SOIL SURVEY

Blaine County Nebraska

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UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with the
UNIVERSITY OF NEBRASKA
Conservation and Survey Division

How to Use THE SOIL SURVEY REPORT

FARMERS who have worked with their soils for a long time know about differences among soils on their own farms and perhaps about differences among the soils on farms of their immediate neighbors. What they do not know, unless soil surveys have been made, is how nearly their soils are like those on experiment stations or other farms, either in their State or other States, where farmers have gained experience with new or different farming practices or enterprises. Farmers and ranchers in Blaine County can avoid some of the risk and uncertainty involved in trying new crops and soil management practices by using this report, for it maps and describes the soils in their county and therefore allows them to compare the soils on their holdings with soils on which new developments have proved successful.

SOILS OF A PARTICULAR FARM

All the soils in Blaine County are shown on the map that accompanies this report. To learn what soils are on a farm or other tract of land, it is first necessary to locate its boundaries on the map. To do this, find the general locality of the farm by using township and section lines, and then locate its boundaries by roads, streams, villages, dwellings, and other landmarks shown on the map. Remember that an inch on the map equals about three-fourths of a mile on the ground.

The next step is to identify the soils on the ranch or farm. Suppose, for example, one finds on a farm an area marked with the symbol VB. This symbol identifies one kind of soil. Look among the colored rectangles in the margin of the map and find the one with VB printed on it. Just above this rectangle is the name of the soil—Valentine fine sand, undulating. All areas of this soil, wherever they appear on the map, have the symbol and color shown in this rectangle.

What is Valentine fine sand, undulating, like, and for what is it used? For this information turn to the section on Soil Types and Phases, where each soil is described and its use and management are briefly discussed. How productive is this soil? The answer will be found in table 5. Find Valentine fine sand, undulating, in the left-hand column of this table and in the columns opposite read the yields of different crops it can be expected to produce. Compare these yields with those given in the table for other soils in the county.

What uses and management practices are suitable for Valentine fine sand, undulating? For this information, first read what is said about the soil in the section on Soil Types and Phases, and then refer to the sections titled Soils and Their Relations and Use, Management, and Productivity of Blaine County Soils.

SOILS OF THE COUNTY AS A WHOLE

A general idea of the soils is given in the introductory part of the section on The Soils of Blaine County and Their Use and Management. This section tells about the principal kinds of soils, where they are found, and how they are related to one another. While reading this section, refer to the soil map and notice how different kinds of soils tend to be arranged in different parts of the county. For example, contrast the soil pattern of the sandhill region in the northern part with the pattern in the loess hills region in the southeastern part. Colors on the map will help you in this. The soils of the county are divided into ten groups, and each group is shown in a different shade of color. The soil patterns on the map frequently indicate well-recognized differences in type of farming, land use, and land-use problems.

A newcomer to the county, especially if he considers buying a farm, will want to know about the climate; types and sizes of farms; principal farm and ranch products and how they are marketed; kinds and conditions of farm tenure, including tenancy; kinds of ranch and farm buildings, equipment, and machinery; availability of churches, schools, roads, railroads, electric power, and water supplies; and cities, villages, and population characteristics. Information about all of these will be found in the sections titled General Nature of the Area, Agriculture, and Additional Facts About the County.

Those interested in how the soils of the county were formed and how they are related to the great soil groups of the world should read the section on Morphology, Genesis, and Classification of Soils.

This publication on the soil survey of Blaine County, Nebraska, is a cooperative contribution from the—

SOIL CONSERVATION SERVICE
and the
UNIVERSITY OF NEBRASKA
Conservation and Survey Division

Issued October 1954

SOIL SURVEY OF BLAINE COUNTY, NEBRASKA [1]

By M. H. LAYTON, Division of Soil Survey, United States Department of Agriculture

Area inspected by B. H. WILLIAMS and F. A. HAYES, Soil Scientists
United States Department of Agriculture in cooperation with the University of Nebraska Conservation and Survey Division

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[1] Field work for this survey was done while the Division of Soil Survey was a part of the Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration. It was transferred to the Soil Conservation Service on Nov. 15, 1952.

