934 to 85° in 1950. Four Julies have had a mean maximum temperature of 100° or higher.

Cold weather may be early or delayed, and some winters are much colder than others. Annual mean temperatures in January, for example, have ranged from 5° in 1930 to 24° in 1939. Cold weather, however, is usually not too prolonged. Over a 44-year period, mean minimum temperatures have averaged lower than 15° in 11 Januaries and in 7 Februaries, but in only 2 years have January and February consecutively had mean minimum temperatures below 15° .

All years of record have had a freezing temperature during each month from October through April, and a temperature of 0° or lower has occurred in every year except 1941. The frost-free period extends from May 27 to September 26, a period of 123 days. The average growing season is from April 28 to October 19, or 174 days.

The wind seems to blow continuously and at a considerable velocity in this area. At Dodge City, Ford County, wind velocity averages 15 miles per hour during the year. Average wind velocity is greatest, 17 miles per hour, during March and least, 13.6 miles per hour, during August. The fastest mile of wind recorded each

month, February through August, has had a velocity of 70 to 78 miles per hour. Most of these high winds occur during thunderstorms. The prevailing wind is from the south.

Sunshine occurs 70 percent of the time that the sun is above the horizon. During the year there is an average of 144 clear days, 107 partly cloudy days, and 114 cloudy days. Rainfall in measurable amounts falls on an average of 78 days a year, or on about 1 day in 5 days. On the average, thunderstorms occur on 54 days of the year.

Probably the greatest weather hazard is drought. Occasionally, this area takes on the characteristics of the southwestern desert for several years at a time. Dust-storms, or "black blizzards," are another hazard. They are the result of prolonged dry weather, lack of vegetative cover, and high winds. (See fig. 16.) They cause very severe erosion. Fortunately, the worst storms are usually only a few hours long.

Thunderstorms are sometimes intense, and damage may result from lightning, from severe wind, and occasionally from tornadoes and hail. Of these, hail is by far the most destructive. Great numbers of hailstones of pea-to-marble size, driven by high winds, have destroyed in a few minutes countywide areas of nearly ripened grain. At times, hailstones as large as baseballs have fallen and have caused much property damage.

Snow blizzards are a threat in winter. Occasionally, snow is driven by the wind for 1 or more days and drifts from fields to block roads. If accompanied by very cold weather, these storms are a severe menace to people or livestock caught without protection.

Effects of Erosion

Erosion is the removal of soil and geologic materials through the action of natural agencies, mainly wind, running water, and gravity. This discussion deals with accelerated soil erosion in Stanton County. Accelerated erosion should not be confused with geologic erosion. Geologic erosion is the gradual process of soil removal that takes place under natural conditions in an undisturbed environment. In contrast, accelerated erosion is the increased rate of soil removal that is brought about by man through changes in the natural cover or soil conditions.

Wind and water are the main causes of soil erosion in Stanton County. Wind erosion is always a hazard and is serious during the recurring periods of drought. Strong winds and limited vegetative growth that are characteristic of drought on the High Plains are conducive to widespread soil blowing.

Water erosion is a hazard on all the sloping, silty soils that are cultivated. Runoff occurs during the hard, dashing thunderstorms when rain falls more rapidly than the water can enter the soil. Practices that slow down or decrease runoff will conserve moisture and help control water erosion.

Some effects of erosion are permanent; the soil is damaged to the extent that it requires a change in its use and management. Other effects are transitory but may impair the use of the land until restorative measures are taken.

During fieldwork on the soil survey, observations of

the effects of erosion were made. Some of the results of wind erosion observed were as follows:

1. Small, low hummocks and drifts of soil form on nearly level and smoothly sloping cultivated fields where active soil blowing is in progress. These hummocks and drifts will blow again unless they are smoothed out and soils tilled to provide a roughened surface that is resistant to erosion. Full use of the area may be restored and permanent soil damage prevented if the surface is roughened, as needed, by additional tillage.
2. Within the more undulating High Plains tableland, the tops of ridges and knolls are more vulnerable to wind action than areas of adjacent nearly level soils. Soil on exposed areas tends to blow more often and, consequently, much of it has been deposited on smoother areas nearby. Some of the finer soil particles are transported great distances by the wind. Much of the silt and sand deposited on the adjacent areas is calcareous. Calcareous silty and sandy soils blow readily, and, therefore, wind erosion may occur after this material is deposited in a field that would otherwise be stable.
3. Soil may drift from actively eroding cultivated fields onto adjacent rangeland and damage or destroy native vegetation. No permanent damage occurs, but the use of the land is impaired until the grass has become reestablished either by deferred grazing or by reseeding.
4. During drought, overuse of some of the very sandy, nonarable rangeland may result in the loss of protective vegetation and severe wind erosion. These areas are thus permanently damaged, and their value for grazing is greatly reduced. Damage to cultivated crops and grass on adjacent areas is caused by the drifting sand. The sandy sediments also increase the hazard of wind erosion on the soils on which they are deposited.

Erosion is serious not only because of the permanent modification of the soil but also because of the short-time damage to crops and forage. Replanting of crops, reseeding of rangeland, and emergency tillage (fig. 10) and

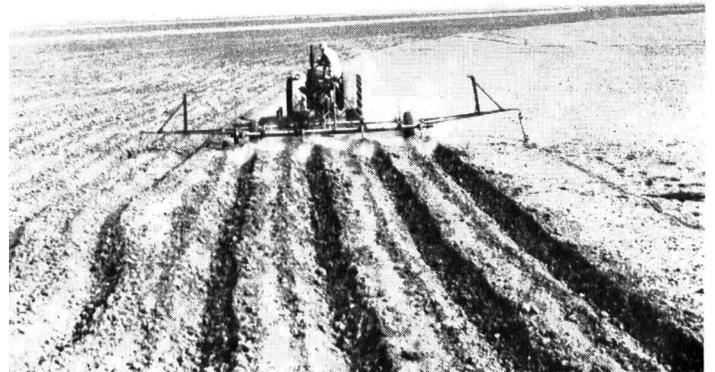


Figure 10.—Emergency tillage is being used to prevent soil blowing on this unprotected field of Ulysses silt loam.

smoothing operations may correct most of the temporary effects of erosion and restore full use of the land, but these practices are time consuming and costly.

In Stanton County, eroded soils are mapped as separate soil units only if erosion has modified some important quality or characteristic of the soil that is significant to its use and management. Many of the soils have been eroded to some degree and are subject to further erosion; the hazard of erosion on all the soils is described in the section "Use and Management of the Soils."

An eroded soil is designated as an eroded phase of a soil type if it still retains many characteristics of the soil type. Some soils have been so altered by erosion that they now have characteristics similar to those of some associated soil type, and they are mapped as such. For example, if the dark-colored surface layer has been removed from a soil that was once Ulysses silt loam, the soil is now designated as a Colby silt loam. Other soils have been modified extremely by erosion and have lost their original identity; these soils are now classified as miscellaneous land types. The miscellaneous land type Blown-out land was presumably another soil before it became eroded.

Measures needed to control erosion vary according to the kind of soil, the degree of slope, and land use. One can generally choose a combination of practices that will control erosion at a particular time. These practices are discussed under each capability unit in the section "Use and Management of the Soils." For more specific and detailed information on the control of erosion, consult a representative of the Soil Conservation Service.

Descriptions of the Soils

The scientist who makes a soil survey examines soils in the field, classifies the soils in accordance with facts that he observes, and maps their boundaries on an aerial photograph or other map.

The soil surveyor bores or digs many holes to see what the soils are like. The holes are not spaced in a regular pattern but are located according to the lay of the land. Generally, they are not more than a quarter of a mile apart, but in places they are much closer. In most soils, each boring or hole reveals several distinct layers, called horizons, which collectively are known as the soil profile.

Soil scientists designate the soil layers, or horizons, with letters of the alphabet. The upper horizon is called the A horizon and is equivalent to the surface layer. It is usually the darkest layer because of the organic matter it contains. Depths of the horizons are measured from the surface downward. The subsoil, or B horizon, is the next layer below the surface soil. Some soils, especially young or weakly developed soils, may not have a B horizon. Their underlying or parent material, designated as the C horizon, is similar in characteristics to the horizons above but has been affected very little by the factors of organic accumulation and weathering that caused the A and B horizons to develop.

Color is usually related to the amount of organic matter in the soil. Streaks and spots of gray, yellow, and brown in the lower layers generally indicate poor drainage and poor aeration.

Texture, or the content of sand, silt, and clay, is determined by the way the soil feels when rubbed between the fingers, and it is later checked by laboratory analysis. Sand is made up of the largest particles, and clay of the smallest. Most soils have some mixture of all three sizes—sand, silt, and clay. Texture determines how susceptible the soil is to wind erosion, how well it retains moisture, plant nutrients, and fertilizer; and whether it is easy or difficult to cultivate.

Structure refers to the arrangement of the soil particles in the natural aggregates found in the soil. Structure gives us clues to the ease or difficulty with which the soil is penetrated by plant roots and by moisture. The aggregates may have prismatic, columnar, blocky, platy, or granular structure. Important characteristics of structure are size, strength, and shape. Soils without definite structure are described as massive (structureless) if the material is coherent and as single grain (structureless) if it is not. Loose sand is a good example of single grain material.

Consistence, or the tendency of the soil to crumble or to stick together, indicates whether it is easy or difficult to keep the soil open and porous under cultivation.

Other characteristics observed in the course of the field study and considered in classifying the soil include the following: The depth of the soil over caliche or compact layers; the presence of gravel or stones in amounts that will interfere with cultivation; the steepness and pattern of slopes; the degree of erosion; the nature of the underlying parent material from which the soil has developed; and the acidity or alkalinity of the soil as measured by chemical tests.

On the basis of the characteristics observed by the soil surveyors or determined by laboratory tests, soils are classified into phases, types, and series. The soil type is the basic classification unit. A soil type may be divided into soil phases. Soil types that resemble each other in most of their characteristics are grouped into a soil series.

As an example of soil classification, consider the Ulysses series of Stanton County. This series is made up of one soil type and three phases as follows:

Series	Type	Phase
Ulysses	Ulysses silt loam	Ulysses silt loam, 0 to 1 percent slopes.
		Ulysses silt loam, 1 to 3 percent slopes.
		Ulysses silt loam, 3 to 5 percent slopes.

Miscellaneous land types are areas that have little true soil. They are not classified by types and series. Instead, they are identified by descriptive names, such as Broken land and Blown-out land.

Where two or more soils are so intricately associated in small areas that it is not feasible to show them separately on the soil map, they are mapped together and called a soil complex. Ulysses-Colby complex, 1 to 3 percent slopes, eroded, is a soil complex mapped in this county.

In the following pages, the soils and miscellaneous land types mapped in Stanton County are described in detail and their various suitabilities for agriculture are discussed. In the profile descriptions, the color of the soil in each horizon consists of the word description and the Munsell color notation. The Munsell notation is a refer-

ence to a specific color in the standard color charts used by soil scientists.

The individual soils, or mapping units, are identified by the same alphabetic symbols that are used to show their location and distribution on the soil map at the back of the report. Also, in the description of each mapping unit is a reference to the capability unit and range site to which it belongs. Technical terms used in the soil descriptions are defined in the Glossary at the back of the report.

The approximate acreage and proportionate extent of each mapping unit is given in table 1. The suitability

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

Soil	Area	Extent
	<i>Acres</i>	<i>Percent</i>
Bayard fine sandy loam.....	708	0.2
Blown-out land.....	391	.1
Bridgeport clay loam.....	9,963	2.3
Broken land.....	764	.2
Colby silt loam, 1 to 3 percent slopes.....	7,248	1.7
Colby silt loam, 3 to 5 percent slopes.....	1,856	.4
Colby silt loam, 5 to 15 percent slopes.....	3,133	.7
Dalhart fine sandy loam, 0 to 1 percent slopes.....	19,210	4.4
Dalhart fine sandy loam, 1 to 3 percent slopes.....	7,417	1.7
Goshen silt loam.....	3,515	.8
Lincoln soils.....	3,847	.9
Lofton clay loam.....	1,126	.3
Mansker clay loam, 0 to 3 percent slopes.....	1,558	.4
Mansker clay loam, 3 to 5 percent slopes.....	239	(¹)
Manter fine sandy loam, 0 to 1 percent slopes.....	2,427	.6
Manter fine sandy loam, 1 to 3 percent slopes.....	15,997	3.7
Manter fine sandy loam, 3 to 5 percent slopes.....	4,012	.9
Otero-Manter fine sandy loams, 1 to 5 percent slopes.....	1,430	.3
Richfield silt loam, 0 to 1 percent slopes.....	195,951	45.3
Tivoli loamy fine sand.....	1,980	.4
Travessilla soils.....	451	.1
Ulysses silt loam, 0 to 1 percent slopes.....	91,629	21.2
Ulysses silt loam, 1 to 3 percent slopes.....	49,508	11.4
Ulysses silt loam, 3 to 5 percent slopes.....	2,618	.6
Ulysses-Colby complex, 1 to 3 percent slopes, eroded.....	2,911	.7
Vona loamy fine sand, 5 to 15 percent slopes.....	2,440	.6
Intermittent water.....	311	.1
Total.....	432,640	100.0

¹ Less than 0.1 percent.

for use, management requirements, and estimated yields are discussed in the section "Use and Management of the Soils."

Bayard Fine Sandy Loam

Bayard fine sandy loam (Bc).—This is a well-drained, light-colored soil weakly developed in moderately sandy alluvial sediments. Most of it occurs along Bear Creek. It is not extensive.

The soil has a grayish-brown, light loam to sandy loam surface layer. Beneath this are stratified layers of loam, sandy loam, and light clay loam.

The Bayard soil has more sand throughout the profile than the associated Bridgeport clay loam. It is deeper and less stratified with sand and gravel than the Lincoln soils.

Representative profile (1,050 feet south and 530 feet east of the northwest corner of sec. 16, T. 27 S., R. 39 W.; in a cultivated, nearly level field) :

- A 0 to 14 inches, grayish-brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 3.5/2) when moist; weak, granular structure; very friable; calcareous; gradual boundary.
- C 14 to 48 inches, pale-brown (10YR 6/2.5), stratified loam and sandy loam with thin layers of clay loam at a depth of 40 inches; dark grayish brown (10YR 4/2) when moist; weak, granular structure to massive with some worm casts in upper part of layer; very friable when moist, slightly hard when dry; strongly calcareous; thin streaks and films of lime in the uppermost 6 inches; porous and permeable.

Variations in the profile are common. The thickness of the sandy loam to light loam surface layer ranges from 10 to 20 inches. The profile of this soil is generally calcareous throughout.

Much of this soil is cultivated with the surrounding soils. Wind erosion is a hazard and will occur whenever the soil is dry and not adequately protected. *Capability unit IVe-2 (dryland)*; *capability unit IIs-1 (irrigated)*; *Sandy range site*.

Blown-out Land

Blown-out land (Bo).—This miscellaneous land type is made up of severely eroded areas that resulted from extreme soil blowing (fig. 11). It occurs mainly within areas of the Manter, Otero-Manter, and Dalhart soils.

Blown-out land consists of the blowouts and the adjoining deposits of loamy fine sand and sand. The blowouts, or eroded areas, are now made up of light-colored, calcareous sandy loam to clay loam. The deposits on adjacent areas of uneroded soils range from 10 to 20 inches in thickness.

Vegetation is sparse over much of the area. The blowouts are barren, or nearly so, and the deposits contain annual weeds and grasses. Areas less than 10 acres in size are shown on the map by blowout symbols. Each symbol represents up to 5 acres.

This inextensive unit is not suited to crops. Areas that are cultivated are further eroded and are generally abandoned. For best land use, areas now being used for crops should be reseeded to suitable native grasses. *Capability unit VIe-2 (dryland)*; *Sandy range site*.



Figure 11.—Blown-out land—a miscellaneous land type that has resulted from extreme soil blowing.

Bridgeport Clay Loam

Bridgeport clay loam (8p).—This is a deep, well-drained, moderately dark, calcareous soil that is weakly developed in alluvium (stream-deposited material). It is nearly level and occurs mostly along Bear Creek, Little Bear Creek, and Sand Arroyo. It also occurs to some extent along the larger tributaries of these intermittent streams.

The alluvium from which this soil has developed consists of sediments from adjacent upland.

This soil has a grayish-brown, heavy loam to clay loam surface layer underlain by lighter colored but otherwise similar material. It is porous and permeable and has the capacity to hold a large amount of water that is available for plants.

The associated Goshen soil has a surface layer that is darker than that of Bridgeport clay loam and is non-calcareous. Bayard fine sandy loam has more sand throughout the profile than the Bridgeport soil.

Representative profile (530 feet east and 200 feet north of the quarter-section corner on the south side of sec. 5, T. 27 S., R. 40 W.; in a cultivated field with a slope of less than 1 percent):

- A₁ 0 to 15 inches, grayish-brown (10YR 4.5/2) clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; friable when moist, hard when dry; calcareous; gradual boundary.
- AC 15 to 25 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) when moist; weak, subangular blocky structure; friable when moist, hard when dry; a few worm casts; calcareous; gradual boundary.
- C 25 to 48 inches, pale-brown (10YR 6/3), light clay loam, brown (10YR 5/3) when moist; massive (structureless) but porous; very friable when moist, slightly hard when dry; strongly calcareous; an occasional small, soft lime concretion.

Variations in the profile are not common. In a few places the subsoil is stratified with layers of fine sandy loam below a depth of 30 inches.

Included within areas of Bridgeport clay loam are small areas of the associated Goshen and Bayard soils.

Most of this soil is cultivated and is well suited to crops. Dryland wheat and sorghum produce satisfactory yields in most years if grown on summer-fallowed land. Some areas are cultivated under irrigation and produce wheat, sorghum, alfalfa, and sugar beets. Wind erosion will occur on this soil if the surface is dry and not protected by growing plants, their residue, or sufficient cloddiness. *Capability unit IIIc-1 (dryland); capability unit I-1 (irrigated); Loamy Upland range site.*

Broken Land

Broken land (Bx).—This is a nonarable miscellaneous land type that occurs within areas of alluvial soils. The areas of Broken land are generally 150 feet or more in width and consist of an entrenched channel and its banks. The soil material is medium textured to moderately fine textured and shows little or no profile development. In some places, lime has been leached to a depth of a few inches.

Broken land occurs in association with the Goshen and Bridgeport soils. It is not suited to cultivation and has

very little value for grazing. *Capability unit VIIw-1 (dryland).*

Colby Series

The Colby soils are light-colored, friable, and silty. They are on the more sloping parts of Stanton County. These inextensive soils are weakly developed in calcareous loess (wind-deposited material) or similar silty sediments of the High Plains.

Colby soils have a grayish-brown, calcareous, friable silt loam surface layer ranging from 4 to 12 inches in depth. This layer is only slightly darker than the underlying parent loess. The soil is so young that a clayey subsoil, or B horizon, has not had time to develop. Free lime occurs throughout the soil profile.

The associated Ulysses and Richfield soils have darker and deeper surface layers than Colby soils. The associated Travessilla soils are shallower and overlie rock fragments or gravel. Mansker soils contain more clay throughout the profile and are not so deep as the Colby soils.

Colby silt loam, 1 to 3 percent slopes (Cb).—Most of Colby silt loam, 1 to 3 percent slopes, is on sloping areas adjacent to drainageways.

Representative profile (528 feet south of the center of sec. 7, T. 27 S., R. 39 W.; in a cultivated field with a 2 percent slope, about 15 miles northeast of Johnson):

- A_{1b} 0 to 4 inches, grayish-brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; friable when moist, slightly hard when dry; calcareous; clear boundary.
- AC 4 to 11 inches, grayish-brown (10YR 5.5/2) silt loam, dark grayish brown (10YR 4.5/2) when moist; mixing of material from horizons above and below has resulted in somewhat lighter colors than those in the above horizon; moderate, medium, granular structure with numerous worm casts; very friable when moist, slightly hard when dry; strongly calcareous; faint films of lime on peds; gradual boundary.
- AC_{ca} 11 to 20 inches, pale-brown (10YR 6/3), heavy silt loam, brown (10YR 5/3) when moist; weak, medium, subangular blocky structure; very friable when moist, soft to slightly hard when dry; strongly calcareous; numerous small, soft lime concretions; gradual boundary.
- C 20 to 40 inches, pale-brown (10YR 6.5/3) silt loam, brown (10YR 5/3) when moist; massive; very friable when moist, soft when dry; contains an occasional round piece of gravel and occasional small chips of hard caliche; strongly calcareous; a few small, soft lime concretions in upper part of horizon.

Variations in the profile are not common. Under native grass the soil may have a noncalcareous, somewhat darker surface layer, less than 6 inches thick.

Small local areas of Ulysses silt loam are included with this soil.