BLAINE County, in the sandhills of Nebraska, is cattle country. Native grass grows abundantly and water is easily obtained from springs and shallow wells. The fairly stable livestock industry now established is appropriate for the soils, most of which are good for native pasture and hay but unsuited to cultivated crops. Ranchers have benefited from past unsuccessful attempts to cultivate the sandy, erodible soils of this county. They cultivate only small acreages, mostly on terraces and bottom lands along streams, and leave the rest under a protective cover of sod. To assist farmers and ranchers in determining the best use and management for their soils, this soil survey was made by the United States Department of Agriculture in cooperation with the University of Nebraska Conservation and Survey Division. Field work was completed in 1941, and, unless otherwise specifically mentioned, all statements in this report refer to conditions in the county at that time.

GENERAL NATURE OF THE AREA

LOCATION AND EXTENT

Blaine County is a rectangular area in north-central Nebraska measuring 24 miles from north to south and 30 miles from east to west (fig. 1). Brewster, the county seat, is 180 miles northwest of Lincoln.

HISTORY AND POPULATION

The first white settlers in the area now within Blaine County were cattlemen who set up ranch headquarters along the North Loup and Middle Loup Rivers. The county was organized in 1885 and named after James G. Blaine of Maine, at that time a recent candidate for the Presidency. Early white settlers came mostly from eastern and southeastern Nebraska, though a few were from other States.

Raising of beef cattle has always been the most important farm enterprise. Dryland farming was attempted before 1900, but the farmers were soon discouraged by drought, insects, and wind erosion. Their lands were taken up by cattlemen. The grasslands of the sandhills and the hay lands of the sandhill valleys and basins have since supported a fairly stable livestock industry.

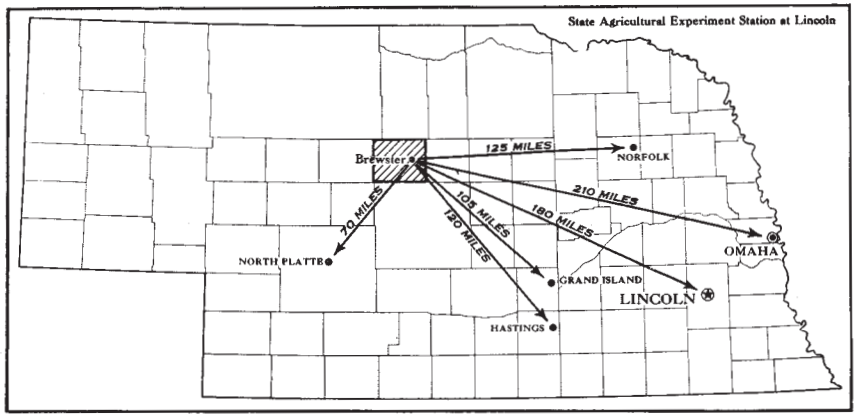

FIGURE 1.—Location of Blaine County in Nebraska.

Population trends have been erratic. The county had 1,146 inhabitants in 1890, but by 1900 nearly half the people had left because of crop failure and shortage of pasture caused by drought and grasshopper damage. Between 1900 and 1930, the population about trebled. In 1950 the county had 1,203 inhabitants, or about the same as it had in 1890. The entire population is classed as rural.

Towns are few and small in size. Brewster, the county seat, had 69 people in 1950. Dunning, with a population of 254 in 1950, is the largest town. It is in the south-central part of the county on a line of the Chicago, Burlington, and Quincy Railroad Company. Purdum has the only bank in the county.

PHYSIOGRAPHY, RELIEF, AND DRAINAGE

PHYSIOGRAPHY

The county is in the northern part of the High Plains Section of the Great Plains physiographic province (*3*).[2] All of it is within the sandhills, except the extreme southeastern corner.

The county is part of a former nearly level to rolling constructional plain of Tertiary age, the relief of which has been considerably modified by wind and water. The bedrock under the entire county is the Ogallala formation of Pliocene (late Tertiary) age (*2*, *7*). In most places the loose sand of the stabilized dunes lies directly on the eroded surface of the Ogallala formation. In the southeastern corner of the county, however, there are terrace deposits overlying the sandstone and a thin capping of loess on the old terrace alluvium (see fig. 12, p. 51).

Sandhills.—In the sandhills, which cover most of the county, the characteristics of the topography are mostly those produced by wind erosion and deposition (*2*). The wind has piled loose sand, believed to have been derived through wind action on late Tertiary and early Pleistocene deposits, into dunes and ridges 10 to 100 feet high. Some of the larger hills, however, are not merely huge piles of eolian sand, but cores of solid Tertiary rock with a mantle of sand.

[2] Italic numbers in parentheses refer to Literature Cited, p. 60.

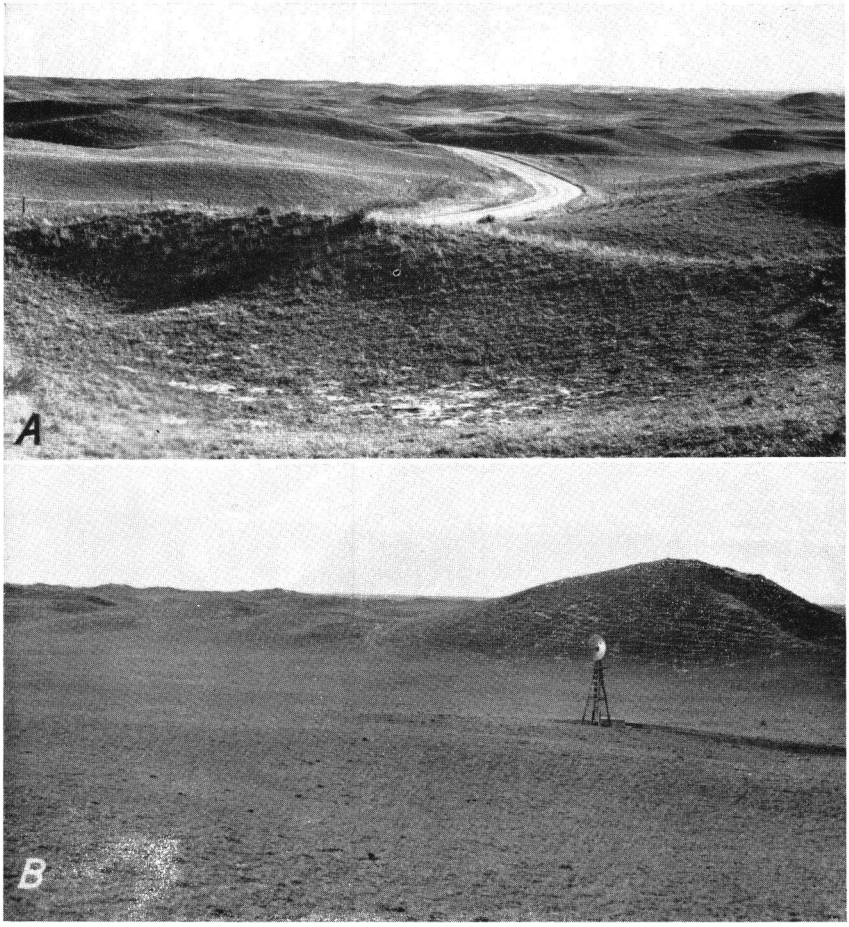

FIGURE 2.—Dune sand, stabilized: *A*, Landscape a few miles southwest of Brewster on State Highway No. 7; *B*, Area northeast of Dunning showing "catstep" erosion on side of dune and windmill to pump water for livestock.

The dunes and ridges are well covered with grass (fig. 2). Most of them are smoothly rounded, but some of them—locally called "choppies"—have sharper tops and more abrupt slopes. These "choppies" have a sparse grass cover and many are pitted with blowouts, especially on the north and west (windward) sides.

In some localities throughout the sandhills, loess has blown or washed into low places and now overlies the loose sand. In the southeastern part of the county, outlying areas of loess, more or less mixed with sand, are scattered among typical sandhill areas.

The generally hilly topography of the sandhills is relieved here and there by undulating or nearly level areas and by numerous small pockets and basins (fig. 3). It is further modified by broad flat-bottomed shallow valleys of the North Loup, Middle Loup, and Dismal Rivers, all of which flow southeastward across the county. On bottoms and terraces along these rivers and their tributaries the alluvial lands of the county occur.

FIGURE 3.—Typical area of Valentine fine sand, undulating, near northeastern corner of Blaine County.