Most of Colby silt loam, 1 to 3 percent slopes, is under cultivation. Because of the degree of slope, runoff is rapid. Water erosion is a serious hazard unless the soil is protected by vegetation and by mechanical measures. Wind erosion can occur any time the soil is not protected by growing vegetation or its residue. *Capability unit IVe-1 (dryland); capability unit IIe-1 (irrigated); Loamy Upland range site.*

Colby silt loam, 3 to 5 percent slopes (Cc).—This soil has a profile similar to the one described for Colby silt loam, 1 to 3 percent slopes, but the darkened surface layer is 3 to 5 inches thick. Much of the soil is under cultivation but is not well suited to crops. Runoff is high because of the steep slopes and the slicking over of the surface soil during rainstorms. As a result, there is a considerable loss of soil and damage to crops that do not have well-established root systems. Wind erosion is also a serious hazard to both the soil and young plants. *Capability unit VIe-1 (dryland); Loamy Upland range site.*

Colby silt loam, 5 to 15 percent slopes (Cd).—Except for stronger slopes, this soil is similar to Colby silt loam, 3 to 5 percent slopes. It is inextensive and occurs in the nonarable steeper parts of erosional valleys along drainageways and stream channels.

Included with this soil are small areas of sandy and moderately sandy soils similar to the Vona and Otero soils and small areas of Travessilla soils.

Nearly all of Colby silt loam, 5 to 15 percent slopes, is under native short grass and is used as rangeland. A few small areas are parts of cultivated fields. However, most of these areas have been abandoned because of wind and water erosion. Those still being cultivated should be retired from cropland and seeded to suitable native grass. *Capability unit VIe-1 (dryland); Loamy Upland range site.*

Dalhart Series

The Dalhart soils are deep, dark, noncalcareous, and friable. They are on nearly level to gently sloping sandy areas of Stanton County. These soils have formed on moderately sandy to moderately fine textured plains sediments that have been reworked to some extent by the wind.

The surface layer, or A horizon, is fine sandy loam that ranges from 4 to 9 inches in thickness. Beneath this is a brown sandy clay loam to clay loam layer that grades to lighter colored, calcareous, heavy sandy loam or loam.

The Dalhart soils have more clay in the subsoil than the associated Manter soils. They have more sand throughout the profile than the Richfield and Ulysses soils. They are noncalcareous to greater depths and have more pronounced development in the B horizon than the associated Ulysses soils.

Dalhart fine sandy loam, 0 to 1 percent slopes (Da).—This is the most extensive of the Dalhart soils. It normally occupies broad, smooth areas that are nearly level.

Representative profile (500 feet west and 150 feet south of the quarter-section corner on the north side of sec. 29, T. 29 S., R. 39 W.; in a cultivated field with a slope of less than 1 percent):

- A_{1p} 0 to 4 inches, dark grayish-brown (10YR 4.5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; loose and structureless; friable, noncalcareous; abrupt boundary.
- A₁ 4 to 7 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; friable when moist, slightly hard when dry; noncalcareous; gradual boundary.
- B₂₁ 7 to 15 inches, dark grayish-brown (10YR 4/2), light sandy clay loam, dark brown (10YR 3/2.5) when

moist; moderate, medium, granular structure; a few worm casts; friable when moist, hard when dry; noncalcareous; gradual boundary.

- B₂₂ 15 to 24 inches, brown (10YR 5/3) sandy clay loam, dark brown (10YR 3/3) when moist; weak, medium, sub-angular blocky structure; friable when moist, hard when dry; a few worm casts; noncalcareous; gradual boundary.

- B_{2c} 24 to 35 inches, brown (10YR 5.5/3), light sandy clay loam, dark brown (10YR 4/3) when moist; moderate, medium, granular structure; friable when moist, slightly hard when dry; calcareous; few small lime concretions at a depth of 30 inches; gradual boundary.

- C 35 to 48 inches, pale-brown (10YR 6/3) loam, brown (10YR 4.5/3) when moist; massive (structureless); friable; calcareous.

This soil is fairly uniform over much of its area. As a result of winnowing by wind, some cultivated areas have a surface cover of loamy fine sand that is up to 4 inches thick. Depth to calcareous material ranges from 10 to 30 inches. The texture of the B horizon ranges from sandy clay loam to heavy sandy loam.

Small areas of Manter soils have been included with this mapping unit.

Most of Dalhart fine sandy loam, 0 to 1 percent slopes, is under cultivation. Sorghum, wheat, and broomcorn are grown. Soil blowing is a serious hazard, particularly when the soil is being summer-fallowed without adequate protective cover. Crop residues carefully maintained on the soil will control or minimize wind erosion. *Capability unit IIIe-2 (dryland); capability unit I-2 (irrigated); Sandy range site.*

Dalhart fine sandy loam, 1 to 3 percent slopes (Db).—This gently sloping soil has a profile similar to that described for Dalhart fine sandy loam, 0 to 1 percent slopes. The surface soil is not quite so thick, ranging from 4 to 7 inches. Depth to calcareous material is also somewhat less; it ranges from 9 to 16 inches.

Most of Dalhart fine sandy loam, 1 to 3 percent slopes, is under cultivation. Soil blowing is a serious hazard and will occur whenever the land is not protected by adequate cover. Water erosion is also a problem on this soil. Crop residues on the surface of the soil will conserve moisture and help control both wind and water-erosion. *Capability unit IIIe-3 (dryland); capability unit IIe-2 (irrigated); Sandy range site.*

Goshen Silt Loam

Goshen silt loam (Go).—This deep, dark-colored, friable, nearly level soil occurs in swales and along narrow intermittent drainageways. It has developed in silty material washed from the soils on higher slopes nearby. The dominant slope gradient is less than 1 percent but is sufficient for good surface drainage. The soil is porous and permeable, absorbs water readily, and has good internal drainage.

Goshen silt loam is associated with the Colby, Ulysses, and Richfield soils. Its surface soil is thicker and darker than those of normal soils of the upland in the county. The dark color may occur at depths ranging from 10 to 36 inches.

Representative profile (530 feet north and 800 feet west of the southeast corner of sec. 3, T. 27 S., R. 40 W.; in a cultivated field of less than 1 percent slope):

- A₁ 0 to 14 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, granular structure; friable when moist, slightly hard when dry; easily penetrated by plant roots, air, and water; non-calcareous; clear boundary.
- B₂ 14 to 24 inches, very dark grayish-brown (10YR 3.5/2), light clay loam, very dark brown (10YR 2.5/2) when moist; moderate, fine, subangular blocky structure; friable when moist, hard when dry; a few worm casts; noncalcareous; clear boundary.
- B_{3ca} 24 to 30 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3.5/2) when moist; moderate, medium, granular structure; friable when moist, slightly hard when dry; calcareous; gradual boundary.
- C 30 to 50 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 5/3) when moist; structureless; friable when moist, slightly hard when dry; porous and permeable; calcareous; numerous small, soft lime concretions at a depth of about 40 inches.

The texture of the surface soil may range from silt loam to a heavy loam where the adjoining slopes are loamy or sandy. The subsoil and substratum range from heavy silt loam to clay loam; the finer textured material occurs in the broader swales. Depth to calcareous material varies, but it usually is more than 15 inches. Remnants of buried soils commonly occur below a depth of 30 inches.

Most of this soil is cultivated with other soils. Although not extensive, it is important for crops because of its high natural productivity. Crops generally benefit from the extra moisture gained as runoff from adjacent areas, and yields are higher than on most other cultivated soils. Water erosion is negligible, but wind erosion will occur whenever the soil is barren of vegetation or its residue. *Capability unit IIIc-2 (dryland)*; *capability unit I-1 (irrigated)*; *Lowland range site*.

Lincoln Soils

Lincoln soils (lf).—These soils consist of slightly altered very sandy and gravelly alluvium. They occur mostly adjacent to and in the stream channels of parts of Bear Creek and Sand Arroyo. The soils are flooded periodically and receive fresh deposits.

The surface layer is grayish brown and averages about 3 to 12 inches in thickness. It is mostly calcareous loam to fine sandy loam in texture and is underlain by a very sandy subsoil.

Lincoln soils are more sandy, more stratified, and considerably shallower than the associated Bayard soil.

Representative profile (NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 11, T. 28 S., R. 41 W.):

- A₁ 0 to 3 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; loose and structureless; calcareous; abrupt boundary.
- C₁ 3 to 7 inches, very pale brown (10YR 7/3) loamy fine sand, brown (10YR 5/3) when moist; loose and structureless; calcareous; abrupt boundary.
- C₂ 7 to 10 inches, grayish-brown (10YR 5/2) loam or sandy loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; very friable when moist, soft when dry; weakly calcareous; abrupt boundary.

- C₃ 10 to 18 inches, pale-brown (10YR 6/3), loamy sand stratified with thin layers of sandy loam; brown (10YR 5/3) when moist; structureless; loose; calcareous.
- C₄ 18 to 40 inches, pale-brown (10YR 6/3), loose sand and loamy sand stratified with thin layers of loam; brown (10YR 5/3) when moist.

The profile of Lincoln soils is quite variable. Layers of mixed sand and gravel, as well as layers of loam and clay loam, may occur throughout the profile.

Small areas of Bayard and Tivoli soils are included with this mapping unit in places.

Lincoln soils are unsuitable for crops and are used mainly for native grass pasture. They support a sparse growth of vegetation, mostly sand sagebrush, yucca, and annual weeds and grasses. *Capability unit VIIw-1 (dryland)*.

Lofton Clay Loam

Lofton clay loam (lo).—This deep, dark, heavy soil generally occupies the small upland depressions that locally are called potholes. These enclosed depressions have no surface drainage. Water may stay in them for several days to a week or more before it drains into the soil and evaporates.

The enclosed basins normally occur on the High Plains and in swales at the heads of drainageways where definable drainage patterns are becoming established.

Lofton clay loam is inextensive in Stanton County. It is associated mainly with broad, nearly level areas of Richfield and Ulysses soils. It has darker, more clayey surface soil and subsoil than the Richfield and Ulysses soils.

Representative profile (500 feet south and 200 feet east of the center of sec. 34, T. 29 S., R. 41 W.; in a cultivated field):

- A₁₁ 0 to 6 inches, grayish-brown (10YR 5/2), light clay loam, very dark grayish brown (10YR 3/2) when moist; weak, granular structure; friable when moist; weakly calcareous; this layer is an overburden derived from surrounding cultivated slopes; abrupt boundary.
- A₁₂ 6 to 10 inches, dark-gray (10YR 4.5/1) clay loam, very dark gray (10YR 3/1) when moist; moderate, fine, granular structure; friable when moist, slightly hard when dry; noncalcareous; clear boundary.
- B₂₁ 10 to 20 inches, gray (10YR 5/1) clay loam, very dark gray (10YR 3/1) when moist; weak, subangular blocky and fine, blocky structure; firm when moist, very hard when dry; a few worm casts; non-calcareous; gradual boundary.
- B₂₂ 20 to 35 inches, light brownish-gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, subangular blocky structure; friable when moist, slightly hard when dry; calcareous; gradual boundary.
- C 35 to 46 inches, pale-brown (10YR 6/3) silty clay loam, brown (10YR 5/3) when moist; weak, medium, subangular blocky structure to massive; friable when moist, slightly hard when dry; calcareous.

The soil profile varies somewhat in characteristics from one depression to another, depending on the size of the depression and the extent of its drainage area. The texture of the surface horizon ranges from silty clay loam to light clay. A few disturbed areas of Lofton clay loam may have 3 to 6 inches of loamy material that has been recently deposited on the surface. Depth to calcareous

material ranges from 18 to 40 inches; 25 inches is about average.

Most of the areas of Lofton clay loam are cultivated with the surrounding areas. Water is ponded long enough at times to delay planting or harvesting. Crops are frequently drowned out and are either replanted or lost. Wind erosion is a hazard unless sufficient crop residues are left on the surface to protect the soil. *Capability unit IVw-1 (dryland); Loamy Upland range site.*

Mansker Series

The Mansker soils in Stanton County are moderately dark and calcareous. They occur inextensively in the western half of the county; the larger areas are north of Sand Arroyo.

The surface soil averages 6 to 9 inches in thickness. Beneath this is a strongly calcareous, light-colored layer that grades into a prominent lime zone at depths ranging from 12 to 20 inches. Mansker soils generally overlie hard or soft caliche. The depth to caliche is generally less than 30 inches.

The Mansker soils differ from the associated Ulysses and Colby soils as follows: They have more clay throughout the profile, and they contain a prominent layer of lime. Richfield silt loams are noncalcareous and are more developed than the Mansker soils.

Mansker clay loam, 0 to 3 percent slopes (Mb).—This nearly level to gently sloping soil is the most extensive of the Mansker soils.

Representative profile (1,580 feet east and 1,060 feet north of the southwest corner of sec. 15, T. 30 S., R. 43 W.; in native pasture on a slope of about 2 percent):

- A₁ 0 to 6 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 3.5/2) when moist; moderate, medium, granular structure; friable when moist, slightly hard when dry; calcareous; gradual boundary.
- AC 6 to 16 inches, light brownish-gray (10YR 6/2) clay loam, brown (10YR 4.5/3) when moist; moderate, medium, granular and weak, fine, subangular blocky structure; numerous worm-cast granules; friable when moist, slightly hard when dry; occasional small limestone fragments and nodules; strongly calcareous; gradual boundary.
- C_{ca} 16 to 25 inches, very pale brown (10YR 7/2.5) clay loam, pale brown (10YR 6/3) when moist; weak, medium, subangular blocky structure; very friable when moist; slightly hard when dry; strongly calcareous; over 30 percent segregated lime occurs as concretions and fine powder; occasional small, hard limestone fragments and nodules; abrupt boundary.
- (?) 25 to 30 inches, light-colored, partly weathered, hard caliche.

Variations in the profile are not common. Normally, the clay loam texture is fairly uniform throughout the profile. The underlying caliche is absent in some nearly level areas.

Included with Mansker clay loam, 0 to 3 percent slopes, are small areas of Ulysses and Colby soils.

Most of Mansker clay loam, 0 to 3 percent slopes, is in native grass and is used for grazing. Some small areas are used for wheat and sorghum. Because of the high lime content, the subsoil is not conducive to good root development. This soil is subject to wind erosion when not protected by growing vegetation or its residue. On the more sloping areas, runoff is high because of the gradi-

ent and the sealing and slicking over of the surface soil during rainstorms. *Capability unit IVe-1 (dryland); Loamy Upland range site.*

Mansker clay loam, 3 to 5 percent slopes (Mc).—This soil is similar to Mansker clay loam, 0 to 3 percent slopes. However, the average depth to the prominent lime horizon and the thickness of the surface soil are less. In a few places the caliche layer may be exposed at the surface.

Most of the soil is in native grass. It is not well suited to cultivation because of steep slopes and the hard caliche near the surface. Areas still being cultivated should be retired from cropland and seeded to suitable native grass. *Capability unit VIe-1 (dryland); Loamy Upland range site.*

Manter Series

The Manter soils in Stanton County are deep, well drained, and moderately dark colored. The upper part of the profile is noncalcareous. These soils occur throughout the county and are the most extensive of the sandy soils. They are on nearly level to moderately sloping or gently undulating topography. They have developed in plains outwash deposits that are moderately sandy and that have been partially reworked by the wind.

Manter soils differ from the Richfield, Ulysses, and Dalhart soils mainly in having more sand throughout the profile. They are noncalcareous to greater depths than the Richfield and Ulysses soils; their depth to calcareous material ranges from 10 to 24 inches. Manter soils are darker, better developed, less sandy, and on smoother topography than the Tivoli soils.

Manter fine sandy loam, 1 to 3 percent slopes (Mh).—This is the most extensive of the Manter soils. The profile of this soil is weakly developed.

Representative profile (100 feet west and 125 feet south of the northeast corner of sec. 34, T. 29 S., R. 41 W.; in a cultivated field on a slope of about 2 percent):

- A_{1p} 0 to 4 inches, dark grayish-brown (10YR 4.5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; loose and disturbed; friable; noncalcareous; abrupt boundary.
- A₁ 4 to 17 inches, dark grayish-brown (10YR 4/2), heavy sandy loam, dark brown (10YR 3/2.5) when moist; moderate, medium, granular structure; many worm casts; friable when moist, slightly hard when dry; noncalcareous; gradual boundary.
- AC 17 to 30 inches, brown (10YR 5/3), heavy sandy loam, dark brown (10YR 3.5/3) when moist; weak, medium, granular structure; many worm casts; friable when moist; hard when dry; calcareous; gradual boundary.
- C₁ 30 to 40 inches, pale-brown (10YR 6/3) sandy loam, brown (10YR 5/3) when moist; structureless; friable when moist, soft when dry; calcareous; gradual boundary.
- C₂ 40 to 50 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) when moist; massive; friable; calcareous.

Significant variations in the profile are not common. From 2 to 4 inches of loamy sand commonly occur on the surface in cultivated fields as a result of winnowing by the wind. The thickness of the dark-colored surface layer ranges from about 8 to 20 inches. The texture of the subsoil may range from sandy loam to light sandy clay loam and loam. Remnants of buried soils and unconforming,



Figure 12.—Lack of protective cover resulted in the loss of wheat on this field of Manter fine sandy loam, 1 to 3 percent slopes.

light-colored silty sediments commonly occur at depths below 18 inches.

Small areas of Dalhart soils are included with this soil. It was not practical or desirable to map these areas separately.

Most of Manter fine sandy loam, 1 to 3 percent slopes, is under cultivation. Soil blowing is a serious hazard, particularly when the soil is summer-fallowed without adequate protective cover (fig. 12). Water erosion also is a hazard on this soil. Maintaining crop residues on the surface of the soil will conserve moisture and help control both wind and water erosion. *Capability unit IIIe-3 (dryland); capability unit IIe-2 (irrigated); Sandy range site.*

Manter fine sandy loam, 0 to 1 percent slopes (Mf).—This nearly level soil is similar to Manter fine sandy loam, 1 to 3 percent slopes. It has a somewhat thicker surface layer, however, and has more clay in the subsoil. Soil blowing is a serious hazard and will occur on areas not protected by adequate cover. *Capability unit IIIe-2 (dryland); capability unit IIs-1 (irrigated); Sandy range site.*

Manter fine sandy loam, 3 to 5 percent slopes (Mk).—This soil is on stronger slopes and in some places has a thinner surface layer than Manter fine sandy loam, 1 to 3 percent slopes. Also, it contains an occasional eroded spot or small blowout. Otherwise, the two soils are similar.

Much of the soil is under cultivation. It is not well suited to crops but may be safely cultivated if wind and water erosion are controlled by careful management. *Capability unit IVe-2 (dryland); Sandy range site.*

Otero-Manter Fine Sandy Loams

Otero-Manter fine sandy loams, 1 to 5 percent slopes (Ox).—This mapping unit is a complex, or mixture, of soils. It consists primarily of Otero fine sandy loam and Manter fine sandy loam. The soils are so closely associated that it is not practical to map them separately. This complex is inextensive and comprises areas of moderately sandy land on billowy topography with side slopes of 1 to 5 percent.

Otero fine sandy loam makes up about 60 percent of the area of this complex and Manter fine sandy loam about 40 percent. The profile of the Manter soil is similar to the profile described for Manter fine sandy loam, 1 to 3 percent slopes.

Otero fine sandy loam is a deep, light-colored, calcareous soil with a fine sandy loam surface soil and sandy loam to sandy clay loam subsoil. It is lighter colored than the associated Manter soil and is calcareous at or near the surface. It is more sandy and has considerably less development than the Dalhart soils. The Otero soil is readily penetrated by plant roots, air, and water. It is subject to wind erosion if the surface soil is not adequately protected.

Representative profile of Otero fine sandy loam (1,600 feet east and 100 feet north of the southwest corner of sec. 16, T. 27 S., R. 40 W.; in a cultivated field):

- A_{1p} 0 to 4 inches, grayish-brown (10YR 5/2), light fine sandy loam, dark grayish brown (10YR 4/2) when moist; structureless; soft; weakly calcareous; abrupt boundary.
- A₁ 4 to 10 inches, grayish-brown (10YR 4.7/2) fine sandy loam, dark grayish brown (10YR 3.5/2) when moist; weak, fine, granular structure to massive; friable when moist, slightly hard when dry; weakly calcareous; clear boundary.
- C_{ca1} 10 to 30 inches, pale-brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) when moist; massive; porous with moderately numerous worm casts; very friable when moist, soft when dry; strongly calcareous; faint films and streaks of lime; abrupt boundary.
- C_{ca2} 30 to 50 inches, very pale brown (10YR 7/3) clay loam, brown (10YR 5/3) when moist; massive; friable when moist, hard when dry; strongly calcareous; occasional small, soft to hard lime concretions.

Variations are common in the profile of Otero fine sandy loam. In many cultivated areas, the uppermost 2 to 4 inches are loamy fine sand. This is the result of winnowing by the wind; the finer particles have been sorted out and blown away, and the surface layer is now more sandy than originally. In some areas under native grass, the surface soil is somewhat darker than elsewhere and is free of lime to a depth of about 6 inches. Otero fine sandy loam, in Stanton County, generally rests unconformably on highly calcareous clay loam or silty clay loam at depths of from 2 to 4 feet. Small blowouts, generally



Figure 13.—Residue of sudangrass provides good protection against wind erosion on Otero-Manter fine sandy loams, 1 to 5 percent slopes.

less than 1 acre in size, are also present. Included within areas of Otero-Manter fine sandy loams, 1 to 5 percent slopes, are insignificant areas of Dalhart fine sandy loam.