Loessal upland.—The topography of the small area of loessal upland in the southeastern corner of the county is quite different from that of the sandhills (fig. 4). The predominant features of the landscape result from water erosion, not wind deposition. Nevertheless, the topography has been modified in some places by drifting sand. The intricate system of tributaries to the North Loup and Middle Loup Rivers has deeply carved the loess and alluvial deposits. Along the V-shaped valleys of these tributaries there are a few flat-topped divides that rise 20 to 80 feet, or to approximately the level of a former loess plain that extended northward beyond the present boundaries of the loess area. Dune sand has blown up onto the west and north sides of these high divides, covered the loess, and given a characteristic sandhill appearance to the landscape. In some places the loess is completely covered, and in others it is found at the surface only near the centers of enclosed valleys and pockets.

Alluvial lands.—Stream terraces and bottoms one-half to one mile wide occur in continuous strips along the North Loup and Middle Loup Rivers, in narrow strips along the Dismal River and Goose Creek, and in discontinuous strips along Rifle and Wild Horse Creeks (fig. 5). These alluvial lands are generally nearly level or level but in places have been reworked by wind and are hummocky. Some areas of alluvial land have a loesslike character because loess has been washed down on them.

GENERAL RELIEF

The county as a whole slopes gently to the south and east. The average elevation is about 2,700 feet above sea level. Elevations have been determined by the United States Geological Survey for many places, including Dunning, 2,624 feet; Linscott, 2,708; and the place where the railroad crosses into Thomas County, 2,698 (*4*). Stream flood plains and terraces generally lie about 75 feet below the surrounding upland.

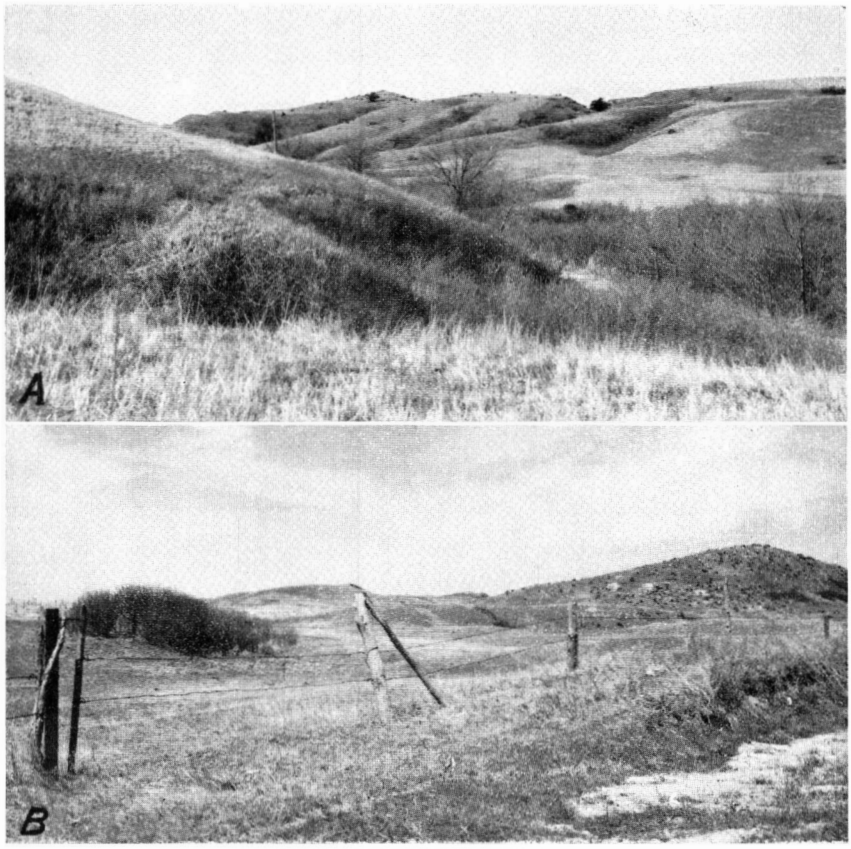

FIGURE 4.—Landscapes in southeastern corner of Blaine County: *A*, Colby fine sandy loam, eroded undulating and rolling, with shrubs and trees in gullies and other protected places; *B*, Colby fine sandy loam, eroded undulating and rolling, with dune sand, rolling and hilly, encroaching on loess hills in left background.

DRAINAGE

The principal streams are the North Loup and Middle Loup Rivers, which flow southeastward across the county. Tributaries are the Dismal River and Goose, Wild Horse, and Rifle creeks. These, with other small streams, complete the drainage system. The county as a whole is well drained; the only poorly drained areas are small patches on the flood plains of streams and in a few basins in the northern part of the county.

An important feature of drainage in the sandhills not apparent to the casual observer is the underground movement of water. There is little runoff in the sandhills; most of the precipitation is quickly absorbed. Rain water moves down rapidly in the loose sands to unite with the ground water. The ground water does not lie in stagnant underground lakes or pools; it moves from areas of high intake to those of natural ground-water discharge. Subsurface water that originated in the sandhills supplies well water for many Nebraska areas south and southeast of Blaine County.

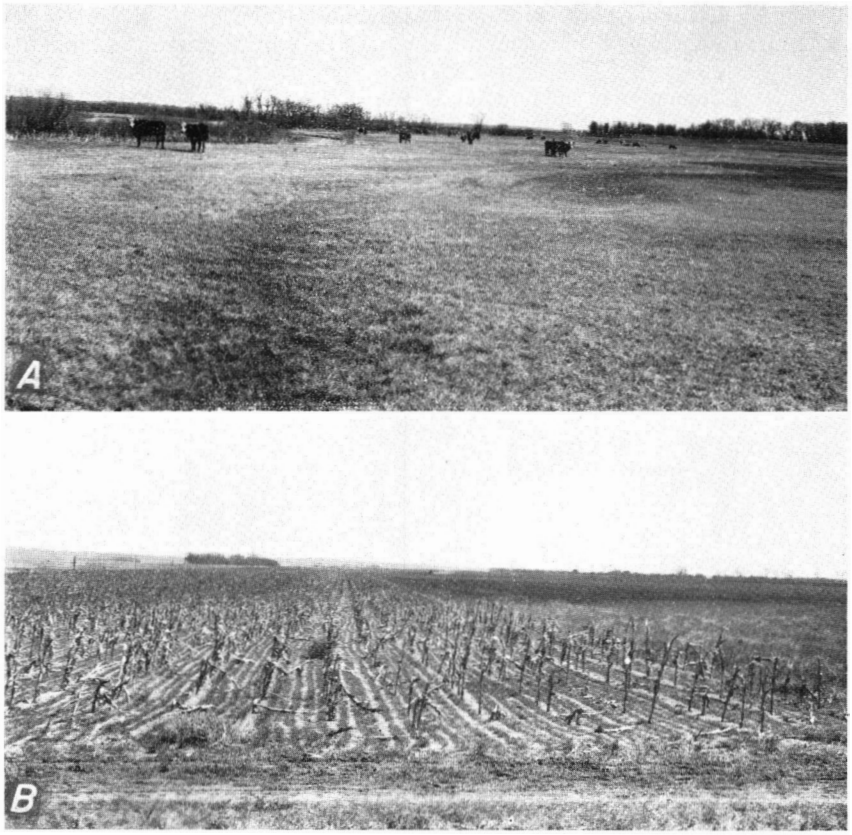

FIGURE 5.—Stream terraces and flood plains: *A*, Loup fine sandy loam on plain of the North Loup River west of Brewster, showing dark streaks caused by high water table; *B*, Tripp fine sandy loam on terrace of the North Loup River, with new growth of rye showing between rows of cornstalks.

CLIMATE

The cool, somewhat dry, mid-latitude continental climate of Blaine County is characterized by extremes of temperature and marked seasonal variations in precipitation (*5*, *6*, *8*). Climatic data compiled from records of the United States Weather Bureau station at Purdum are given in table 1. They are considered representative for the county.

Winters are cold. The average temperature for the season is below freezing, and short periods of subzero weather are common in both January and February. Spring is a short cool season with occasional late snowstorms. Summers are long, with hot days and warm nights. Temperatures above 100° F. are often reached in July and August. The long autumn—cool, dry, and sunny—is, perhaps, the most pleasant season.

The average frost-free period is 142 days, but in any given year the growing season may be considerably shorter or longer. Killing frosts have occurred as late as May 30 and as early as September 9. The grazing period usually begins about May 1 and ends about

December 1, but the majority of the ranchers winter their livestock on the range. They supplement the winter forage with cottonseed cake and hay and increase the amounts fed during cold and very snowy weather.