This complex of soils is suitable for limited crop production. The danger of wind erosion is great. Active wind erosion on this soil is a menace to adjacent soils. The soil can be cultivated safely, however, if carefully managed to control blowing (fig. 13). *Capability unit IVe-2 (dryland); Sandy range site.*

Richfield Silt Loam

Richfield silt loam, 0 to 1 percent slopes (Rm).—This soil occurs on broad, nearly level areas and is the most extensive soil in Stanton County. It is deep, dark, and well drained and has developed in medium to moderately fine textured loess (wind-deposited material).

Richfield silt loam, 0 to 1 percent slopes, has a darker surface layer, a more developed subsoil, and greater depth to calcareous material than the associated Ulysses soils. Depth to the light-colored calcareous material ranges from about 8 to 18 inches. This soil has less sand throughout the profile than the Dalhart soils.

Representative profile (300 feet east and 100 feet south of the northwest corner of sec. 32, T. 28 S., R. 39 W.; in a cultivated field of less than 1 percent slope):

- A_p 0 to 5 inches, dark grayish-brown (10YR 4.5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure to massive; friable when moist, slightly hard when dry; noncalcareous; gradual boundary.
- B₂₁ 5 to 10 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, prismatic structure that breaks to fine to moderate, medium, subangular blocky; friable when moist, slightly hard when dry; clay films continuous but very thin over structural aggregates; noncalcareous; clear boundary.
- B₂₂ 10 to 15 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; soil material is somewhat finer textured (about 35 or 36 percent clay) than that in horizon above; moderate, medium, prismatic structure that breaks to moderate, medium, subangular blocky; firm when moist, very hard when dry; clay films over structural aggregates continuous and pronounced, but not all rootlet channels and pores are filled; noncalcareous; gradual boundary.
- B_{2b} 15 to 24 inches, grayish-brown (10YR 5/1.5) silty clay loam, very dark gray (10YR 3/1.5) when moist; this is a buried layer; moderate, medium, subangular blocky structure; friable when moist, hard when dry; calcareous in upper part and strongly calcareous in lower part; numerous small, soft lime concretions; clear boundary.
- B_{ca} 24 to 34 inches, pale-brown (10YR 6/3) silty clay loam, dark brown (10YR 4/3) when moist; weak to moderate, medium, subangular blocky structure; friable when moist, slightly hard when dry; strongly calcareous; an occasional small, soft lime concretion; gradual boundary.
- C 34 to 48 inches, pale-brown (10YR 6/3), light silty clay loam or silt loam, brown (10YR 5/3) when moist; structureless; very friable when moist, soft when dry; strongly calcareous; this horizon consists of loess parent material.

Variations in the profile are uncommon but occur in some places. When moist, the A and B horizons range from very dark grayish-brown (10YR 3/2) to dark brown (10YR 3/3). In some places darkened layers, which are



Figure 14.—Irrigated wheat on Richfield silt loam, 0 to 1 percent slopes.

remnants of buried soils, occur 24 to 48 inches or more below the surface. Although not unusual, these buried soils are not typical of this mapping unit. The layers of buried soils are not related to the present soil nor to any features of the present landscape.

Small areas of Ulysses silt loams and Dalhart fine sandy loams have been included with this mapping unit. It was impractical to map these areas separately.

Richfield silt loam, 0 to 1 percent slopes, is well suited to crops, and most of it is under cultivation. Dryland wheat and sorghum produce satisfactory yields in most years if grown on summer-fallowed land. Some areas are cultivated under irrigation (fig. 14) and produce alfalfa, sugar beets, vegetables, wheat, and sorghum. Wind erosion will occur on this soil if the surface is dry and not protected by growing plants or their residue, or by sufficient cloddiness. *Capability unit IIIc-1 (dryland); capability unit I-1 (irrigated); Loamy Upland range site.*

Tivoli Loamy Fine Sand

Tivoli loamy fine sand (Ts).—This soil is light colored, noncalcareous, and weakly developed. It has formed in deep, wind-deposited sand. It is inextensive and occurs mostly along Bear Creek and Sand Arroyo. The topography is undulating to hummocky. Most slopes are from 5 to 15 percent, but a few are less than 5 percent.

Tivoli loamy fine sand has a thin, grayish-brown surface layer that is only slightly darker than the fine sand beneath. It absorbs water rapidly and has little or no runoff. It has a low capacity to hold available moisture.

The Tivoli soil has more sand throughout the profile than the associated Manter soils. Manter soils are darker colored and occupy smoother topography than the Tivoli soil.

Representative profile (990 feet west and 1,520 feet north of the quarter section corner on the south side of sec. 11, T. 28 S., R. 41 W.; in a native pasture):

- A_{1p} 0 to 2 inches, grayish-brown (10YR 5/2), light loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, platy structure; friable; weakly calcareous; this layer is a recent deposition; gradual boundary.

- A₁ 2 to 8 inches, grayish-brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) when moist; very weak, granular structure; very friable when moist, soft when dry; noncalcareous; clear boundary.
- AC 8 to 20 inches, pale-brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) when moist; structureless; soft when dry, very friable when moist; noncalcareous; gradual boundary.
- C 20 to 40 inches, very pale brown (10YR 7/3) fine sand, brown (10YR 5/3) when moist; structureless; weakly calcareous at a depth of 36 inches.

Significant variations in the profile are not common. The depth of the darkened surface layer ranges from 6 to 11 inches. Recent deposition has added finer textured sediments, and in some places the uppermost 2 to 4 inches are sandy loam or loam in texture. Depth to calcareous material is generally more than 30 inches.

Included with this mapping unit are small areas of Manter soils. It would be difficult and impractical to map these areas separately.

Tivoli loamy fine sand is unsuitable for crops. Although most of it remains in native grass range, a few areas have been broken out and cultivated. Since soil blowing cannot be controlled under cultivation, these areas should be reseeded to suitable native grass. Important range management practices that will protect and improve the grass cover are (1) proper grazing, (2) the stabilizing of blow-outs, and (3) in some places the reseeded of suitable native grasses. Soil blowing will occur where vegetation does not provide adequate protection against the wind. *Capability unit VIe-2 (dryland); Sands range site.*

Travessilla Soils

Travessilla soils (Ty).—These soils occur on steep slopes and broken topography adjoining larger stream channels in the western part of Stanton County. Geologic erosion has stripped away the mantle of silty and loamy sediments that normally occur on the High Plains and has exposed the underlying sandstone (fig. 15). The shallow, stony Travessilla soils have developed as these materials slowly weathered.

These soils have a thin, grayish-brown loam or fine sandy loam surface layer over sandstone. Barren, unweathered stony outcrops of the underlying material are common.



Figure 15.—Outcrop of Cockrum sandstone from which Travessilla soils have formed.

These inextensive soils occupy steeper and more broken slopes than the associated but unrelated Colby and Mansker soils. Sandstone or shale underlies the Travessilla soils but not the Colby or Mansker soils.

Representative profile (¼ mile north and 690 feet east of the southwest corner of sec. 11, T. 29 S., R. 43 W.):

- A 0 to 6 inches, grayish-brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 3.5/2) when moist; weak, medium, platy structure in uppermost 3 inches but fine, granular below; friable when moist, soft when dry; noncalcareous; abrupt boundary.
- C 6 inches +, noncalcareous sandstone (Cockrum sandstone of the Dakota formation).

Variations in the profile are common. The thickness of the surface layer over sandstone ranges from 3 to 10 inches. The soil may be weakly calcareous in some places. Within some areas of this mapping unit are small areas of Mansker soils and a shallow, weakly developed soil over gravel or shale.

The Travessilla soils are inextensive, nonarable, and valuable only for grazing. They support sparse stands of native grass, chiefly side-oats grama, blue grama, and little bluestem. *Capability unit VIIs-1 (dryland); Rough Breaks range site.*

Ulysses Series

Ulysses soils are deep, moderately dark, and well drained. These soils of the upland are on nearly level to gently sloping topography. They are weakly developed in loess or loess mixed with plains sediments that are more or less silty.

The Ulysses soils have a less clayey and more friable subsoil than the associated Richfield soils. They are thicker and darker than the associated Colby soils. The thickness of the dark-colored layer in the Ulysses soils ranges from 6 to about 14 inches. This layer is less sandy than that of the associated Dalhart soils.

Ulysses silt loam, 0 to 1 percent slopes (Uc).—This is the most extensive of the Ulysses soils. Most of it occurs on slopes of slightly less than 1 percent.

Representative profile (1,060 feet east and 400 feet south of the center of sec. 26, T. 27 S., R. 39 W.; in a cultivated field):

- A_{1p} 0 to 4 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) when moist; very fine, granular structure; friable when moist, slightly hard when dry; weakly calcareous; gradual boundary.
- A₁ 4 to 8 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, granular structure; friable when moist, slightly hard when dry; weakly calcareous; clear boundary.
- AC 8 to 12 inches, grayish-brown (10YR 5/2), heavy silt loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, granular structure with a few fine to medium, subangular blocks; friable when moist, slightly hard when dry; a few thin clay films; worm casts abundant; living organisms have caused some mixing of colors with the horizons above and below; calcareous; clear boundary.
- C_{ca} 12 to 16 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 5/3) when moist; massive (structureless); friable when moist, soft when dry; a few soft, small lime concretions; strongly calcareous; gradual boundary.

- C 16 to 49 inches, very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) when moist; massive (structureless); friable when moist, soft when dry; calcareous.

Variations within the profile of this soil are uncommon. Under native vegetation, depth to calcareous material ranges from 6 to 15 inches. Cultivated areas may be calcareous to the surface. A weak B horizon occurs in places. Remnants of buried soils are common at depths below 18 inches.

Small areas of the associated Colby and Richfield soils have been included within areas of this soil.

Nearly all of this soil is under cultivation. Wheat and sorghum, seeded on areas that have been summer-fallowed, yield satisfactorily in most years. Wind erosion will occur if the surface is dry and not protected by growing vegetation, its residue, or sufficient cloddiness. *Capability unit IIIe-1 (dryland)*; *capability unit I-1 (irrigated)*; *Loamy Upland range site*.

Ulysses silt loam, 1 to 3 percent slopes (Ub).—This soil is similar to Ulysses silt loams, 0 to 1 percent slopes. Its average depth to calcareous material is slightly less, however, and a higher percentage of cultivated areas is calcareous at the surface. The texture of the top 2 to 4 inches is loam in many cultivated fields. This is the result of winnowing by the wind; the finer soil particles have been sorted and blown away, and the coarser, sandier particles were left on the field.

Much of this soil is now used for wheat and sorghum. Wind and water erosion and the conservation of moisture are problems on cultivated areas of this soil. *Capability unit IIIe-1 (dryland)*; *capability unit IIe-1 (irrigated)*; *Loamy Upland range site*.

Ulysses silt loam, 3 to 5 percent slopes (Uc).—This soil is similar to Ulysses silt loam, 1 to 3 percent slopes. Because of the stronger slopes, runoff is great and the loss of soil by water erosion is a serious hazard unless the soil is protected by vegetation and by mechanical measures. Wind erosion is a hazard any time the soil is not protected by growing vegetation or by its residue. *Capability unit IVe-1 (dryland)*; *Loamy Upland range site*.

Ulysses-Colby Complex

Ulysses-Colby complex, 1 to 3 percent slopes, eroded (Ue).—This mapping unit is a complex, or mixture, of soils that consists primarily of Ulysses silt loam and Colby silt loam. The soil pattern within the complex is so variable and intermixed that it is not practical to map these soils separately. This soil complex is relatively inextensive. The soils are gently sloping to gently undulating.

The Ulysses-Colby complex, 1 to 3 percent slopes, eroded, occurs in association with Richfield soil and other Ulysses soils. It is composed, on the average, of about 65 percent Ulysses soils, 25 percent Colby soils, and 10 percent Otero fine sandy loam. Much of the Colby soil was Ulysses soil before it was thinned by erosion. The Ulysses, Colby, and Otero soils are described elsewhere in this section.

Variations from the normal profiles of these soils are common. The texture of the uppermost 2 to 4 inches of soil is loam or sandy loam in many cultivated fields. This is the result of winnowing by the wind; the finer soil particles have been sorted out and blown away, and the

coarser, sandier particles have been left. Commonly, the profile is intermediate in characteristics between those of the Colby and Otero soils. There are a few small blow-outs and eroded spots in the Otero soil.

Included within this complex are small areas of Vona soil.

Much of the acreage of this complex is used for dryland wheat and sorghum. The soils are not well suited to crops, but they may be safely cultivated if carefully managed to control wind and water erosion. *Capability unit IVe-1 (dryland)*; *capability unit IIe-1 (irrigated)*; *Loamy Upland range site*.

Vona Loamy Fine Sand

Vona loamy fine sand, 5 to 15 percent slopes (Vo).—This deep, light-colored, well-drained soil has a loamy fine sand surface layer and a sandy loam subsoil. It occurs on hummocky topography. It also occupies the steep side slopes of drainageways in the sandier upland.

Vona loamy fine sand, 5 to 15 percent slopes, has profile characteristics similar to Otero fine sandy loam but is darker and noncalcareous to greater depths. It is more sandy throughout than the associated Ulysses or Colby soils. It is less sandy in the subsoil than the Tivoli soil.

Representative profile (500 feet north and 300 feet west of the southeast corner of sec. 29, T. 28 S., R. 41 W.; in a native pasture on a slope of about 5 percent):

- A 0 to 12 inches, grayish-brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2.5) when moist; structureless; loose; noncalcareous; clear boundary.
- B₁ 12 to 29 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) when moist; weak, coarse, prismatic structure that breaks to weak, fine, granular; friable when moist, hard when dry; noncalcareous; gradual boundary.
- B₂ 29 to 39 inches, brown (10YR 5.5/3) fine sandy loam, dark brown (10YR 4/3) when moist; weak, coarse, prismatic structure that breaks to weak, fine, granular; friable when moist, slightly hard when dry; a few worm casts; noncalcareous; gradual boundary.
- C 39 to 48 inches, pale-brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) when moist; structureless; calcareous.

Variations in the profile are not common. The texture of the surface layer ranges from light fine sandy loam to loamy fine sand and the thickness from 6 to 14 inches. In a few places, the upper few inches of the subsoil are light sandy clay loam. Depth to calcareous material is variable but generally is greater than 15 inches.

Vona loamy fine sand, 5 to 15 percent slopes, is not well suited to crops because of low water-holding capacity and high susceptibility to wind erosion. Cultivated areas are eroded regardless of the precaution taken. For best land use, areas now used for crops should be reseeded to suitable native grass. *Capability unit VIIe-2 (dryland)*; *Sands range site*.

Use and Management of the Soils

This section deals with the classification and grouping of the soils according to their suitability for crops, rangeland, woodland, and wildlife habitats and the management needs of the soils in each use.

There are six main parts in this section. In the first

part the capability classification used by the Soil Conservation Service is explained. The capability classes, subclasses, and units are given for both dryland and irrigation farming in Stanton County. The second part consists of a discussion of management of the soils under dryland farming. General management and management by capability units are discussed. Estimated yields of wheat and grain sorghum are given for each arable soil. In the third main part, general management and management by capability units are given for irrigation farming.

The fourth part of the section discusses principles of range management and groups the soils according to range sites. A description of each range site is given.

In the fifth and sixth parts of this section are brief discussions of the use of the soils as woodland and for wildlife habitats.

Capability Classification

The soils of the county have been grouped to show their suitability for use for crops and rangeland. This grouping was based on the ability of the soils to produce the common cultivated crops and pasture plants over a long period of time without deterioration.

There are eight general land capability classes, but all do not necessarily occur in a particular area. Classes I through IV include soils that are suitable for cultivation and for other uses.

Soils in class I have few limitations that restrict their use. They are at least moderately fertile and are not subject to more than slight erosion, droughtiness, or wetness. They can be used for crops with only the special practices recognized as needed for good farming. These soils are suited to a wide range of plants and may be used for crops, rangeland, woodland, or wildlife habitats.

Soils in class II have some limitations that reduce the choice of plants or require the use of moderate practices to keep the land productive. Soils in this class can be used for crops, rangeland, woodland, or wildlife habitats.

Because of low rainfall and recurrent drought in Stanton County, none of the soils used for dryland farming are placed in classes I and II. In irrigated areas, soils may be placed in class I or II if the climatic limitation has been removed by relatively permanent irrigation systems.

Soils in class III have severe limitations that reduce the choice of plants, or require moderate conservation practices. These soils may be used for crops, rangeland, woodland, or wildlife habitats.

Soils in class IV have very severe limitations that restrict the choice of crops, require very careful management, or both. These soils, with enough care, can be used for crops, rangeland, woodland, or wildlife habitats.

Classes V through VIII contain soils that are limited in use and are generally not suitable for cultivation.

Soils in class V have little or no erosion hazard but have some other limitation that is impractical to remove and that limits their use largely to rangeland, woodland, or wildlife habitats. There are no class V soils in Stanton County.

Soils in class VI have severe limitations that make them generally unsuited to cultivation and limit their

use largely to grazing, woodland, or wildlife habitats. Most of them have such limitations as steep slope, severe erosion, wetness, or low moisture-holding capacity. Soils in class VI generally have physical characteristics that permit the use of tillage implements to prepare the land for seeding permanent grasses and for renovating and reseeding depleted rangeland.

Soils in class VII have very severe limitations that make them unsuited to cultivation and restrict their use largely to grazing, woodland, or wildlife habitats. These soils are more severely restricted than those of class VI because of limitations that cannot be corrected, such as steep slopes, serious erosion hazard, or shallowness. Soils in class VII in Stanton County may be used only as rangeland or as wildlife habitats.

The soils and land types in class VIII have such limitations that they produce little useful vegetation. They are limited to use for recreation, for wildlife habitats, or for water supplies. There are no soils in class VIII in Stanton County.

Each of the eight capability classes contains soils that have limitations and management problems of about the same degree. The soils in the same class may differ greatly, however, and therefore have different kinds of hazards and limitations. The dominant kind of limitation, except in class I, is indicated by one of four subclasses. The kinds of limitation, preceded by their symbols are as follows: (e) Risk of erosion; (w) excess water, either in or on the soil; (s) soil limitations in the root zone; and (c) climatic limitations. All of these subclasses do not usually occur in each capability class in an area the size of a county.

If soils within the same class and subclass require different management or give significantly different response to the same management, they are grouped into capability units. A capability unit, therefore, is a group of soils similar in most of the features that affect management and response to management. Capability units are designated by consecutive numbers, such as IIIe-1 and IIIe-2.

The capability classes, subclasses, and units in Stanton County are given in the following lists. The first list is for soils used for dryland farming and the second is for soils used for irrigation farming. Only the general characteristics of the principal soils in each capability unit are indicated. A discussion of each dryland unit is given later in the section "Management by Capability Units (Dryland)," and a discussion of each irrigated unit is given in the section "Management by Capability Units (Irrigated)."

CAPABILITY CLASSIFICATION FOR DRYLAND FARMING

Class III.—Soils that can be used for crops but have severe limitations that reduce the choice of plants or require special conservation practices, or both.

Subclass IIIc: Soils having moderate climatic limitations.

Unit IIIc-1: Silt loams and clay loams with nearly level slopes.

Unit IIIc-2: Deep, dark, nearly level silt loams of the lowland.

Subclass IIIe: Soils highly susceptible to erosion when used for crops.

Unit IIIe-1: Silt loams with gentle slopes.

Unit IIIe-2: Fine sandy loams with nearly level slopes.

Unit IIIe-3: Fine sandy loams with gentle slopes.

Class IV.—Soils that can be used for crops but have very severe limitations that restrict the choice of plants, require very careful management, or both.

Subclass IVe: Soils subject to very severe erosion when used for crops.

Unit IVe-1: Light-colored silt loams and clay loams with gentle slopes.

Unit IVe-2: Fine sandy loams with gentle slopes.

Subclass IVw: Soils severely affected by excess water.

Unit IVw-1: Clay loams of upland depressions.

Class VI.—Soils that are generally unsuited to crops and that have moderate limitations or hazards under grazing.

Subclass VIe: Soils subject to severe erosion if not protected.

Unit VIe-1: Silt loams and clay loams with moderate to steep slopes.

Unit VIe-2: Loamy fine sands with undulating to hummocky slopes.

Class VII.—Soils that are unsuited to crops and that have severe limitations or hazards under grazing.

Subclass VIIw: Soils subject to damaging overflow.

Unit VIIw-1: Soils subject to flooding and wind erosion.

Subclass VIIs: Shallow, stony soils with limited root zone.

Unit VIIs-1: Steep, shallow loams and sandy loams over sandstone.

CAPABILITY CLASSIFICATION FOR IRRIGATION FARMING

Class I.—Soils that have few limitations that restrict their use when irrigated.

Unit I-1: Silt loams and clay loams with nearly level slopes.

Unit I-2: Nearly level fine sandy loams with sandy clay loam subsoil.

Class II.—Soils that have moderate limitations or moderate risks of damage if not protected when irrigated.

Subclass IIs: Soils that have moderately rapid permeability.

Unit IIs-1: Nearly level fine sandy loams that have loam to sandy loam subsoils.

Subclass IIe: Gently sloping soils that are subject to erosion when irrigated.

Unit IIe-1: Silt loams with gentle slopes.

Unit IIe-2: Fine sandy loams with gentle slopes.

Management of Dryland³

The soils of Stanton County were covered with grass before they were cultivated. Roots permeated the soil, and living and dead vegetation protected the surface. Rain and wind did little damage to these protected soils. Water was absorbed rapidly, and there was little flash

³ By EARL J. BONDY, agronomist, Soil Conservation Service, Garden City, Kans.

runoff. Only geologic erosion occurred, and this was at a slow, harmless rate. Except in a few areas of rough broken land, erosion and soil formation were in balance.

Cultivation of crops, especially without irrigation, has reduced the organic matter content of the soils and caused the deterioration of the structure and the general physical condition of the soils. As a result of the poorer physical condition and management systems that left the land unprotected, the soils were eroded by both wind (fig. 16) and water.

Conservation of cropland is based on the principle of keeping a protective cover on the surface of the soil at all times. It is not necessary to restore the native grass. However, as in nature, a plant cover must be provided at all times.

Conservation practices, such as residue management and the minimum amount of tillage, are necessary on all cropland. Terracing, contouring, and stripcropping are other conservation measures that may be used effectively to control wind and water erosion. Soil and water can be conserved best by a combination of these practices. A single practice may reduce erosion and conserve some moisture, or it may do both, but it seldom provides complete conservation.

Following is a discussion of the conservation practices needed in dryland farming in Stanton County.

Cropping system.—A cropping system consists of a sequence of crops grown on a given area over a period of time. It may be made up of a regular rotation of different crops, grown in a definite order, or of the same crop, grown year after year on the same area. Some cropping systems may include different crops but lack a definite and planned order in which the crops are grown.

Good management includes a cropping system and such supporting practices as residue management, minimum amount of tillage, contouring, stripcropping, and terracing. Such management must be designed to hold damage by wind and water to a minimum and to maintain or increase the productivity of the soil.

In many seasons the total amount of moisture available under continuous cropping is not enough to produce a worthwhile crop. After harvest, the soil must be managed so that additional soil moisture accumulates before the seeding of the next crop. During this fallow period, generally called summer fallow, wind and water erosion must also be controlled.

A flexible cropping system, as shown in table 2, can be used as a guide to plan more stable production of crops. Table 2 shows the best method of management, on fields with soils suitable for wheat, when the depth of moist soil and the condition of the cover are known. June 1, July 15, and September 1 have been selected as the approximate dates for determining the depth of moist soil and the condition of the surface cover.

Crops are planted primarily for protective cover if the depth of moist soil is less than 24 inches at planting time.

A field has adequate cover if growing plants or residue, or both, when combined with the factors of soil texture, cloddiness, and surface roughness, will keep erosion at a minimum. Otherwise, it has inadequate cover.

Tillage.—In this dryland area, tillage has many objectives. Among other things, it is used to manage crop residues, to control weeds, and to maintain desirable structure and physical condition of the soil. Farmers carry



Figure 16.—Duststorm at Johnson, Kans., on Mar. 13, 1957.

out most of their soil management program through tillage.

Management of crop residues and control of weeds are needed to provide suitable conditions for seeding and managing the next crop. Residues are of most value when left on the surface to protect the soil from erosion and to prevent the deterioration of the structure caused by raindrops. With undercutting equipment, farmers can kill weeds but still leave the residues on the surface.

The surface must be roughened by tillage whenever the soil becomes bare of vegetation and is subject to wind erosion. Surface roughening minimizes the damage from soil blowing as long as the clods are big enough to resist blowing.

Soils with stable aggregates have desirable soil structure. On such soils, tillage is needed only to eradicate weeds and to manage residues and should be used only to meet these needs. Excessive tillage breaks down the aggregates and leaves the soil subject to crusting and blowing. It is important to till the soil when the moisture content is most favorable in order to maintain good structure. Compact layers or tillage pans may result if the soils, particularly loams or silt loams, are tilled when too wet.

Residue management.—This is a system of managing plant residues to conserve soil and water. The soil is tilled, planted, and harvested so as to keep residues on the surface of the soil until the next growing crop provides protection.

Plant residues, if properly managed, will reduce losses of soil and water by protecting the soil surface from the wind and from the impact of raindrops. The moisture intake of the soil will be increased because surface-sealing crusts will be less likely to form.

Residue management should be used on all cropland. The methods used will depend on the kind of soil, the cropping system, the amount of residue, the season, and the physical condition of the soil. The amount of residue required to protect the soil varies; it depends on the kind of residue, the height of the stubble, the texture and cloddiness of the soil, and the roughness of the surface. Residue management is basic in conservation farming and should be used along with other needed measures.

Contouring.—In contour farming, tillage and planting operations are performed parallel to terraces or contour guide lines. As a result, furrows, ridges, and wheel tracks are nearly level. The furrows and ridges hold much of the rainwater where it falls, thus decreasing runoff and

TABLE 2.—A flexible cropping system, in which wheat is the principal crop, and needed conservation practices are used¹

Date	Depth of moist soil	Adequate cover on field	Inadequate cover on field
June 1-----	<i>Inches</i>		
	Less than 24-----	Manage soil until the depth of moist soil is 24 inches; then plant sorghum or manage until July 15.	Manage soil until the depth of moist soil is 24 inches; then plant sorghum, or roughen surface and manage until July 15.
	More than 24-----	Plant sorghum or manage for wheat-----	Plant sorghum, or roughen surface and manage for wheat.
July 15-----	Less than 30-----	Manage soil for wheat and expect to seed primarily for a cover crop and a possible grain crop; be ready to plant wheat any time after August 20, if the soil contains enough moisture.	Plant sorghum for a cover crop, or plant early-maturing grain sorghum.
	More than 30-----	Manage soil for wheat with the expectancy of a grain crop.	Manage soil for wheat and expect to seed wheat primarily for a cover crop but possibly for a grain crop.
Sept. 1-----	Less than 36-----	Plant wheat with the expectancy of a grain crop (the soil should be moist to a depth of at least 24 inches at seeding time); if there is not enough moisture for seeding of wheat, manage for crop production in the next year.	Plant for a cover crop but possibly for a grain crop; if there is not enough moisture for seeding of wheat, roughen surface and manage for sorghum or wheat to be grown in the next year.
	More than 36-----	Plant wheat with the expectancy of a grain crop; if moisture conditions in the surface soil are unfavorable for seeding of wheat, manage for crop production in the next year.	Plant wheat for a cover crop but possibly for a grain crop; if moisture conditions in the surface soil are unfavorable for seeding of wheat, roughen surface and manage for sorghum to be grown in the next year.

¹ Prepared by FRED MEYER, JR., work unit conservationist, Syracuse, Kans.

erosion. When contouring is practiced, yields of crops increase because more water is absorbed by the soil and made available to crops. Also, somewhat less power is required than when up-and-down-hill farming is practiced.

Contouring is most effective when it is used with other conservation measures, such as residue management, terracing, and stripcropping.

Terracing.—This practice consists of the construction of ridges and channels across the slope to intercept runoff water. On sloping fields, terraces help to control erosion and to conserve moisture that otherwise would be lost through runoff (fig. 17). On nearly level fields, terraces are used mainly to conserve moisture.

Contouring and other conservation measures should be used along with terracing. Each row that is planted on the contour between terraces acts as a miniature terrace, holding back some water to soak into the soil. When ter-

acing and contouring are used together, yields are increased and soil losses are decreased.

The horizontal distance needed between terraces depends on the slope and kind of soil. Since much of the precipitation falls during severe storms, a terrace system protects other conservation practices, such as contouring, residue management, and contour stripcropping.

Stripcropping.—This is a system of growing suitable crops in narrow strips on the same field. Strips of erosion-resistant crops or their residues are alternated with strips of other crops or fallowed land. Good stands of wheat and sorghum and thick, heavy stubble are considered erosion resistant. Stripcropping helps control wind erosion by shortening the distance that loose soil can move. It reduces water erosion by providing a barrier of growing crops.

Two types of stripcropping are (1) contour stripcropping and (2) wind stripcropping. Contour stripcropping is used on sloping fields to help control both wind and water erosion. The strips are arranged on the contour; terraces or contour guide lines are used to establish the pattern. Wind stripcropping is used on fields of nearly level or coarse-textured soils where water erosion is not a problem and on some sloping fields where the slopes are so complex that farming on the contour is not practical. The strips are uniform in width, are usually straight, and are arranged across the direction of the prevailing winds.

The width of strip necessary to control soil blowing varies according to the kind of soil. The strips may need to be wider on silt loams and clay loams than on sandy soils.

Stripcropping will reduce soil blowing, but it does not completely control blowing when used alone. It is much more effective when used along with good management of residues, minimum amount of tillage, and other needed conservation measures.



Figure 17.—Terraces recently constructed on Colby silt loam, 1 to 3 percent slopes.

Management by capability units (dryland)

In this subsection the soils of Stanton County are arranged in capability units for dryland farming. The significant features of the soils in each capability unit, together with their hazards and limitations, are described. Suggestions for use and management of the soils of each unit are also given. The management practices referred to in the discussions of capability units are described under the heading "Management of Dryland", and a plan of a flexible cropping system is shown in table 2.

CAPABILITY UNIT IIIc-1

This unit consists of deep, dark, fertile soils that occupy relatively smooth, nearly level areas. The texture of the surface soils and subsoils is silt loam or clay loam. The soils have a high moisture-holding capacity and are easily penetrated by plant roots, air, and water. Conservation of moisture and control of wind erosion are problems. The soils in this unit are:

- Bridgeport clay loam (Bp).
- Richfield silt loam, 0 to 1 percent slopes (Rm).
- Ulysses silt loam, 0 to 1 percent slopes (Ua).

Wheat and sorghum are suited to these soils. Good management consists of growing suitable crops in a flexible cropping system and the use of residue management and the minimum amount of tillage to conserve soil and water. Contouring, terracing, and stripcropping are also effective conservation measures on these soils.

Grazing of crop residues should be limited so that enough stubble remains to protect the soil.

CAPABILITY UNIT IIIc-2

Only one soil is in this capability unit. It is a deep, dark, fertile, alluvial soil that occupies nearly level swales in the upland and benches in the valleys. The surface soil is dark silt loam. The subsoil is loam to clay loam, has a high moisture-holding capacity, and is easily penetrated by plant roots, air, and water. This soil receives extra moisture as runoff from adjacent areas. However, conservation of moisture and control of wind erosion are problems. The soil in this unit is:

- Goshen silt loam (Go).

Wheat and sorghum are well suited to this soil. Good management includes the use of suitable crops in a flexible cropping system designed to help conserve soil and water. It also includes the use of residue management and the minimum amount of tillage consistent with good yields. Stripcropping may be used. Terracing and contouring will help conserve water and may be used if the site is suitable by engineering standards.

CAPABILITY UNIT IIIe-1

Only one soil is in this capability unit. It is a deep, dark, fertile soil that occurs on gently sloping upland. The surface soil is silt loam, and the subsoil is silt loam or silty clay loam.

The surface soil tends to seal over during rainstorms. The subsoil is easily penetrated by plant roots, air, and water and has a high moisture-holding capacity. Conservation of moisture and control of wind and water erosion are problems on this soil. The soil in this unit is:

- Ulysses silt loam, 1 to 3 percent slopes (Ub).

Wheat and sorghum are well suited to this soil. Good management consists of growing suitable crops in a flexible cropping system and the application of needed soil and water conservation measures, such as residue management, minimum amount of tillage, terracing, and contouring. Contour stripcropping, if needed, may be used to help control erosion.

CAPABILITY UNIT IIIe-2

This unit consists of deep, dark, fertile soils on nearly level areas of the upland. The surface soils are fine sandy loam, and the subsoils range from sandy loam to clay loam. The soils are easily penetrated by plant roots, air, and water and have a high moisture-holding capacity. Because of the semiarid climate, the conservation of moisture and control of wind erosion are problems. The soils in this unit are:

- Dalhart fine sandy loam, 0 to 1 percent slopes (Do).
- Manter fine sandy loam, 0 to 1 percent slopes (Mf).

Sorghum is well suited to these soils. Wheat may be grown successfully if crop residues are carefully used to protect the soils against blowing. During extended drought, crops must be planted solely to provide protection against wind erosion.

Good management of these soils includes the growing of suitable crops in a flexible cropping system, and the use of needed soil and water conservation measures, especially residue management and the minimum amount of tillage. Contouring, terracing, and stripcropping are effective measures that may also be used. Grazing of crop residues should be limited so that enough stubble is left to protect the soil.

CAPABILITY UNIT IIIe-3

This unit consists of deep, dark, fertile soils that occupy gently sloping to gently undulating upland. The surface soils are fine sandy loam, and the subsoils range from loam to sandy clay loam. The soils are easily penetrated by plant roots, air, and water and have a high moisture-holding capacity. The control of wind and water erosion and the conservation of moisture for crops are the major problems on these soils. The soils in this unit are:

- Dalhart fine sandy loam, 1 to 3 percent slopes (Db).
- Manter fine sandy loam, 1 to 3 percent slopes (Mh).

Sorghum is well suited to these soils. Wheat may be grown successfully if residue management, minimum amount of tillage, and contouring are used. Terracing or contour stripcropping, or both, can be used to help control erosion.

CAPABILITY UNIT IVe-1

This unit consists of deep soils that occupy gently sloping to moderately sloping upland. The surface soils are moderately dark to light colored silt loam or clay loam and are generally calcareous within the plow layer. The subsoils are friable, calcareous clay loam or silt loam; they are high in moisture-holding capacity and easily penetrated by plant roots, air, and water. These soils are low in organic matter. The surface seals over during rainstorms and causes excessive runoff and serious erosion. Wind erosion is also a serious hazard and occurs whenever the soils lack a protective cover. The soils in this unit are:

Colby silt loam, 1 to 3 percent slopes (Cb).
 Mansker clay loam, 0 to 3 percent slopes (Mb).
 Ulysses silt loam, 3 to 5 percent slopes (Uc).
 Ulysses-Colby complex, 1 to 3 percent slopes, eroded (Ue).

These soils are not well suited to crops, but may be used for them. They are better suited to the production of native grass for range. Usually, yields of wheat and sorghum are low, but good yields are obtained when precipitation is greater than normal. Because of the serious hazard of wind and water erosion, the soils must be protected at all times. During periods of drought, crops must be planted solely for protection against wind erosion.

Good management of these soils, when used for crops, requires the growing of suitable crops in a flexible cropping system and the use of such measures as residue management, minimum amount of tillage, terracing, contouring, and contour stripcropping. If the slopes are too complex for a satisfactory system of terraces or contour lines, wind stripcropping should be used.

CAPABILITY UNIT IVe-2

This unit consists of deep, moderately fertile soils that occupy gently undulating to moderately sloping areas. The surface soils are moderately dark to light colored fine sandy loam. The subsoils are sandy loam to loam and have only moderate moisture-holding capacity. The soils are easily penetrated by plant roots, air, and water. Control of wind erosion is the main problem. Runoff is slow, and water erosion is insignificant. The soils in this unit are:

Bayard fine sandy loam (Bo).
 Manter fine sandy loam, 3 to 5 percent slopes (Mk).
 Otero-Manter fine sandy loams, 1 to 5 percent slopes (Ox).

Because of the hazard of wind erosion, these soils are not well suited to crops. Although they may be used for crops, they are better suited to the production of native grass for range.

Good management of these soils, when used for crops, should provide for control of wind erosion by the use of residue management and the minimum amount of tillage in a cropping system in which sorghum is grown continuously. Wheat is not suited to these soils. Summer fallowing is not advisable because of the severe hazard of wind erosion.

CAPABILITY UNIT IVw-1

Only one soil is in this unit. It is a deep, dark, slowly permeable soil that occupies small upland depressions.

The texture of the surface soil and subsoil ranges from clay loam to silty clay loam. Water remains on the surface for as much as several days after rainstorms. Consequently, planting and harvesting are often delayed and growing crops may be drowned. Wind erosion is a hazard, particularly after crops have been lost and no cover remains on the soil. The soil in this unit is:

Lofton clay loam (Lo).

When used for crops, this soil is usually managed like the surrounding soils in the same field. If conservation practices, such as terracing, contouring, minimum amount of tillage, and residue management, are used on the adjacent soils, some runoff water can be kept out of the depressions occupied by this soil. In places surface drainage is feasible. For further help in managing the soil in the

depressions, consult a local representative of the Soil Conservation Service.

CAPABILITY UNIT VIe-1

This unit consists of deep soils that occupy moderately to steeply sloping uplands. The surface soils are moderately dark to light colored, calcareous silt loam and clay loam. The subsoils are friable, calcareous, silt loam and clay loam, and they have a high moisture-holding capacity. These soils are easily penetrated by plant roots, air, and water. Erosion by wind and water is a serious hazard. The soils in this unit are:

Colby silt loam, 3 to 5 percent slopes (Cc).
 Colby silt loam, 5 to 15 percent slopes (Cd).
 Mansker clay loam, 3 to 5 percent slopes (Mc).

These soils are suitable only for range. Runoff and erosion are excessive if the soils are cultivated. Suitable native grass should be planted in areas now cultivated. Proper range use, deferred grazing, or rotation grazing is needed to produce adequate forage for livestock and cover for the soil. More information on good management of grassland is given in the section "Range Management."

CAPABILITY UNIT VIe-2

This unit consists of soils in moderately undulating to hummocky areas of the upland. The surface soils and subsoils are light-colored loamy fine sand.

Within this unit are small, severely eroded areas, mainly on sandy soils. These eroded areas are made up of blowouts and of places where soil material has been deposited. The texture of the blowout areas ranges from loamy fine sand to loam and clay loam.

Rainfall is absorbed rapidly, but these sandy soils will not hold large amounts of water. Erosion by water is not a problem, even on the steeper slopes. Wind erosion is a serious hazard and occurs whenever the soils are not protected. The soils in this unit are:

Blown-out land (Bo).
 Tivoli loamy fine sand (Ts).
 Vona loamy fine sand, 5 to 15 percent slopes (Vo).

Because of low moisture-holding capacity and susceptibility to soil drifting, these soils are suitable only for native grass. Blowouts develop quickly in places where grass is destroyed by overgrazing and trampling. Overgrazing of grassland can be prevented through proper range use and deferred grazing. Blowouts and bare spots should not be grazed but should be seeded to suitable native grass. More information on grassland management is given in the section "Range Management."

CAPABILITY UNIT VIIw-1

This capability unit consists of two mapping units. Broken land occurs along the North Fork of the Cimarron River, along Bear Creek, and along Sand Arroyo. This land type consists of the entrenched channel and adjacent steep side slopes. Texture of the surface layer in such areas is mainly silt loam. Lincoln soils occur in flood plains and have surface layers that are mainly fine sandy loam and loam in texture.

Frequent flooding, scouring, and dumping of sediments are hazards on all areas. Furthermore, wind erosion is a hazard on Lincoln soils. In this capability unit are:

Broken land (Bx).
 Lincoln soils (L).

Areas comprising this capability unit are suited only for grassland. Little can be done to protect such areas except to maintain a good grass cover through controlled grazing.

CAPABILITY UNIT VII₆-1

The shallow soils in this unit occupy steep, more or less broken slopes along upland drainageways. They also occur along the low escarpment that borders parts of Bear Creek and Sand Arroyo. The surface soil is loam or sandy loam and is underlain by sandstone at depths of about 3 to 10 inches. Rock outcrops are common. The soils have low moisture-holding capacity and a restricted root zone. Runoff is excessive. This unit consists of:

Travessilla soils (Ty).

These soils are suitable only for grass. Water and wind erosion will occur if the grass is overgrazed and a good cover is not maintained. Little can be done to protect these soils except to maintain a good grass cover by control of grazing. More information on management of grassland is given in the section "Range Management."

Estimated yields

A limited amount of moisture is available to crops under dryland farming. Yields are high only if the yearly rainfall is above normal. In dry years, the moderately sandy soils produce higher crop yields than the finer textured soils. In years when the precipitation is above normal, however, the finer textured soils produce the higher yields. Yields depend largely on the amount of moisture in the soil at planting time and the amount of precipitation during the growing season.

Information on the long-time average yields of crops for the soils of Stanton County is limited. Records for a long period are necessary to smooth out fluctuations in yields caused by recurring and alternating periods of drought and abnormally high precipitation. However, on the basis of data obtained from farmers and observations made by members of the survey party and the Kansas State Agricultural Experiment Station, average yields per acre of seeded wheat and grain sorghum have been estimated for the arable soils (table 3).

The yields in table 3 are estimates of average production over a period of years. They may not apply directly to any specific tract of land in any particular year, because management practices and soil characteristics differ slightly from farm to farm and because the climate fluctuates. The main value of the estimated yields is to bring out the relative productivity of the soils.

Estimated long-time average yields per acre that can be obtained by using the prevailing, or most common, system of management are shown in columns A of table 3. Estimated average yields that may be obtained by using an improved management system are shown in columns B.