The relief of this county is nowhere so great as to cause marked differences in temperature. Locally there are doubtlessly minor differences in temperature resulting from air drainage down slopes and from changes in wind direction and speed caused by the hills and ridges. On the whole, however, topography does not have an important effect on the climate of this area.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Purdum, Blaine County, Nebraska*

[Elevation, 2,600 feet]

Month	Temperature [1]			Precipitation [2]			
	Average	Absolute maximum	Absolute minimum	Average	Total for the driest year	Total for the wettest year	Average snowfall
	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*	*Inches*
December	26. 2	74	−27	0. 72	0. 78	1. 35	6. 3
January	23. 0	72	−35	. 55	. 37	1. 55	5. 3
February	26. 2	74	−34	. 76	. 83	2. 22	6. 3
Winter	25. 1	74	−35	2. 03	1. 98	5. 12	17. 9
March	35. 8	89	−18	1. 39	2. 60	3. 31	9. 5
April	47. 7	98	4	2. 47	1. 23	6. 04	4. 6
May	57. 8	101	16	2. 99	1. 05	3. 37	1. 2
Spring	47. 1	101	−18	6. 85	4. 88	12. 72	15. 3
June	67. 8	106	33	3. 29	1. 50	4. 72	0
July	74. 9	110	39	2. 85	1. 88	2. 98	0
August	72. 8	108	37	2. 85	1. 91	2. 36	0
Summer	71. 8	110	33	8. 99	5. 29	10. 06	0
September	63. 5	102	12	1. 61	. 80	5. 83	. 1
October	51. 2	96	−3	1. 33	. 34	2. 00	3. 4
November	37. 0	81	−16	. 67	1. 12	. 23	4. 9
Fall	50. 6	102	−16	3. 61	2. 26	8. 06	8. 4
Year	48. 7	110	−35	21. 48	[3] 14. 41	[4] 35. 96	41. 6

[1] Average temperature based on 49-year record, 1903 to 1951; highest and lowest temperatures from 37-year record, 1894 to 1930.

[2] Average precipitation based on 56-year record, 1875 to 1930; wettest and driest years based on 29-year record, 1902 to 1930; snowfall on 33-year record, 1898 to 1930.

[3] In 1931.

[4] In 1915.

Most of the precipitation comes in the seasons when it is most needed. At Purdum, the average annual precipitation is 21.48 inches, distributed as follows: Winter, 2.03; spring, 6.85; summer, 8.99; and fall, 3.61. The average rainfall during the growing season is relatively high, but this average may be misleading. Actually, the rainfall during the growing season varies a great deal from year to year both in quantity and distribution. The extremes are indicated by figures on precipitation for the driest and wettest years given in table 1.

Rainfall is more dependable in May and June than in July and August. Dry spells lasting several weeks are common during the middle of the summer. Sometimes they greatly reduce crop yields and growth of pasture. Corn is more likely to be adversely affected by drought than the small grains, for it is slower to mature and requires moisture in the latter part of the summer. Dry weather in May and June favors the hatching and growth of grasshoppers, which cause much crop damage in some years.

Spring and summer rains are ordinarily short and hard; they start as thunderstorms. Locally, summer rains may be accompanied by hail, but crop damage from this source is never extensive. Fall rains are frequently slow and gentle. The average yearly snowfall is 41.56 inches. Blizzards occur in some winters.

From October through April the prevailing wind is from the northwest; during the rest of the year it comes from a southerly direction. Average wind speed is not high, but strong winds are common during cyclonic storms and thunderstorms. Tornadoes are extremely rare.

VEGETATION

This county is dominantly grassland (see figs. 2, *A* and 4, *A*, pp. 4 and 6). Shrubs and trees grow only in favorable local areas. Tall coarse grasses are dominant on the very sandy soils, and mixed tall and short species on the less sandy soils and the loamy soils of the loess hills. Old ranchers state there is a greater variety and better stand of grasses now than there was 50 years ago because of better range management and prevention of fires.

The terraces and better drained bottom lands support several species of tall grasses, including big bluestem (*Andropogon gerardi*), Indiangrass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*), and slender wheatgrass (*Agropyron trachcaulum*). True prairie species grow in sandhill valleys and broad basins—junegrass (*Koeleria cristata*), little bluestem, or prairie beardgrass (*Andropogon scoparius*), tall dropseed (*Sporobolus asper*), and western wheatgrass (*Agropyron smithii*).