Prevailing management.—The prevailing, or most common, system of management used in the production of wheat is as follows:

1. Tillage operations are performed in straight lines, generally parallel to field boundaries and not on the contour.
2. The manner and frequency of tillage and the equipment used soon destroy protective crop residues.
3. The cropping system consists of alternate wheat and fallow. Winter wheat is seeded early in au-

TABLE 3.—*Estimated long-time average yields per acre of seeded wheat and sorghum grown on the arable soils under two levels of management*

[Columns A show yields to be expected under prevailing management, and columns B show yields to be expected under improved management; absence of a yield figure indicates the soil is not suited to the crop specified; wheat yields reflect the general use of summer fallow]

Soil	Wheat		Grain sorghum	
	A	B	A	B
Bayard fine sandy loam.....	Bu. 8.5	Bu. 12.0	Bu. 14.0	Bu. 17.5
Bridgeport clay loam.....	12.5	15.5	12.0	14.5
Colby silt loam, 1 to 3 percent slopes.....	10.0	14.0	10.0	12.0
Dalhart fine sandy loam, 0 to 1 percent slopes.....	16.0	20.0	20.0	27.0
Dalhart fine sandy loam, 1 to 3 percent slopes.....	12.0	16.0	16.0	20.0
Goshen silt loam.....	16.0	20.0	22.0	27.0
Lofton clay loam.....	9.0	13.0	13.0	15.0
Mansker clay loam, 0 to 3 percent slopes.....	10.0	15.0	10.0	13.0
Manter fine sandy loam, 0 to 1 percent slopes.....	12.0	16.0	16.0	20.0
Manter fine sandy loam, 1 to 3 percent slopes.....	10.0	14.0	15.0	19.0
Otero-Manter fine sandy loams, 1 to 5 percent slopes.....			12.0	16.0
Richfield silt loam, 0 to 1 percent slopes.....	14.5	18.0	15.0	18.0
Ulysses silt loam, 0 to 1 percent slopes.....	14.0	18.0	15.0	18.0
Ulysses silt loam, 1 to 3 percent slopes.....	11.5	16.0	12.0	14.5
Ulysses-Colby complex, 1 to 3 percent slopes, eroded.....	10.5	14.5	11.0	13.5

tumn on land that was left idle and kept free of weeds during the growing season. If a satisfactory stand of wheat is not obtained, or if the wheat blows out during winter or spring, the land is planted to sorghum.

4. Crop residues are grazed whenever available. Growing wheat, both seeded and volunteer, is usually grazed during fall and winter.

The prevailing system of management used for grain sorghum on all soils except the Dalhart and Manter is as follows:

1. Sorghum is seeded on land that was in wheat the previous season. Following the wheat harvest, the soil is plowed to obtain a stand of volunteer wheat that will be used for fall pasture.
2. The soil generally is clean tilled at least twice in the spring before sorghum is planted on about June 1. The first tillage is done to kill the volunteer wheat. Subsequent tillage is shallow and is intended to control weeds.
3. Sorghum is drilled in rows spaced about 20 inches apart. After it emerges, the sorghum is cultivated once with a rotary-hoe type implement. Later, if weeds are numerous, the crop may be sprayed with a chemical weedkiller.

4. Because of inadequate moisture, sorghum in many fields is not harvested for grain. The plants on these fields and the residues remaining on harvested fields are grazed off by sheep and cattle.

Under prevailing management, sorghum generally is grown continuously on the Dalhart and Manter soils. Spring tillage, other cultivation, and spraying are done in about the same way on these soils as on the other arable soils. Residues are grazed in fall and winter.

Improved management.—The improved system of management consists of the use of needed measures to conserve soil and water and the use of a suitable cropping system. Erosion is controlled by (1) residue management; (2) contour tillage; (3) stripcropping; (4) cover crops; and (5) tillage at the proper time, emergency tillage, and avoidance of overtilage. More information on soil and water conservation practices and on the use of an appropriate cropping system is given in the subsection "Management by Capability Units (Dryland)."

Irrigation Farming

In the past few years, irrigation has become important in Stanton County. Before 1950, only a small acreage in the county was irrigated. By 1957, enough water to irrigate approximately 50,000 acres was being pumped from an estimated 200 wells. By 1958, there were approximately 35 miles of underground pipeline in the county.

Much of the irrigation farming (fig. 18) is in conjunction with dryland farming. The farms are large, and only part of a farm may be irrigated each year. The semiarid climate in Stanton County also influences irrigation. Often irrigation water is used to supplement rainfall that is below average.

The flow of the surface streams is intermittent and cannot be relied on to provide enough irrigation water. Irrigators, therefore, depend almost exclusively on ground water. The Pliocene and Pleistocene deposits and the Dakota formation, as shown in figure 23, are the sources of most of the irrigation water. The depth to water ranges from 50 feet to about 250 feet. Irrigation wells produce an average of about 1,200 to 1,500 gallons of water per minute. One large well in the county produces 3,500 gallons per minute. In Stanton County the demand

on the reservoir of ground water is large and will probably become larger, whereas the amount of recharge is probably low. Things to consider before going into irrigation farming and ways of improving the management of irrigated soils are discussed in this section.

Planning an irrigation system.—Various factors should be considered when planning an irrigation system. Some of these are the (1) suitability of the soils for irrigation, (2) methods of applying water, and (3) preparation of the land.

The suitability of a soil for irrigation depends on many characteristics, chiefly permeability and available moisture-holding capacity.

Permeability is the quality of the soil that enables water or air to move through it. Most of the soils of Stanton County are moderately permeable. In planning an irrigation system, the irrigator should know the permeability and texture of the soils on his farm. This information will help him determine the methods needed to get water to the field and to apply it. The permeability of the soils of Stanton County is given under the heading "Management by Capability Units (Irrigated)."

Available moisture-holding capacity refers to the ability of the soil to retain moisture within the root zone for use by crops. Sandy soils have a low available moisture-holding capacity but release most of their water fairly easily. Soils that contain more clay have a higher capacity to hold water but release it less readily. Soils with a limited available moisture-holding capacity are likely to be droughty and, therefore, require frequent irrigations.

The available moisture-holding capacity for soils of different texture is as follows:

<i>Texture</i>	<i>Inches of available water per foot of soil depth</i>
Sand.....	0.25 to 0.75
Loamy sand.....	.75 to 1.25
Sandy loam.....	1.00 to 2.00
Loam, sandy clay loam, silt loam, clay loam, silty clay loam.....	2.00 to 3.00

Other characteristics that affect the suitability of the soil for irrigation are (1) the depth of the soil and possible restrictions to the penetration of plant roots, water, and air; and (2) the erodibility of the soil. Most irrigable soils of Stanton County have no serious restrictive layers.

Another factor to consider in planning an irrigation system is the method of applying water. The two general methods used in Stanton County are gravity irrigation and sprinkler, or overhead, irrigation.

In gravity irrigation the water may be confined within borders or basins and completely cover the surface, or it may flow in furrows or corrugations. The efficiency of the irrigation system is affected by the topography, kind of soil, and methods of water application. Table 4 gives the suitable irrigation methods for groups of irrigable soils when planted to various crops.

Methods of irrigation shown in table 4 are described as follows:

BASIN OR LEVEL BORDER: This method consists of quickly filling a diked area with water to the desired depth and allowing the water to percolate into the soil. It is especially suited to flat areas.



Figure 18.—Irrigated grain sorghum on Richfield silt loam, 0 to 1 percent slopes.

TABLE 4.—*Methods of irrigating soils of various slopes planted to stated crops*

Soil and map symbol	Grain sorghum, forage sorghum, corn, and other row crops	Small grains, legumes, and annual pasture crops	Sugar beets, vegetables, and other specialty crops	Grass
Bridgeport clay loam (Bp). Goshen silt loam (Go). Richfield silt loam, 0 to 1 percent slopes (Rm). Ulysses silt loam, 0 to 1 percent slopes (Ua).	Basin or level border; border; furrow; sprinkler.	Basin or level border; border; corrugation; sprinkler.	Basin or level border; border; furrow; sprinkler.	Basin or level border; border; corrugation; sprinkler.
Bayard fine sandy loam (Ba). Dalhart fine sandy loam, 0 to 1 percent slopes (Da). Manter fine sandy loam, 0 to 1 percent slopes (Mf).	Basin or level border; border; furrow; sprinkler.	Basin or level border; border; sprinkler.	Basin or level border; border; furrow; sprinkler.	Basin or level border; border; sprinkler.
Colby silt loam, 1 to 3 percent slopes (Cb). Ulysses silt loam, 1 to 3 percent slopes (Ub). Ulysses-Colby complex, 1 to 3 percent slopes, eroded (Ue).	Border; contour bench; furrow; sprinkler.	Border; contour bench; corrugation; sprinkler.	Border; contour bench; furrow; sprinkler.	Border; corrugation; sprinkler.
Dalhart fine sandy loam, 1 to 3 percent slopes (Db). Manter fine sandy loam, 1 to 3 percent slopes (Mh).	Basin and level border; contour bench; furrow; sprinkler.	Basin and level border; contour bench; sprinkler.	Basin and level border; contour bench; furrow; sprinkler.	Border; sprinkler.

BORDER: In this method, a sheet of water is released down a narrow strip between low ridges or borders; the water infiltrates the soil as the sheet advances.

CONTOUR BENCH: In this method, water is applied in border strips that contain no cross slope and are constructed across the natural slope of the land. Grades are slight in the direction of irrigation. Normally each strip is of the same width throughout its length.

CORRUGATION: A method by which water is applied in small furrows running down the slope from the head ditch.

FURROW: A method by which water is applied in the furrows between the rows of plants. It is called contour-furrow irrigation if furrows cross the prevailing slope on an acceptable grade.

SPRINKLER: This is a method of providing irrigation by means of spray from perforated pipes or nozzles.

Also important in planning an irrigation system is the preparation or leveling of the land. But before this can be done, it is necessary to determine the (1) method of applying water; (2) amount and cost of leveling; (3) location of ditches; (4) possibility of drainage onto the field from adjacent areas; (5) direction of irrigation and length of run; and (6) disposition of irrigation waste water and runoff from rainstorms. Where land leveling is needed, the depth to which the soil can be safely disturbed must be known. The irrigable soils of Stanton County are generally deep enough to allow for reasonable cuts.

Other important factors to consider in planning an irrigation system are quantity and quality of available water, crops to be grown, and the source of power.

A well-planned system will (1) increase the efficiency of applying irrigation water; (2) reduce labor requirements; (3) prevent excessive erosion; and (4) provide adequate drainage.

Irrigation practices.—Good management of irrigated soils of Stanton County requires efficient use of water, which includes irrigating at the proper time with the proper amount of water. The land should be prepared to provide for efficient application and disposal of water and for control of erosion. Proper crops and cropping systems should be chosen and the needed fertilizer used.

Efficient use of irrigation water is of chief importance to good irrigation management. Over much of the county, less than half the water applied benefits growing crops. The misuse and waste of irrigation water usually cause soil damage by erosion, leaching of plant nutrients, or waterlogging. This often increases the cost of irrigation water and farming. Some practices contributing to the misuse of water are (1) excessively long irrigation runs; (2) excessive stream flow; (3) delivery of irrigation water through open ditches; and (4) use of sprinklers on hot, windy days, which causes loss of water by drift and evaporation.

Control of erosion on irrigated land is important. The degree of slope safe for irrigation and the desirable size of the stream depend on intake rate of water and erosion resistance of the soil. Much of the erosion on irrigated soil is due to irrigation runs that are too long and are on relatively steep slopes (fig. 19). Runoff from heavy rainstorms also causes erosion on steeply graded or sloping areas. Movement of soil particles occurs whenever water flows over loose soil. It is most likely to occur when irrigation water is applied to furrows or borders immediately after cultivation. By use of small streams of water on gentle slopes, erosion can be kept to a minimum. Irrigation land left unprotected when dry is subject to wind erosion. Proper residue management or surface roughening will protect the soil from blowing.

Management affects both the chemical and physical condition of the soil. By good management, farmers can raise yields year after year and at the same time maintain

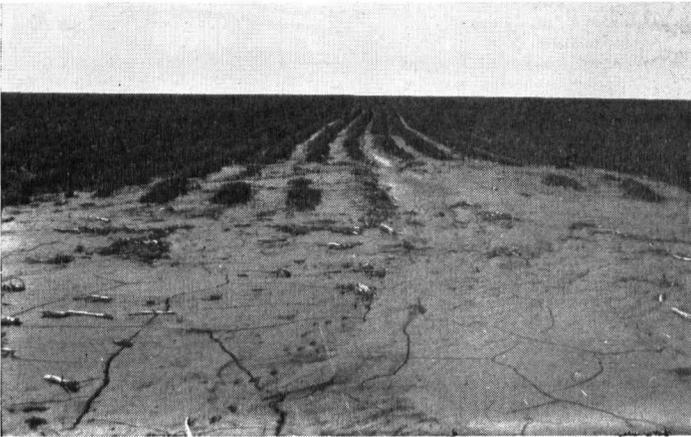


Figure 19.—Long runs and steep slopes have resulted in loss of soil and irrigation water from this field.

or improve the soil. To do this, they must provide for an annual increment of organic matter on all fields. Crops should be rotated so that a sod crop is grown every few years to rebuild and stabilize soil aggregates.

The use of commercial fertilizer, particularly nitrogen, has become increasingly important in irrigation farming. On some soils, mineral fertilizer, especially phosphate, may be necessary for high crop yields. Laboratories of the Kansas Agricultural Experiment Station in Manhattan and Garden City conduct soil fertility tests. Soil tests are available to the public at a small charge per sample tested.

When to irrigate.—Irrigation is an artificial means of recharging the rooting depth of the soil with water. It is the soil that is irrigated, not the crop. Research shows a marked reduction in crop yields for nearly all crops if the moisture in the root zone falls to less than 20 percent of the total available moisture-holding capacity of the soil. The critical level varies with the soil as well as with the crop. Usually the most practical time to start irrigation is when the readily available moisture has been reduced to 50 or 60 percent of capacity. This should allow enough time to cover the area with water before yields are adversely affected.

The following test can be used on loam, silt loam, or clay loam soils to estimate the content of readily available moisture at a given time:

1. First, remove a handful of loose soil with an auger or spade; the profile can be checked at any depth.
2. Squeeze the handful of soil very firmly three or four times; use about medium pressure.
3. If the soil is too dry to form a ball, it contains less than one-fourth of the moisture readily available at field capacity.
4. If the soil forms a ball, it contains at least one-fourth of the moisture readily available at field capacity.
5. Toss the moist ball about 1 foot into the air, and catch it just as you would catch a baseball.
6. If the ball breaks within five tosses or less, it is fragile. A fragile ball contains from one-fourth to one-half the moisture readily available at field

capacity. If the ball is fragile, the soil is at the best moisture content for irrigation.

7. If the ball is still intact after it has been tossed five times, it is durable. A durable ball contains more than one-half the moisture readily available at field capacity. You do not need to irrigate if the ball is durable.
8. If, after you have squeezed the soil firmly, some soil sticks to your hand, the readily available moisture is between 75 and 100 percent of field capacity.

This simple field test is not so reliable on coarse sandy loams, loamy sands, or sands as on the medium textured and moderately fine textured soils. If sandy soils are tested, the balls of soil are generally fragile even when the moisture content is at field capacity.

Many people have learned through experience that the productivity of irrigated land may be relatively short lived. If the water and the soils are suited to irrigation, irrigated land will be highly productive under good management for generations to come. However, if the land, the water, or the management is not suited to irrigation farming, the land can become unproductive in a relatively short time because of salt accumulations, erosion, or waterlogging.

Management by capability units (irrigated)

In this subsection the irrigable soils of Stanton County have been placed in capability units. The significant features of the soils in the same unit are described, the hazards and limitations of the soils are pointed out, and applicable management practices are given. The individual soils and their map symbols are listed for each capability unit.

CAPABILITY UNIT I-1 (IRRIGATED)

The soils in this unit are nearly level and have silt loam to clay loam surface soils and subsoils. They are deep, well drained, and moderately permeable, and they have a high moisture-holding capacity. The soils are:

- Bridgeport clay loam (Bp).
- Goshen silt loam (Go).
- Richfield silt loam, 0 to 1 percent slopes (Rm).
- Ulysses silt loam, 0 to 1 percent slopes (Uc).

Good management of these soils includes the following practices that maintain or improve fertility and tilth: (1) Use of a cropping sequence that includes a deep-rooted legume; (2) use of crop residues to maintain organic matter and tilth; and (3) application of commercial fertilizer as needed. Suitable crops on these soils are wheat, sorghum, alfalfa, sugar beets (fig. 20), tame grasses, and vegetables.

Engineering or mechanical practices that conserve and make the most efficient use of irrigation water should be used. Land leveling is commonly needed. Control of runoff from adjacent areas may be necessary, depending upon the site. For further information on conservation irrigation and related engineering problems, consult a local representative of the Soil Conservation Service.

CAPABILITY UNIT I-2 (IRRIGATED)

Only one soil is in this unit. It is deep and nearly level and has a fine sandy loam surface layer and a sandy clay loam or sandy loam subsoil. It is fertile, well drained,



Figure 20.—Sugar beets on an irrigated field of Richfield silt loam, 0 to 1 percent slopes.

and moderately permeable, and has a high moisture-holding capacity. The soil in this unit is:

Dalhart fine sandy loam, 0 to 1 percent slopes (D_o).

Good management of this soil should provide for maintenance or improvement of fertility and tilth and efficient use of irrigation water. Practices that maintain fertility and tilth are (1) use of a cropping sequence that includes a deep-rooted legume; (2) use of crop residues; and (3) application of commercial fertilizer as needed. Suitable crops on this soil are wheat, sorghum, alfalfa, sugar beets, tame grass for hay and pasture, and vegetables.

Land leveling will help obtain efficient use of water. Other engineering problems may arise, depending upon the site. For further information on conservation irrigation and related engineering problems, consult a local representative of the Soil Conservation Service.

CAPABILITY UNIT H_s-1 (IRRIGATED)

This unit consists of deep, nearly level soils that have fine sandy loam surface layers and loam to sandy loam subsoils. The soils are fertile, well drained, and moderately permeable. They have a low moisture-holding capacity because of the moderately sandy subsoils. These soils are:

Bayard fine sandy loam (B_o).

Manter fine sandy loam, 0 to 1 percent slopes (M_f).

Good management of these soils includes practices that maintain or improve fertility and tilth and that make the most efficient use of irrigation water. The capacity of these soils to hold water is low because of the moderately sandy subsoils. Care must be taken to avoid overirrigation and leaching of plant nutrients.

Fertility and tilth can be maintained through the (1) use of a cropping sequence that includes a deep-rooted

legume; (2) use of crop residues; and (3) application of commercial fertilizer as needed. Suitable crops on these soils are wheat, sorghum, alfalfa, sugar beets, tame grass for hay and pasture, and vegetables.

Land leveling will help obtain efficient use of water. Other engineering problems may arise, depending upon the site. For further information on conservation irrigation and related engineering problems, consult a local representative of the Soil Conservation Service.

CAPABILITY UNIT IIe-1 (IRRIGATED)

This unit consists of deep, gently sloping soils of the upland. These soils have silt loam surface layers over silt loam or silty clay loam subsoils. They are fertile, well drained, and moderately permeable, and they have a high moisture-holding capacity. Water erosion and efficient use of irrigation water are problems. The soils in this unit are:

- Colby silt loam, 1 to 3 percent slopes (Cb).
- Ulysses silt loam, 1 to 3 percent slopes (Ub).
- Ulysses-Colby complex, 1 to 3 percent slopes, eroded (Ue).

Good management of these soils must provide for erosion control, efficient use of irrigation water, and maintenance of fertility and tilth. A cropping sequence that consists of close-growing crops and deep-rooted legumes and the use of crop residues and commercial fertilizer will maintain and improve soil fertility and tilth. Alfalfa, sweetclover, tame grasses, wheat, sorghum, and sugar beets are suitable crops.

Land leveling, irrigation on the contour, and sprinkler irrigation of close-growing crops will minimize the danger of erosion. Drop structures may be necessary to control erosion in irrigation ditches. Other engineering and erosion control problems may arise, depending upon the site. A local representative of the Soil Conservation Service can help you with these problems.

CAPABILITY UNIT IIe-2 (IRRIGATED)

This unit consists of deep, gently sloping soils of the upland. The soils have dark-colored fine sandy loam surface layers and loam to sandy loam subsoils. They are fertile, well drained, and moderately permeable, and they have a high moisture-holding capacity. Erosion and efficient use of irrigation water are problems. The soils in this unit are:

- Dalhart fine sandy loam, 1 to 3 percent slopes (Db).
- Manter fine sandy loam, 1 to 3 percent slopes (Mh).

Good management of these soils must provide for erosion control, efficient use of irrigation water, and maintenance of fertility and tilth. A cropping sequence that consists of close-growing crops and deep-rooted legumes and the use of crop residues and fertilizer will maintain and improve soil fertility and tilth. Alfalfa, sweetclover, tame grass, wheat, sorghum, and sugar beets are suitable crops.

Land leveling, irrigation on the contour, and sprinkler irrigation of close-growing crops help to control erosion and to use water efficiently. Other engineering and erosion control problems may arise, depending upon the site. Consult a local representative of the Soil Conservation Service for help on these problems.

Range Management ⁴

Rangeland makes up nearly 10 percent of the total area of Stanton County. It is scattered throughout the county, but some concentrations occur in the southwestern part along Bear Creek and in the extreme northeastern part. The size of the areas ranges from a few acres to approximately 2,500 acres. Most of the rangeland is not suitable for cultivation.

The raising of livestock is the third largest agricultural industry in Stanton County. The success of the livestock industry depends on the way ranchers and farmers manage their range and other feed resources.

Principles and practices of range management

High forage production and the conservation of soil, water, and plants on rangelands are obtained through the maintenance of range that is in good and excellent condition and through the improvement of range that is depleted. This is accomplished by managing the grazing so as to encourage the growth of the best native forage plants.

Leaf development, root growth, flower-stalk formation, seed production, forage regrowth, and storage of food in the roots are essential stages in the development and growth of grass. In order to maintain maximum forage yields and peak annual production, grazing must be regulated to permit these natural processes of growth.

Livestock are selective in grazing and constantly seek the more palatable plants. If grazing is not carefully regulated, the better plants are eventually eliminated. Less desirable or second-choice plants increase. If heavy grazing is continued, even the second-choice plants will be thinned out or eliminated and undesirable weeds or invaders will take their place.

Research by agricultural workers and experience by ranchers have shown that if only about half the yearly growth of grass is grazed, damage to the desirable plants is minimized, and the condition of the range will be maintained or improved. The forage left on the ground does these things—

1. Serves as a mulch that is permeable for the infiltration and storage of water in the soil. The more water stored in the ground, the better the growth of grass for grazing.
2. Enables roots to increase in number and in length and, thereby, permits them to reach additional moisture and plant nutrients. Overused grass cannot reach deep moisture because not enough green shoots are left to provide the food needed for good growth of roots.
3. Protects the soil from wind and water erosion. Grass is the best kind of cover to prevent erosion.
4. Allows the better grasses to maintain or improve in vigor. This prevents weeds from growing or helps to crowd them out.
5. Enables plants to store food for rapid, vigorous growth after droughts and in spring.
6. Stops snow where it falls so that it will melt and soak into the soil for use at a later date.

⁴ By PETER N. JENSEN, range conservationist, Soil Conservation Service, Dodge City, Kans.

7. Provides for greater feed reserve for use during dry years; otherwise, operators may be forced to sell livestock during droughts.

Sound range management requires adjustment in the stocking rate from season to season according to the amount of forage produced. Range management should provide for reserve pastures or other feed during droughts or other periods when production of forage is curtailed. Thus, the range forage can be moderately grazed at all times. In addition, it often is desirable to keep part of the livestock, such as stocker steers, readily salable. If this is done, the rancher can adjust the number of livestock with the amount of forage produced without sacrificing breeding animals.

Management practices that improve rangeland, that cost little to use, and that are needed on all rangeland, regardless of other practices used, are defined as follows:

Proper range use.—This is the practice of grazing rangeland at a rate that will maintain vigorous plants, carbohydrate reserves, and enough residues to conserve soil and water. In addition, this practice helps to maintain the most desirable vegetation or to improve the quality of vegetation that has deteriorated.

Deferred grazing.—This is the postponement of grazing on a given range. It is used to increase the vigor of the forage or to permit the desirable plants to produce naturally by seed or to increase free from grazing pressure. In addition to improving the range, deferred grazing helps build up a reserve of range forage for later use.

Rotation-deferred grazing.—This is a practice by which one or more pastures are rested at planned intervals throughout the growing season. Each pasture is given a different rest period each successive year to permit the desirable forage plants to develop and produce seed every second, third, or fourth year.

Following is a list of practices needed for range improvement. These practices help control livestock on the range and promote better management.

1. Range seeding.—This is the establishment, by seeding or reseeding, of native or improved dominant grasses (fig. 21) on rangeland. Here are some points to consider in range seeding:



Figure 21.—Revegetation of a mixture of native grass on class VI land.

- a. The area to be seeded should have a climate and soil that naturally support range plants. This insures that the range can be maintained with no care other than proper management of grazing.
 - b. A mixture of native grass that consists primarily of species dominant in the climax vegetation should be seeded. Strains of each species that are known to be suited to the area can be used. Grass seed harvested within 150 miles of the county should be favored.
 - c. Stubble of drilled forage or grain sorghum is the ideal seedbed for grass. This type of cover protects the soil from erosion, provides a firm seedbed, and is relatively free from weeds; the mulch helps retain moisture in the upper layer of soil.
 - d. Newly seeded areas should not be grazed for at least 2 years.
2. Water developments.—Watering places should be located over the entire range, if possible, so that livestock do not have to go too far. Good distribution of water helps achieve uniform use of the range. Generally, wells, ponds, and dugouts supply water for livestock, but in some places water must be hauled. The makeup of each range determines which type of water development is the most practical.
 3. Fencing.—Fences should be constructed to separate ranges used during different seasons. In some places different range sites are separated if there is a great difference in the way they are used.
 4. Salting.—This is necessary on many sites to supplement native range forage. Progressive salting, or periodic moving of salt grounds, will distribute grazing and promote more uniform use of the range.
 5. Weed and brush control.—Chemical or mechanical means may be needed to control undesirable plants on some sites. This will improve range forage. In Stanton County the dominant undesirable plant is sand sagebrush.

Livestock management needed to achieve high production and conserve range resources includes:

1. A feed and forage program to keep livestock in a productive and desirable condition throughout the year. The program should include the use of range forage, concentrates, and hay or tame pasture, or harvested roughages. During emergencies, the use of reserved roughages and also the use of deferred grazing on native pastures will indirectly help conserve plants, soil, and water. The reserves are in addition to the normal winter supply of feed. Feed shortages can be avoided by carrying in reserve the surplus produced in years of high yields. Feed reserves can be stored in stacks or silos.
2. A breeding program that provides for the type of livestock most suitable for the range, a supply of calves in seasons when forage is most nutritious, and continued improvement of livestock consistent with the type of range and the climate.
3. Culling of nonproductive animals from the herds.

Range sites

Different kinds of range produce different kinds or different amounts of grass, or both. To manage rangeland properly, an operator should know the different kinds of land (range sites) in his holdings and the plants each site is capable of growing. He will then be able to use the management needed to produce the best forage plants on each site. Important terminology used in the discussion of rangeland is described next.

Range sites are areas of rangeland that differ from each other in their ability to produce significantly different kinds or amounts of climax, or original, vegetation. A significant difference is one great enough to require different grazing or other management practices to maintain or improve the present vegetation. Climax vegetation is the combination of plants that grew originally on a given site. The most productive combination of forage plants or rangeland is generally the climax type of vegetation.

Range condition is a term used to compare the kinds and amounts of present vegetation with the original, or climax, vegetation. It is determined by estimating the percentage of present vegetation that is original, or climax, vegetation for the site. Changes in range condition are primarily due to the intensity of grazing and to drought. Range condition is expressed as follows:

Condition class	Percentage of climax vegetation on the site
Excellent-----	76 to 100
Good-----	51 to 75
Fair-----	26 to 50
Poor-----	0 to 25

The range sites in Stanton County are the Sandy, Sands, Loamy Upland, Lowland, and Rough Breaks. The dominant sites are the Sandy and the Sands. There is some concentration of the Loamy Upland site in the extreme northeastern part of the county.

Yields of forage on the different range sites are influenced mainly by climate, nature of the individual soil, and management. Yields of top growth of forage produced on range sites in excellent condition may be expected to vary with amounts of rainfall received each year. In addition, yields will be influenced by the amount of grazing in past years. Yields of forage are decreased through the activities of rodents and insects, through trampling of animals, and through other causes. These factors vary from year to year and greatly affect the annual yield of forage.

Following is an estimate of the total top growth of forage, during years of average rainfall, for the range sites in excellent condition:

Range site	Pounds per acre (air-dry weight)
Loamy Upland-----	1,250 to 2,000
Sandy-----	1,500 to 2,000
Sands-----	2,000 to 2,500
Rough Breaks-----	1,500 to 2,000
Lowland-----	3,000 to 4,000

The descriptions of the range sites that follow include the (1) names of the soils and the map symbol of each soil; (2) dominant vegetation on each site when it is in excellent condition; and (3) management practices needed to maintain and improve range condition.

In the descriptions of range sites, vegetation is referred to in terms of *increasers*, *decreasers*, and *invaders*. Decreasers and increasers are climax plants. Decreasers are the most heavily grazed and are, consequently, the first to

be destroyed by overgrazing. Increasers withstand grazing better or are less palatable to the livestock; they increase under grazing and replace the decreasers. Increasers also finally decrease, if grazing pressure continues. Invaders are weeds that become established after the climax vegetation has been reduced by grazing.

SANDY SITE

This range site consists of deep, nearly level to gently sloping soils of the upland. The soils have fine sandy loam surface layers and sandy loam to clay loam subsoils. They are moderately permeable. The moisture-holding capacity is moderate to high.

The soils in this range site and the map symbol of each are as follows:

- Bayard fine sandy loam (Ba).
- Dalhart fine sandy loam, 0 to 1 percent slopes (Da).
- Dalhart fine sandy loam, 1 to 3 percent slopes (Db).
- Manter fine sandy loam, 0 to 1 percent slopes (Mf).
- Manter fine sandy loam, 1 to 3 percent slopes (Mh).
- Manter fine sandy loam, 3 to 5 percent slopes (Mk).
- Otero-Manter fine sandy loams, 1 to 5 percent slopes (Ox).

Decreaser grasses in the climax vegetation, such as sand bluestem, little bluestem, switchgrass, and side-oats grama, make up 55 percent of the vegetation; other perennial grasses and forbs account for the rest. The dominant increasers include such grasses as blue grama, sand dropseed, buffalograss, and sand paspalum. Sand sagebrush and small soapweed are the dominant woody increasers. Common invaders are perennial three-awns, windmillgrass, and annuals.

Under present management this site is generally in poor condition. It is producing approximately one-fourth its potential.

Grazing practices needed to maintain or improve the condition of the site are proper range use, deferred grazing, and rotation-deferred grazing.

SANDS SITE

This range site is made up of deep, nearly level to undulating and dune-type soils. They have loamy fine sand surface soils and loamy fine sand to clay loam subsoils. They are rapidly permeable. Moisture-holding capacity is low to high, depending on the texture of the subsoil.

The soils in this range site and the map symbol of each are as follows:

- Blown-out land (Bo).
- Tivoli loamy fine sand (Ts).
- Vona loamy fine sand, 5 to 15 percent slopes (Vo).

Decreaser grasses in the climax vegetation, such as sand bluestem, little bluestem, switchgrass, side-oats grama, and big sandreed, make up 65 percent of the vegetation; other perennial grasses and forbs account for the rest. The dominant increasers are such grasses as blue grama, sand dropseed, and sand paspalum. Sand sagebrush is the principal woody invader. Common invaders are false buffalograss, purple sandgrass, and red lovegrass.

Under present management this site is generally in poor condition. It is producing approximately one-fourth its potential in kinds and amounts of plants.

Grazing practices needed to maintain or improve the condition of the site are proper range use, deferred grazing, rotation-deferred grazing, and brush control.

LOAMY UPLAND SITE

This range site consists of nearly level to gently sloping soils that have loam to clay loam surface layers and subsoils. These soils are moderately permeable, well drained, and high in moisture-holding capacity. The soils in this range site and the map symbol of each are as follows:

Bridgeport clay loam (Bp).
 Colby silt loam, 1 to 3 percent slopes (Cb).
 Colby silt loam, 3 to 5 percent slopes (Cc).
 Colby silt loam, 5 to 15 percent slopes (Cd).
 Lofton clay loam (Lo).
 Mansker clay loam, 0 to 3 percent slopes (Mb).
 Mansker clay loam, 3 to 5 percent slopes (Mc).
 Richfield silt loam, 0 to 1 percent slopes (Rm).
 Ulysses silt loam, 0 to 1 percent slopes (Uo).
 Ulysses silt loam, 1 to 3 percent slopes (Ub).
 Ulysses silt loam, 3 to 5 percent slopes (Uc).
 Ulysses-Colby complex, 1 to 3 percent slopes, eroded (Ue).

The climax vegetation is a mixture of such grasses as blue grama, buffalograss, western wheatgrass, side-oats grama, and little bluestem. Buffalograss is the main increaser on grazed areas. Blue grama and buffalograss are the dominant grasses at present. Annuals are the principal invaders. In droughty years pricklypear is the common invader.

Under present management the Loamy Upland site is generally in fair to good condition. It is producing approximately one-half its potential in kinds and amounts of plants.

Grazing practices needed to maintain and improve the condition of the site are proper range use, deferred grazing, and rotation-deferred grazing.

ROUGH BREAKS SITE

The soils in this range site are weakly developed and occur on steep, broken slopes. Runoff is excessive, and the moisture-holding capacity is low.

The mapping unit in this range site and its map symbol are as follows:

Travessilla soils (Ty).

Decreaser grasses in the climax vegetation, such as little bluestem and side-oats grama, make up at least 60 percent of the cover; other perennial grasses and forbs account for the rest. The dominant increasers include blue grama and hairy grama.

Under present management the Rough Breaks site is producing near its potential in kinds and amounts of plants.

Grazing practices needed to maintain or improve the condition of the site are proper range use, deferred grazing, and rotation-deferred grazing.

LOWLAND SITE

Only one soil is in this range site. It is a nearly level, deep, moderately permeable soil that is high in moisture-holding capacity. The texture ranges from sandy loam to clay loam. The site receives additional moisture from occasional floods and as runoff from adjacent areas.

The soil in this range site and its map symbol are as follows:

Goshen silt loam (Go)

Decreaser grasses in the climax vegetation, such as switchgrass, big bluestem, Indiangrass, Canada wildrye, little bluestem, and side-oats grama, make up at least 55 percent of the cover; other perennial grasses and forbs

account for the rest. The dominant increaser grasses include western wheatgrass, blue grama, and buffalograss.

Under present management the Lowland site is producing near its potential in kinds and amounts of plants.

Grazing practices needed to maintain or improve the condition of the site are proper range use, deferred grazing, and rotation grazing.

UNCLASSIFIED

Broken land (Bx) is not classified as to range site because of instability caused by scouring and cutting by floodwaters that quickly recede. The unstable plant cover consists primarily of annual grasses and forbs.

The Lincoln soils (lf) are not classified as to range site because of instability caused by deposition of soil material, shifting of the stream channel, and flooding. The areas are very sandy and gravelly and occur on flood plains of Bear Creek. The vegetation is sparse and unstable. The cover consists primarily of annual grasses and forbs and isolated willows.

Woodland Management

There are no native forests or woodlands in Stanton County. Since trees and shrubs survive only where they receive extra moisture, plantings have been made only for farmstead windbreaks and for shade and landscaping.

Windbreak plantings help protect farmsteads and livestock. They can be established by proper planning and care. Dryland windbreaks, made up of conifers and hardwoods, should remain effective for 25 to 35 years on upland areas and for 40 to 60 years on lowland areas. Competition by grass and weeds for available moisture must be eliminated before trees and shrubs will grow well. Cultivation will keep weeds under control and make the soil favorable for the penetration of water and air. Irrigation and the diversion of runoff water from other areas to the windbreak site will supply extra moisture needed by trees. Irrigated windbreaks provide protection much sooner than those grown on dryland.

The trees most tolerant of drought and suitable for planting are eastern redcedar, Rocky Mountain juniper, Siberian elm, and osage-orange. Blown-out land, Broken land, Lincoln soils, Lofton clay loam, and Travessilla soils are not considered suitable for trees. The other soils are suitable for trees and shrubs and are grouped in planting sites as follows:

Silty Upland site—
 Bridgeport clay loam.
 Colby soils.
 Mansker soils.
 Richfield silt loam.
 Ulysses soils.
 Ulysses-Colby soils.
 Sandy Upland site—
 Bayard fine sandy loam.
 Dalhart soils.
 Manter soils.
 Otero-Manter fine sandy loams.
 Tivoli loamy fine sand.
 Vona loamy fine sand.
 Lowland site—
 Goshen silt loam.

In table 5 the approximate average height of trees and shrubs after 10 years of growth is given for the different sites.

TABLE 5—Trees and shrubs suitable for windbreaks on dry-land and irrigated planting sites and approximate average height attained by trees after 10 years of growth

Suitable trees and shrubs	Silty Upland site		Sandy Upland site		Lowland site	
	Dry-land	Irrigated	Dry-land	Irrigated	Dry-land	Irrigated
	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>
Tamarisk.....	10	20	10	15	12	20
Russian-olive.....	12	22	13	22	15	22
Osage-orange.....	12	22	13	22	15	22
Mulberry.....	15	20	17	24	18	24
Siberian elm.....	22	32	25	35	26	32
Honeylocust.....	12	22	14	24	15	22
Eastern redcedar.....	5	9	8	11	8	9
Rocky Mountain juniper.....	5	9	8	11	8	9
Ponderosa pine.....	5	9	8	11	8	9
Skunkbush sumac.....	5	9	8	11	8	9

Wildlife Management

The ring-necked pheasant is perhaps the best known game bird throughout the county. A few quail, both bobwhite and blue, inhabit areas along the Sand Arroyo and Bear Creek. Jackrabbits are numerous throughout the county. There are a few prairie-dog towns in native pastures. Doves and migratory waterfowl often stop over in the county during migrations.

Areas that are unproductive can be improved to provide food, cover, and water for wildlife native to the area. These areas include ditchbanks, fence rows, farmstead windbreaks, and ponds and adjacent areas. Practices needed are the planting of trees and food-bearing shrubs, construction of ponds, control of grazing, and protection of vegetation from burning. Up-to-date information on management of wildlife areas can be obtained from your county agent or a local representative of the Soil Conservation Service.

Formation and Classification of the Soils

This part of the report tells how the soils were formed, describes the characteristics of the different soils, and classifies the series into great soil groups.

Factors of Soil Formation

Soil is the product of the forces of weathering and soil formation acting on the parent material deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by the interaction of the following factors: (1) The kind of parent material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time the forces of development have acted on the material. A discussion of each of the factors of soil formation follows.

Parent material

Geological history.—About 180 million years ago, shortly before the uplift of the Appalachian Mountains, the area that is now western Kansas was covered by a shallow sea. Marine sediments deposited during this period formed what is known as the Permian rocks (figs. 22 and 23). While the Appalachian Mountains were being formed, the High Plains rose above the level of the sea. Streams flowing over the exposed Permian rocks eroded fine-textured materials and redeposited them along the flood plains. These materials formed the Triassic (?) red beds.

The Cretaceous period began about 100 million years ago with the deposition of sand that became Cheyenne sandstone. Cheyenne sandstone originated from stream deposits or from marine sediments in shallow water. After the deposition of the material that formed the Cheyenne sandstone, the land was again covered by sea. The dark clay that formed the Kiowa shale was deposited in this sea. Next, conditions similar to those during formation of the Cheyenne sandstone recurred, and nearly pure quartz sand was deposited. Cockrum sandstone, which developed from these deposits, is classified as the uppermost division of the Dakota formation and includes beds that were formerly designated as Dakota sandstone. It is the oldest formation (Late Cretaceous) exposed in Stanton County.

Early in the Tertiary or in the Late Cretaceous period, the land was uplifted and erosion began. Swift streams from the Rocky Mountains cut valleys through the Cretaceous rocks and deep into Cockrum sandstone. This geologic erosion removed the overlying Late (Upper) Cretaceous rocks and exposed older rocks of the Dakota formation. A broad basin or trough was formed in the northern part of Stanton County. The present shape of this pre-Tertiary trough is shown in figure 23.

When the Rocky Mountains reached their maximum height and began to erode, sand, gravel, clay, and silt were carried considerable distances by the swift streams. The Ogallala formation (Pliocene and Pleistocene undifferentiated beds) developed from these deposits of outwash material, which were gradually built up to about the present level of the High Plains.

Late in the Pleistocene epoch, several geologic events began and continued, at least intermittently, into the Recent epoch. Much of the present topography is the result of erosion and other geological and climatic changes during this time. Many of the intermittent streams have cut into the rocks of the Ogallala formation. Bear Creek and Sand Arroyo have cut through the Ogallala rocks and exposed Cockrum sandstone of the Dakota formation. Great duststorms deposited a blanket of Peorian loess over much of the area. These storms probably recurred several times. After the loess was deposited, the wind winnowed the plains sediments. This wind action produced the moderately sandy, partially reworked ridges and subdued dune-type topography that occurs mostly south of the streams but also throughout the county.

Parent material of the principal soils.—The soils of Stanton County have developed mainly from the wind-blown deposits of loess, and the old alluvial sediments deposited by water; in places these materials have been

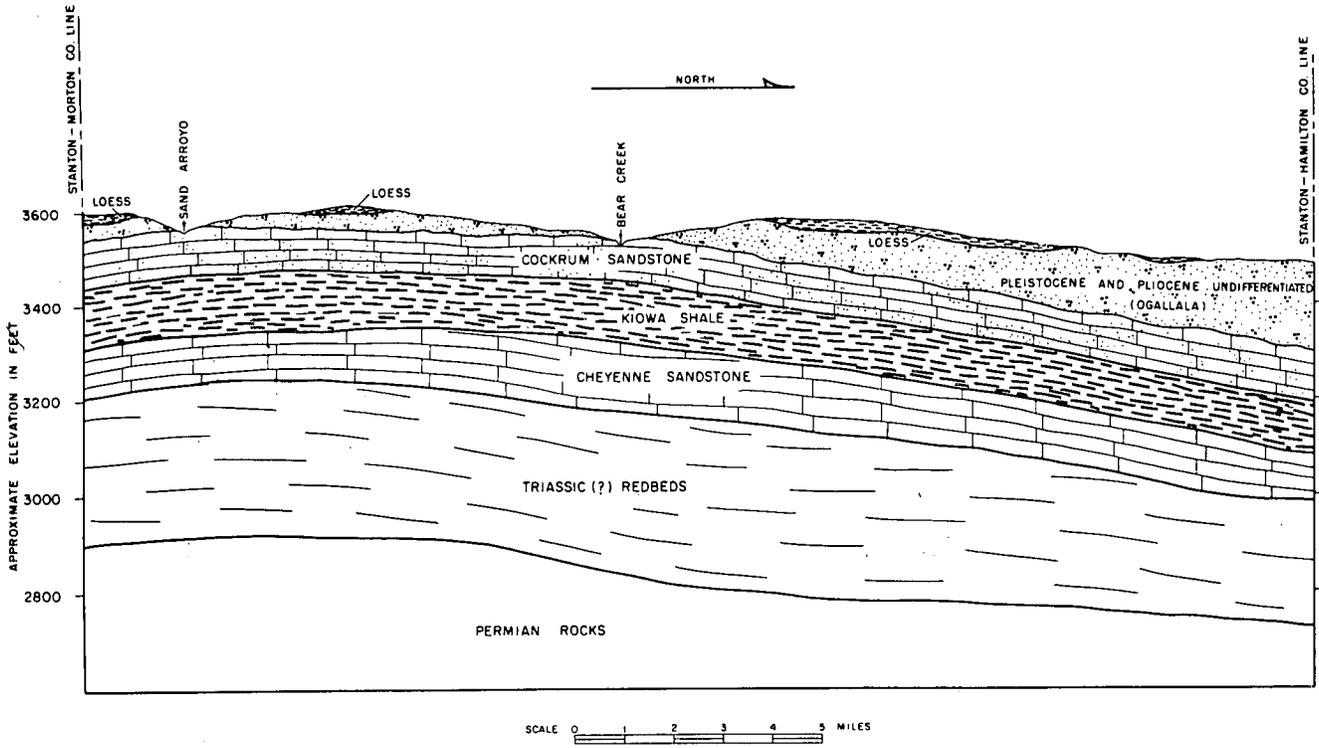


Figure 22.—North-south geologic profile through the western part of Stanton County.

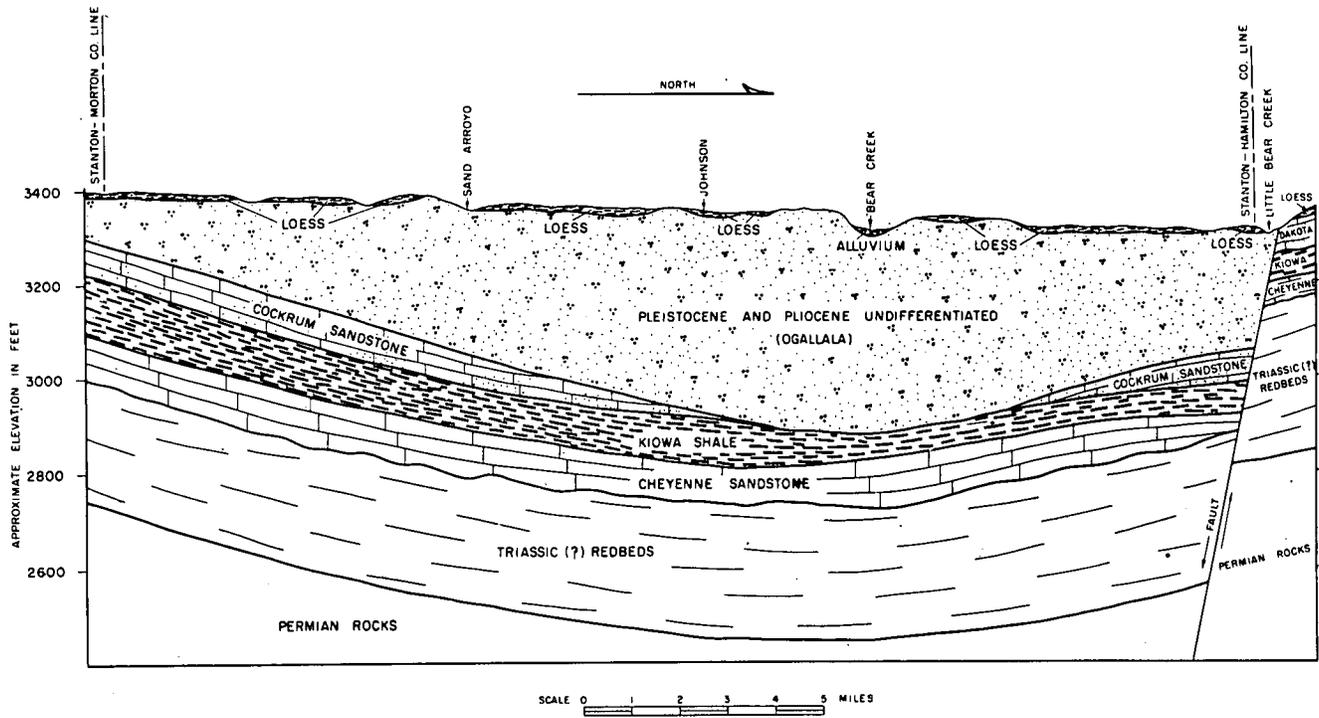


Figure 23.—North-south geologic profile through the central part of Stanton County.

partly reworked since they were deposited. In areas where surface deposits of loess or alluvium are absent, the soils have developed from outcrops of hard sandstone.

The loess was deposited late in the Pleistocene epoch and into the Recent epoch. This silty material was laid down as a thin mantle over most of the county. Loess is more than 50 percent silt and is pale brown, calcareous, friable, and porous. In Stanton County, Richfield silt loam and Ulysses silt loams are the dominant soils developed in loess.

The undifferentiated Pleistocene and Pliocene deposits, as represented by the Ogallala formation, were laid down by streams before the loess was deposited. Wind and water erosion has exposed and reworked the silty to sandy material. The Manter series is the most extensive soil series developed in this material.

Alluvium, consisting of mixtures of sand, gravel, silt, and clay, has been deposited by water in the stream valleys, and, to some extent, in upland drainageways. Alluvium is the youngest material in which soil formation is taking place. Bridgeport clay loam is the dominant kind of soil developed in alluvium.

Sandy sediments were apparently deposited after the loess. Most of the sand lies in narrow bands south of and adjacent to Bear Creek and Sand Arroyo. Tivoli loamy fine sand has developed in this sandy eolian material.

Cockrum sandstone of the Dakota formation in the parent rock of the Travessilla soils.

Climate

Climate affects the physical, chemical, and biological relationships in the soil. The amount of water that percolates through the soil depends partly on rainfall, humidity, and frost-free periods. Water dissolves small amounts of the minerals present, and carries them out of the soil. Temperature influences the growth of organisms and affects chemical reactions in the soil.

Because of the limited amount of precipitation in Stanton County, soil minerals have not been weathered and leached to any great extent. Calcium carbonate may occur at depths as great as 20 to 30 inches, but in places it is at the surface.

Plant and animal life

Animal life and vegetation are indispensable in soil development. Small burrowing animals, worms, and insects help mix the soil. Bacteria, fungi, and other microorganisms help to weather rock and to decompose organic matter. They influence the chemical and biological processes in the soil.

The numerous worm casts in the soils are evidence of the presence of animal life. Ulysses silt loams have many worm casts throughout the soil profile.

The type and amount of vegetation are important in soil development and are determined in part by the climate and in part by the kind of soil material. Vegetation adds organic matter to the soil and thus influences its structure and physical condition as well as its chemical characteristics. It influences the climate within the soil by providing shade and by helping the soil to retain moisture.

The soils of Stanton County have developed under grass. As a result, the typical soil profile in the county consists of dark-colored upper horizons that are rich in organic matter, a transitional horizon that is, in many places, slightly

finer in texture and somewhat lighter in color, and underlying parent material that is generally light in color and high in calcium carbonate.

Relief

Relief, or lay of the land, influences soil formation through its effect on water relationships, erosion, temperature, and plant cover. Soils on steep slopes absorb less moisture, and normally their profiles are not as well-developed as those of soils on flats and in depressions. In addition, the soil-forming processes on steep slopes are retarded by the continual loss of material from the surface through erosion.

Time

The length of time required for soil development depends largely on the other factors of soil formation. Soils develop slowly in the dry climate and under the sparse vegetation of Stanton County, whereas they may develop much more rapidly in areas of moist climate and dense vegetation. As water moves downward through the soil profile, lime and fine particles are gradually leached from the surface and deposited in the subsoil. The amount of this leaching depends primarily on the length of time the soil has been in place, the permeability of the soil, and the amount of water available. As the fine particles are deposited in the subsoil, a horizon of clay accumulation is formed. In many areas, similar horizons of accumulation are formed in the subsoil where lime carbonate is deposited after being leached from the surface soil.

Characteristics of the Soils

The soils of Stanton County have developed under grass and in a semiarid climate. Their parent materials were apparently mainly loess and outwash sediments that were deposited and later reworked by wind and water. A minor part of the parent material, however, was eolian sand and weathered sandstone.

Richfield soils.—These soils have developed from loess. Richfield silt loam, 0 to 1 percent slopes, the only Richfield soil mapped in the county, is dark grayish brown and has good differentiation between the A, B, and C horizons. This soil is generally noncalcareous to depths of 8 to 18 inches. Slopes are normally less than 1 percent.

Ulysses soils.—These soils are intermediate between the Colby and Richfield soils in most characteristics. Ulysses soils have developed in loess or similar silty sediments. They are dark grayish brown, and their B horizon, if present, is only weakly developed. Under native grass, they may be noncalcareous to depths of 6 to 15 inches, but in cultivated areas they are commonly calcareous at the surface. Where associated with Manter soils, the Ulysses soils have surface layers that approach loam in texture.

Colby soils.—The Colby silt loams are the only Colby soils mapped in the county. They are grayish brown and calcareous. They have a weakly developed profile that has A and C horizons but lacks a B horizon. The A horizon consists of only slightly altered and somewhat darkened parent material of loess or similar silty sediments. The Colby silt loams generally occur on somewhat stronger slopes than the Ulysses soils.

Mansker soils.—These soils have developed in somewhat fine textured, highly calcareous, plains sediments. Mans-

ker clay loams, the only Mansker soils mapped in the county, have a weakly developed profile with a prominent horizon of calcium carbonate that generally occurs at depths between 12 and 20 inches. This material is generally underlain by partly weathered, hard caliche within a depth of 30 inches. These soils occupy slopes ranging from 0 to 5 percent.

Manter soils.—These soils have formed from moderately sandy, calcareous plains sediments that have been partly reworked by the wind. Manter fine sandy loams, the only Manter soils mapped in Stanton County, are moderately dark and have a noncalcareous incipient B horizon ranging in texture from loam to light sandy clay loam. The texture of the C horizon varies; it may be sandy clay loam, sandy loam, or loam. Manter soils occupy nearly level to gently sloping relief.

Dalhart soils.—These soils have developed in moderately sandy to moderately fine textured, calcareous plains sediments that have been reworked somewhat by wind. Dalhart fine sandy loams, the only Dalhart soils mapped in the county, are dark grayish brown. They have a B horizon of sandy clay loam. The underlying material, like that of Manter soils, is variable in texture. Most areas of Dalhart soils occur on nearly level to gently sloping relief south of Bear Creek and Sand Arroyo.

Otero soils.—These soils have developed in moderately sandy, calcareous plains sediments. Otero fine sandy loam is mapped in a complex with Manter fine sandy loam. The profile has light-colored A and C horizons but lacks a B horizon. This soil commonly occurs on the crests of ridges and knolls.

Tivoli soils.—These soils occur in the narrow bands of dune topography adjacent to and south of Bear Creek and Sand Arroyo. The soil material has been reworked by wind; most of the finer sediments have been blown away and the fine sand has been left. Tivoli loamy fine sand, the only Tivoli soil mapped in Stanton County, has an A horizon of loamy fine sand, no B horizon, and a C horizon of fine sand.

Bridgeport soils.—These soils have developed in moderately fine textured alluvium that was washed from higher lying areas of calcareous plains sediments. Bridgeport clay loam, the only Bridgeport soil mapped in the county, is moderately dark, well drained, and calcareous. The profile has A and C horizons but lacks a B horizon. Most of the soil is in the nearly level valleys of Bear Creek and Little Bear Creek.

Bayard soils.—These soils have developed in moderately sandy alluvium. Bayard fine sandy loam, the only Bayard soil mapped in Stanton County, is calcareous and lacks a well-developed profile. It occurs in association with the Bridgeport soil along stream bottoms and drainageways, but it does not occupy large, continuous areas.

Goshen soils.—These soils have developed in medium-textured alluvium that washed from higher lying Richfield, Ulysses, and Colby soils. Goshen silt loam, the only Goshen soil mapped in the county, is noncalcareous, dark colored, and has a moderately well developed profile. This soil is generally noncalcareous to a depth of 15 inches. It occupies swales and narrow intermittent drainageways in the upland.

Lofton soils.—These soils have developed from fine-textured material that was blown and washed from adjacent Richfield and Ulysses soils. Lofton clay loam, the

only Lofton soil mapped in the county, occupies upland depressions, locally called potholes. Runoff from adjacent soils collects in these depressions, and the soil has therefore developed under wetter conditions than are normal for this area. As a result, the soil material has undergone more weathering, and the soil profile is more strongly developed than in other soils in the county.

Lincoln soils.—These soils consist of very sandy and gravelly alluvium that occurs adjacent to and in the channel of Bear Creek and in parts of Sand Arroyo. These young soils are calcareous and show little or no profile development. Relief is slightly undulating, and the areas are subject to recurrent flooding and deposition of fresh soil material.

Travessilla soils.—These soils overlie outcrops of Cockrum sandstone of the Dakota formation. They have developed in part from weathered sandstone with some admixture of material deposited by the wind. The Travessilla soils are very shallow and have an undeveloped profile. They occur on steep, broken topography.

Vona soils.—These soils have developed in sandy sediments deposited by the wind. Vona loamy fine sand, the only Vona soil mapped in the county, is deep, light colored, and well drained. It occurs in hummocky areas.

Classification of the Soils

Soils are classified on the basis of the kinds of layers, or *soil horizons*, that are found in a vertical soil section, or *soil profile*. On the basis of similarities of soil profile characteristics, the soils of Stanton County are classified into 15 classes, called soil series. The soils grouped within a soil series may vary somewhat in surface texture or in slope, but they are similar in the kind, thickness, and arrangement of soil horizons in their profiles. Each soil series is named for a place near where it was first identified; for example, the Manter series is named for the town of Manter in Stanton County.

Soil series are further classified into broader classes called great soil groups. The series within each great soil group may differ greatly in characteristics, such as thickness of profile and degree of development of the different horizons, but they have major profile characteristics in common and have similar kinds of horizons arranged in the same sequence. The 15 soil series in Stanton County are classified into 6 great soil groups. Stanton County is in the Chestnut soil zone. Table 6 shows the classification of the soil series into great soil groups and some important characteristics of each of the soil series in the county.

General Nature of the County

This section describes the physiography, relief, and drainage of Stanton County. It also discusses the history and agriculture and other subjects of general interest.

Physiography, Relief, and Drainage

Stanton County lies in the central part of the High Plains section of the Great Plains province. In general, most of the county consists of nearly level to gently sloping upland plains. The land slopes gently to the east.

TABLE 6.—*Classification and important characteristics of the soils of Stanton County*

Great soil group and series	Physiographic position	Relief	Parent material	Native vegetation
Chestnut soils:				
Dalhart.....	High Plains.....	Nearly level to gently sloping.	Partly reworked, moderately sandy, plains sediments.	Grass.
Goshen.....	Swales and narrow intermittent drainageways.	Nearly level.....	Colluvial-alluvial material..	Grass.
Lofton.....	Depressions.....	Nearly level.....	Fine loess and alluvial sediments.	Grass.
Manter.....	Ridges and knobs of the High Plains.	Nearly level to gently undulating.	Partly reworked, moderately sandy, plains sediments.	Grass.
Richfield.....	High Plains.....	Nearly level.....	Loess.....	Grass.
Ulysses (intergrading toward Regosols):	High Plains.....	Nearly level to gently sloping.	Loess.....	Grass.
Brown soils:				
Vona.....	High Plains.....	Hummocky and steep.....	Sandy plains sediment deposited by the wind.	Grass and sagebrush.
Calcisols:				
Mansker.....	Slopes of upland drainageways and also knobs.	Gently to moderately sloping.	Calcareous plains sediments..	Grass.
Alluvial soils:				
Bayard.....	Alluvial flood plains.....	Nearly level to gently undulating.	Moderately coarse textured alluvium.	Grass.
Bridgeport.....	Alluvial benches and broad valleys.	Nearly level.....	Local alluvium.....	Grass.
Lincoln.....	Alluvial flood plains and stream channels.	Nearly level to hummocky..	Sandy alluvium.....	Sparse grass and sagebrush.
Lithosols:				
Travessilla.....	Slopes of streams and upland drainageways.	Steep and broken.....	Weathered sandstone.....	Grass.
Regosols:				
Colby.....	Slopes of upland drainageways.	Gently sloping to moderately steep.	Loess or similar plains sediments.	Grass.
Otero.....	Ridges and knobs of the High Plains.	Gently sloping to undulating.	Partly reworked, moderately sandy, plains sediments.	Grass.
Tivoli.....	Sandhills.....	Slightly dunny to undulating.	Sand deposited by wind.....	Grass and sagebrush.

Throughout the county there are narrow, discontinuous, low ridges that generally run from southwest to northeast. The nearly level plains are broken by these ridges and a few intermittent streams. The more sloping land occurs adjacent to these streams and their tributaries.

A narrow belt of sandy soils, generally less than 2 miles wide, occurs adjacent to and south of the larger streams—Bear Creek and Sand Arroyo. These areas have sandy, subdued dune-type topography next to the stream channel; they become less sandy and less undulating to the south. In general, they are more hilly or rolling than the surrounding land.

Elevations in the county range from 3,700 feet, at a point north of Bear Creek along the Kansas-Colorado state line, to about 3,100 feet, in the southeastern corner. The average gradient is about 20 feet to the mile.

Bear Creek and Sand Arroyo, which cross the county from west to east, comprise the major drainage pattern of the county. The streams in these drainageways flow only for short periods following heavy rains.

Bear Creek, a prominent stream in southeastern Colorado, originates 50 miles or more west of the Kansas state

line. It enters Stanton County about 7 miles north of the southwestern corner. Bear Creek flows northeastward across the county and leaves it at a point about 3 miles south of the northeastern corner. From there it flows a short distance eastward and then northeastward to a point about 10 miles south of the Arkansas River in the southern part of Kearny County, where all traces of it gradually disappear within the sandhills. The waters from Bear Creek never have been known to reach the Arkansas River.

In the southwestern part of Stanton County, Bear Creek has cut a moderately deep, steep-sided valley through the Ogallala formation, exposing the underlying Cockrum sandstone. (See fig. 22.) In the northeastern part of the county, Bear Creek follows an old erosional trough, which is becoming filled with alluvium. This trough is a broad, shallow valley that in places is almost unrecognizable.

Little Bear Creek marks a fault line, across the southwestern corner of Hamilton County and drains southward into Stanton County. This intermittent stream

enters Stanton County about 12 miles west of the northeastern corner and flows southeastward to the point where it joins Bear Creek. Within Stanton County, Little Bear Creek flows within the same old erosional trough as Bear Creek.

The northwestern corner of Stanton County is dissected by tributaries of Little Bear Creek. These tributaries drain northeastward into Hamilton County.

Sand Arroyo enters the county about 2 miles north of the southwestern corner. From here it parallels Bear Creek in a northeasterly direction for about 12 miles, and then it flows east and leaves the county at a point about 7 miles north of the southeastern corner. Like Bear Creek, Sand Arroyo is in a shallow, inconspicuous valley throughout most of its course. In the western part of its course, it has cut a moderately deep, conspicuous valley. After leaving Stanton County, Sand Arroyo joins the North Fork Cimarron River in the southern part of Grant County. The North Fork Cimarron River crosses the southeastern corner of Stanton County in a narrow but prominent valley.

Sand Arroyo is within the watershed of the Cimarron River. Bear Creek and Little Bear Creek are within the watershed of the Arkansas River.

History

Stanton County was organized in 1873 and named in honor of Edwin M. Stanton, a former Secretary of War. Later the county became a part of Hamilton County and remained so until February 1887, when the original boundary lines were restored. The year 1887 was the "big boom" period in Stanton County, and many new settlers came into the area.

In the fall of 1922, the Santa Fe railroad announced it would construct a branch line from Satanta, Kansas, to the Kansas-Colorado State line. By 1923, the line was in operation. News that the new branch line would terminate on the open prairie caused a rush of settlers to the western part of Stanton County. Here, a new town sprang up. It was named Manter, after Frank Manter, a vice president of the Santa Fe railroad.

The population of the county has fluctuated over the years. It has decreased rapidly during prolonged

droughts but has increased as new settlers arrived during periods when there was enough rainfall to produce crops.

When tractors became a practical source of farm power, more and more land was plowed and large-scale, cash-grain farms came into being.

After the drought and duststorms of the 1930's, people began to be concerned about soil erosion and land deterioration. In 1949, the farmers and other landowners organized the county into a soil conservation district to promote proper land use and the conservation of soil and water. Since the formation of the district, soil and water conservation practices such as terracing, contouring, residue management, and supplemental irrigation have been applied on many areas.

Agriculture

The economy of Stanton County is based mainly on dryland farming, although cattle ranching was once predominant. Increasingly large acreages of sod were plowed when wheat became more important as a cash crop and as tractor power became available. Particularly large acreages were plowed in the 1920's. At present most of the land is cultivated, mainly to wheat and grain sorghum that are shipped out of the county. Farming operations are on a large scale and are highly mechanized.

Crops

Wheat and sorghum are the only important crops climatically suited to dryland farming in this part of the High Plains. Minor crops are broomcorn, barley, and rye. On the silty soils, crops are usually grown in a system that leaves the land fallow every other year. During the fallow period, weeds are controlled to conserve moisture for the following crop. Sorghum is generally grown continuously on the sandy soils because of the difficulty in controlling soil blowing during a fallow period.

Acreage of various crops harvested in Stanton County are given for stated years in table 7.

Pasture

Stanton County has approximately 40,000 acres of grassland. Most of the pasture and rangeland either is nonarable or lies within nonarable areas. The spots within nonarable areas are not convenient to cultivate.

TABLE 7.—Acreage of various crops harvested in stated years¹

Crop	1919	1925	1930	1935	1940	1945	1950	1955	1957
Wheat.....	416	19,791	83,102	4,310	78,000	158,000	154,000	94,000	19,000
Sorghum:									
Grain.....	(²)	20,788	15,917	26,012	38,980	21,880	27,800	71,500	110,000
Forage.....	(²)	6,374	3,105	38,641	19,430	20,490	10,180	53,900	21,000
Corn.....	1,167	3,348	11,823	10,041	500	50	20	20	300
Barley.....	213	2,999	5,392	2,434	9,380	4,430	940	650	1,400
Rye.....	69	74	100	0	80	10	20	300	200
Broomcorn.....	1,603	2,058	7,590	7,994	1,025	940	350	220	1,420
Alfalfa.....	0	0	5	0	0	0	90	1,060	600
Sugar beets.....	0	0	0	0	0	0	0	0	1,150

¹ Based on biennial reports of the Kansas State Board of Agriculture.

² Not reported.

TABLE 8.—Numbers of livestock in stated years¹

Livestock	1919	1921	1925	1930	1935	1940	1945	1950	1955	1957
Horses and mules	3,309	3,633	4,116	1,657	933	220	480	350	270	200
Milk cows	226	385	471	367	531	1,000	700	490	400	300
Other cattle	11,737	12,614	8,546	4,313	4,877	2,230	19,100	10,410	14,500	7,700
Sheep	55	280	193	711	6,978	4,320	26,500	9,460	13,770	8,400
Hogs	440	793	959	1,601	1,150	1,650	2,270	1,920	500	650
Chickens	(²)	11,860	21,100	15,600	10,000	9,300				

¹ Based on biennial reports of the Kansas State Board of Agriculture.

² Not reported.

Livestock

The number of livestock on farms and ranches in Stanton County in stated years is shown in table 8. Cattle usually outnumber other kinds of livestock. The number of cattle is relatively stable but decreases during continued drought. Many sheep and cattle are brought into the county during years when wheat pasture and sorghum stubble are available for grazing. The number of cattle and sheep is therefore much greater during fall and winter than during the rest of the year. The number of dairy cattle is consistently low. Many farmers do not keep a milk cow. Hogs and poultry are of minor commercial importance.

Farm equipment and labor

Tillage and harvesting are performed with mechanically powered equipment. In the early 1920's most of the farm power was supplied by horses and mules. In 1921, the Kansas State Board of Agriculture reported only 11 tractors in the county. In 1954, a total of 672 tractors were reported by the Federal census. Large, standard wheel-type tractors are generally used on dryland farms, while general purpose or rowcrop tractors are used on irrigated land.

Wheat and grain sorghum are harvested with large, self-propelled combines. In 1930, only 50 combines were reported by the Kansas State Board of Agriculture, but by 1954 there were 277 combines, according to the Federal census. Most farmers own enough equipment for tillage and planting, but many must hire part or all of their grain combined. Custom operators from outside the area commonly furnish much of the labor and the equipment needed for the harvest. The demand for farm labor is seasonal. The local labor supply is about adequate for planting and tillage, but transient labor is generally needed for harvesting.

Tenure and size of farms

According to the 1954 census, about 14 percent of the farms were operated by owners, 53 percent, by part owners, and 33 percent, by tenants. Only one farm was operated by a manager. Few dryland farmers own all the land they operate. Commonly an operator rents land from three or four different owners. Leasing arrangements are usually on a crop-share basis; the landlord gets from one-fourth to one-third of the crop.

The number of farms in the various size groups is shown in figure 24.

Water Supply

In Stanton County, water for domestic use is obtained from drilled wells. Most of the water for livestock comes from wells, but a few small dams to impound water have been constructed across intermittent streams in the upland. During extended droughts, there is not enough water in these ponds to supply livestock. Water in sufficient quantity to irrigate field crops is pumped from deep wells drilled in the rocks of the Ogallala and Dakota formations.

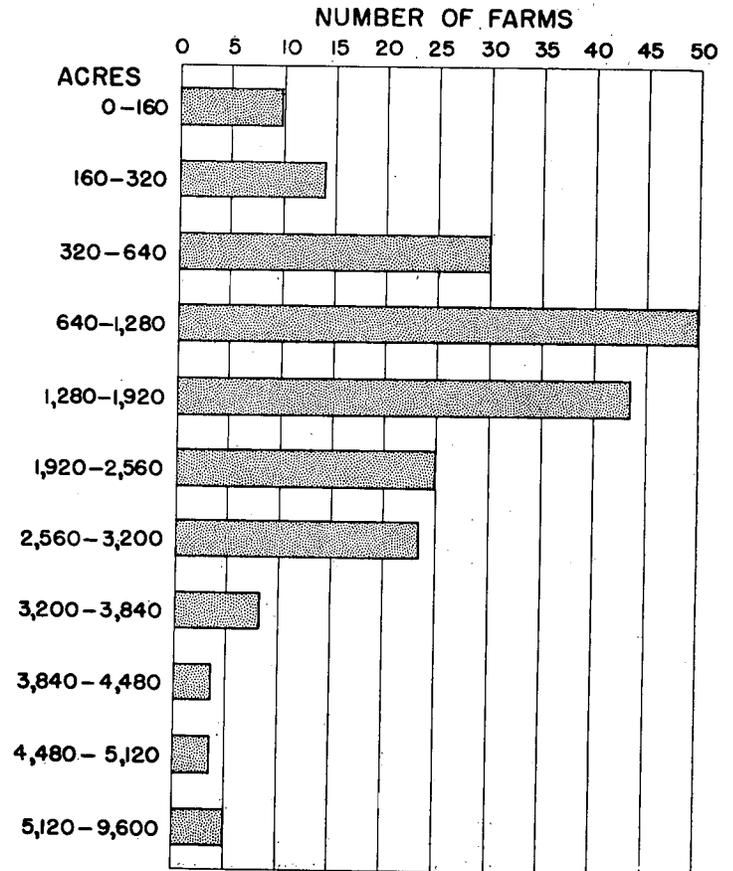


Figure 24.—Number of farms in various size groups in Stanton County:

Industries

Nonagricultural industries are of minor importance in Stanton County. The largest nonagricultural industry is the production of natural gas. The gas wells, which occur mostly in the eastern third of the county, constitute part of Hugoton gasfield.

Sand and gravel used locally for road surfacing and in concrete are obtained mostly from stream channels. In some places hard calcareous beds (caliche) provide road-surfacing materials.

Transportation and Markets

Stanton County is served by the Atchison, Topeka, and Santa Fe Railroad, which runs from Dodge City through Satanta and into Colorado. The railroad passes through all the communities in the county—Bigbow, Johnson, Manter, and Saunders.

U.S. Highway 160 passes from east to west through the middle of the county. State Highway 27 crosses the middle of the county from north to south. U.S. Highway 270 coincides with State Highway 27 from the northern boundary to Johnson, and from there it follows the same route eastward as U.S. Highway 160. Some of the county roads and the roads along section lines are impassable at times because of mud or drifting snow. In general, however, the roads are good throughout the year.

All the towns have grain-handling and storage facilities and provide railroad transportation to the terminal elevators and markets to the east.

Community Facilities

All rural elementary schools have been consolidated with schools in Bigbow, Johnson, and Manter. Students are transported by schoolbuses.

Churches of various denominations are located in Johnson, Manter, and Bigbow. There is a small hospital at Johnson.

Since the Rural Electrification Administration was organized, all rural areas have been served with electricity. According to the 1954 census, 251 farms have electricity.

Glossary

Aggregate. A single mass or cluster of soil consisting of many soil particles held together.

Alluvium. Sand, silt, mud, or other sediments deposited by running water.

Buried soil. Soil covered by more recently deposited materials in which the present soil has formed.

Calcareous soil or soil material. Soil containing sufficient free calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with hydrochloric acid.

Classification, soil. Soils are arranged into groups, in several categories, on the basis of their characteristics. Beginning with the lowest category, the soil type, soils are classified on the basis of progressively fewer characteristics into the groups of more inclusive categories, namely, series, family, great soil group, suborder, and order.

Clay. Small mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that contains 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A coating or film of clay that has been deposited on the surface of a soil aggregate.

Clay loam. Soil material containing 27 to 40 percent clay and 20 to 45 percent sand.

Colluvium. Soil material or mixtures of soil material and rock fragments that have moved downslope and accumulated through the influence of gravity, including creep and local wash.

Complex, soil. A soil mapping unit consisting of two or more soil types or phases so intermingled that they cannot be separated on the scale of mapping used.

Concretion. Local concentration of certain chemical compounds, such as calcium carbonate or compounds of iron, that form nodules of mixed composition and of various sizes, shapes, and coloring.

Consistence, soil. The attributes of soil material that are expressed by the degree and kind of cohesion and adhesion or by the resistance to deformation or rupture. Terms commonly used to describe consistence are *loose, soft, hard (dry)*; *friable, firm, loose (moist)*; and *sticky or plastic (wet)*. *Friable* soil, for example, is easily crumbled by the fingers.

Deep soil. Terms that relate to depth of soil need to be defined in relation to the purpose for which they will be used. In this report a soil described as deep has an effective root zone of 36 inches or more over rock or other strongly contrasting material.

Field capacity. The amount of moisture remaining in a soil after the free water has been allowed to drain away into drier soil material beneath; usually expressed as a percentage of the oven-dry weight of soil or other convenient unit. It is the highest amount of moisture that the soil will hold under conditions of free drainage after excess water has drained away following a rain or irrigation that has wet the whole soil.

Gravel. Rounded or angular fragments from 2 millimeters to 3 inches in diameter.

Horizon, soil. A layer of soil, approximately parallel to the soil surface, that has characteristics produced by soil-forming processes. The relative positions of the several soil horizons in the soil profile and their nomenclature are given below:

A horizon. The surface horizon of a mineral soil having maximum biological activity, or eluviation (movement of soil materials from one place to another within the soil), or both.

B horizon. A layer of soil, usually beneath the A horizon, in which clay, iron, and aluminum compounds, and accessory organic matter have accumulated. It has well-defined characteristics, in contrast to horizons above and below, of texture, structure, and usually color.

C horizon. A layer of unconsolidated material, relatively little affected by influence of organisms and presumed to be similar in physical, chemical, and mineralogical composition to the material from which at least part of the overlying solum has developed.

Loamy sand. Soil material containing at the upper limit 85 to 90 percent sand, and the percentage of silt plus 1½ times the percentage of clay is not less than 15; at the lower limit it contains not less than 70 to 85 percent sand, and the percentage of silt plus twice the percentage of clay does not exceed 30.

Loamy soils. A general expression for soils with textures intermediate between clay and sand.

Loess. Geologic, wind-transported deposit of relatively uniform fine sediments, high in silt content.

Outwash sediments. Old alluvial sediments, generally now in upland positions, that consist of more or less sorted gravel, sand, silt, or clay.

Phase, soil. The subdivision of a soil type or other soil classification unit on the basis of variations in characteristics that are not significant to the classification of the soil in its natural landscape but are significant to the use and management of the soil. Differences in slope and degree of erosion account for the main variations of this kind in western Kansas.

Profile, soil. A vertical section of the soil through all its horizons and extending into the underlying, or parent, material.

Relief. The differences in altitude of a land surface, considered collectively.

Sand. Individual mineral particles having diameters of 0.05 to 2.0 millimeters. The textural class name for soil material that contains 85 percent or more of sand; the percentage of silt, plus 1½ times the percentage of clay, does not exceed 15.

Sandy clay. Soil material containing 35 percent or more clay and 45 percent or more sand.

Sandy clay loam. Soil material that contains 20 to 35 percent clay, less than 28 percent silt, and 45 percent or more sand.

Sandy loam. Soil material that contains either 20 percent clay or less, and the percentage of silt plus twice the percentage of clay exceeds 30, and 52 percent or more sand; or less than 7 percent clay, less than 50 percent silt, and between 43 and 52 percent sand.

Series, soil. A group of soils that have horizons similar in their differentiating characteristics and arrangement within the profile, except for texture of the surface soil, and are formed from similar parent materials. Each soil series is given the name of a town or other geographic feature, generally one near the place where it was first identified, such as Colby, Richfield, or Ulysses.

Silt. Individual mineral particles having diameters of 0.002 to 0.05 millimeter. The textural class name for soil material containing 80 percent or more silt and less than 12 percent clay. Locally the term silt is also used to refer to loamy sediments of any size class that were deposited by floodwaters.

Silt loam. Soil material that contains 50 percent or more silt and 12 to 27 percent clay or 50 to 80 percent silt and less than 12 percent clay.

Silty clay. Soil material that contains 40 percent or more clay and 40 percent or more silt.

Silty clay loam. Soil material that contains 27 to 40 percent clay and less than 20 percent sand.

Solum. The upper part of the soil profile, above the parent material, in which the processes of soil formation are active. This includes the A and B horizons in mature soils.

Structure, soil. The aggregation of primary soil particles into compound particles that are separated from adjoining aggregates by surfaces of weakness. An individual soil aggregate is called a ped.

Subsoil. Generally, that part of the soil below the plow layer in which plant roots grow. The B horizon in soils with distinct profiles.

Texture, soil. Refers to the relative proportions of clay, silt, and sand in soil material. It is indicated by the textural class name—such as silt loam or sandy clay—of the soil. (See Clay; Sand; Silt; and also the definitions of the following textural classes: Clay loam; Loamy sand; Sandy clay; Sandy clay loam; Sandy loam; Silt loam; Silty clay; Silty clay loam.)

Coarse-textured soil. Soil material of textural classes of sand and loamy sand. (Also known as light texture.)

Fine-textured soil. Soil material of textural classes of sandy clay, silty clay, and clay. (Also known as heavy texture.)

Tilth. The physical condition of a soil in respect to its fitness for growth of specified plants.

Topsoil. A general term used in at least four different senses: (1) surface soil layer or plow layer; (2) the original or present dark-colored upper soil; (3) the A horizon; (4) presumed fertile soil material used to spread on lawns, gardens, and roadbanks.

Type, soil. A subdivision of a soil series based on texture of the A horizon. The name of a soil type consists of the series name plus the textural class name of the A horizon; examples are Colby silt loam and Ulysses silt loam.

GUIDE TO MAPPING UNITS, CAPABILITY UNITS, AND RANGE SITES

[See table 1, p. 9, for approximate acreage and proportionate extent of the soils, and table 3, p. 2, for estimated average yields per acre on arable soils under dryland farming]

Map symbol	Mapping unit	Capability unit				Range site	Page	
		Page	Dryland	Page	Irrigated			
Ba	Bayard fine sandy loam.....	9	IVe-2	23	IIIs-1	28	Sandy.....	31
Bo	Blown-out land.....	9	VIe-2	23	(1)		Sands.....	31
Bp	Bridgeport clay loam.....	10	IIIc-1	22	I-1	27	Loamy Upland.....	32
Bx	Broken land.....	10	VIIw-1	23	(1)		(2).....	
Cb	Colby silt loam, 1 to 3 percent slopes.....	10	IVe-1	22	IIe-1	29	Loamy Upland.....	32
Cc	Colby silt loam, 3 to 5 percent slopes.....	11	VIe-1	23	(1)		Loamy Upland.....	32
Cd	Colby silt loam, 5 to 15 percent slopes.....	11	VIe-1	23	(1)		Loamy Upland.....	32
Da	Dalhart fine sandy loam, 0 to 1 percent slopes.....	11	IIIe-2	22	I-2	27	Sandy.....	31
Db	Dalhart fine sandy loam, 1 to 3 percent slopes.....	11	IIIe-3	22	IIe-2	29	Sandy.....	31
Go	Goshen silt loam.....	11	IIIc-2	22	I-1	27	Lowland.....	32
Lf	Lincoln soils.....	12	VIIw-1	23	(1)		(2).....	
Lo	Lofton clay loam.....	12	IVw-1	23	(1)		Loamy Upland.....	32
Mb	Mansker clay loam, 0 to 3 percent slopes.....	13	IVe-1	22	(1)		Loamy Upland.....	32
Mc	Mansker clay loam, 3 to 5 percent slopes.....	13	VIe-1	23	(1)		Loamy Upland.....	32
Mf	Manter fine sandy loam, 0 to 1 percent slopes.....	14	IIIe-2	22	IIIs-1	28	Sandy.....	31
Mh	Manter fine sandy loam, 1 to 3 percent slopes.....	13	IIIe-3	22	IIe-2	29	Sandy.....	31
Mk	Manter fine sandy loam, 3 to 5 percent slopes.....	14	IVe-2	23	(1)		Sandy.....	31
Ox	Otero-Manter fine sandy loams, 1 to 5 percent slopes.....	14	IVe-2	23	(1)		Sandy.....	31
Rm	Richfield silt loam, 0 to 1 percent slopes.....	15	IIIc-1	22	I-1	27	Loamy Upland.....	32
Ts	Tivoli loamy fine sand.....	15	VIe-2	23	(1)		Sands.....	31
Ty	Travessilla soils.....	16	VIIIs-1	24	(1)		Rough Breaks.....	32
Ua	Ulysses silt loam, 0 to 1 percent slopes.....	16	IIIc-1	22	I-1	27	Loamy Upland.....	32
Ub	Ulysses silt loam, 1 to 3 percent slopes.....	17	IIIe-1	22	IIe-1	29	Loamy Upland.....	32
Uc	Ulysses silt loam, 3 to 5 percent slopes.....	17	IVe-1	22	(1)		Loamy Upland.....	32
Ue	Ulysses-Colby complex, 1 to 3 percent slopes, eroded.....	17	IVe-1	22	IIe-1	29	Loamy Upland.....	32
Vo	Vona loamy fine sand, 5 to 15 percent slopes.....	17	VIe-2	23	(1)		Sands.....	31

¹ Considered unsuitable for irrigation.

² Because the soil and vegetation are unstable, this soil is not considered a true range site.



Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at (800) 457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at <http://offices.sc.egov.usda.gov/locator/app>.

Nondiscrimination Statement

Nondiscrimination Policy

The U.S. Department of Agriculture (USDA) prohibits discrimination against its customers, employees, and applicants for employment on the basis of race, color, national origin, age, disability, sex, gender identity, religion, reprisal, and where applicable, political beliefs, marital status, familial or parental status, sexual orientation, whether all or part of an individual's income is derived from any public assistance program, or protected genetic information. The Department prohibits discrimination in employment or in any program or activity conducted or funded by the Department. (Not all prohibited bases apply to all programs and/or employment activities.)

To File an Employment Complaint

If you wish to file an employment complaint, you must contact your agency's EEO Counselor (<http://directives.sc.egov.usda.gov/33081.wba>) within 45 days of the date of the alleged discriminatory act, event, or personnel action. Additional information can be found online at http://www.ascr.usda.gov/complaint_filing_file.html.

To File a Program Complaint

If you wish to file a Civil Rights program complaint of discrimination, complete the USDA Program Discrimination Complaint Form, found online at http://www.ascr.usda.gov/complaint_filing_cust.html or at any USDA office, or call (866) 632-9992 to request the form. You may also write a letter containing all of the information requested in the form. Send your completed complaint form or letter by mail to U.S. Department of Agriculture; Director, Office of Adjudication; 1400 Independence Avenue, S.W.; Washington, D.C. 20250-9419; by fax to (202) 690-7442; or by email to program.intake@usda.gov.

Persons with Disabilities

If you are deaf, are hard of hearing, or have speech disabilities and you wish to file either an EEO or program complaint, please contact USDA through the Federal Relay Service at (800) 877-8339 or (800) 845-6136 (in Spanish).

If you have other disabilities and wish to file a program complaint, please see the contact information above. If you require alternative means of communication for

program information (e.g., Braille, large print, audiotape, etc.), please contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

Supplemental Nutrition Assistance Program

For additional information dealing with Supplemental Nutrition Assistance Program (SNAP) issues, call either the USDA SNAP Hotline Number at (800) 221-5689, which is also in Spanish, or the State Information/Hotline Numbers (<http://directives.sc.egov.usda.gov/33085.wba>).

All Other Inquiries

For information not pertaining to civil rights, please refer to the listing of the USDA Agencies and Offices (<http://directives.sc.egov.usda.gov/33086.wba>).