In the dune-sand areas some yucca (*Yucca glauca*) and various kinds of grasses occur. The grasses most common are blowout grass (*Redfieldia flexuosa*), sandhill muhly (*Muhlenbergia pungens*), hairy grama (*Bouteloua hirsuta*), sandhill lovegrass (*Eragrostis trichodes*), sand reedgrass (*Calamovilfa longifolia*), sandhill bluestem (*Andropogon hallii*), sand dropseed (*Sporobolus cryptandrus*), blue grama (*Bouteloua gracilis*), and western needlegrass (*Stipa comata*). Selective and excessive grazing brings about changes. Excessively grazed areas of dune sand have more sandhill muhly, sand dropseed, and blue grama and less switchgrass and lovegrass.

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A number of groves and strips of deciduous trees and shrubs grow along the streams in valleys and canyons where they receive runoff water or are in places having high water table during the growing season. The most common are cottonwood (*Populus sargentii*), peach-leaved willow (*Salix amygdaloides*), green ash (*Fraxinus pennsylvanica* var. *lanceolata*), red ash (*Fraxinus pennsylvanica*), American elm (*Ulmus americana*), hackberry (*Celtis occidentalis*), boxelder (*Acer negundo*), chokecherry (*Prunus melanocarpa*), and wild plum (*Prunus americana*). A few redcedar (*Juniperus virginiana*) are on rough land, particularly on the north-facing slopes, and along rivers. Most of the trees are small; those cut are used mostly for fence posts and fuel.

SOILS OF BLAINE COUNTY AND THEIR USE AND MANAGEMENT

Soils differ because they have formed in different environments and because they differ in age. Soil development is influenced by (1) climate; (2) living things, especially plants; (3) parent material, especially the kinds of minerals; and (4) relief or topography. These four, plus age, are called the factors of soil formation or, in other words, the factors responsible for the differences among soils. Man himself, by cultivation, cropping, stimulating erosion, improving drainage, and the like, also causes differences among soils.

In the beginning there is only the parent material from which the soils will develop. Where only hard rocks are exposed at the surface, these must first be broken down into very small pieces that will hold water, release nutrients needed by plants, and provide a place for plants to root. Where the materials are loose and unconsolidated, as they are in Blaine County, plants will soon start to grow, and at the same time, soils will begin to form. Soil formation is slow at first, but as nitrogen and organic matter accumulate, plants grow more abundantly and the soils develop more rapidly. The nitrogen comes almost exclusively from the air. A little of it is brought down by rains, some is fixed by micro-organisms, and perhaps some is fixed directly by plants and the soil itself. As the plants grow and die, year after year, the organic matter (humus) accumulates, especially in surface layers, which become darker in color. After a time the amount of organic matter in the soil does not change, because old organic matter is decomposing and disappearing as fast as new organic matter is added. In addition to the accumulation of organic matter, many other things happen as a soil develops. For example, if there is enough rainfall and adequate drainage, the easily soluble salts in the parent material are washed downward and out of the soil. Slowly soluble calcium and magnesium carbonates, commonly called lime, are washed downward and accumulate in a layer below the subsoil.

Climate has a very important effect on plant and soil environment in different parts of the world. In Blaine County, however, the climate is relatively uniform and cannot account for broad differences among the soils. Nevertheless, climate, as modified by relief, has some effect in the county. For example, north-facing slopes are likely a little cooler and moister than south-facing slopes and therefore provide a slightly different environment for soil development.

Vegetation also has had little influence on development of different kinds of soils in Blaine County. The trees are young and scattered; they have had little or no effect on the soils. This greatly contrasts with conditions in other parts of the United States, where both trees and grass grow vigorously and have markedly affected soil development. In Blaine County, parent material, relief, and age are the factors responsible for important differences among the soils. The relationships of these factors to the various soil series are shown in table 2.

As shown in table 2, eolian (wind-blown) noncalcareous sands are the most common parent material in the county, and many soils have formed from them. On the stabilized hilly and steep dunes only a very small amount of organic matter has accumulated in the surface few inches, and the soil is called Dune sand, stabilized. In a few places the dunes are not stabilized and consist only of loose sand. Where the relief is gently sloping to rolling the soils have a little more organic matter and are called Valentine (fig. 6). The areas of Valentine soils are often referred to as dry valleys.

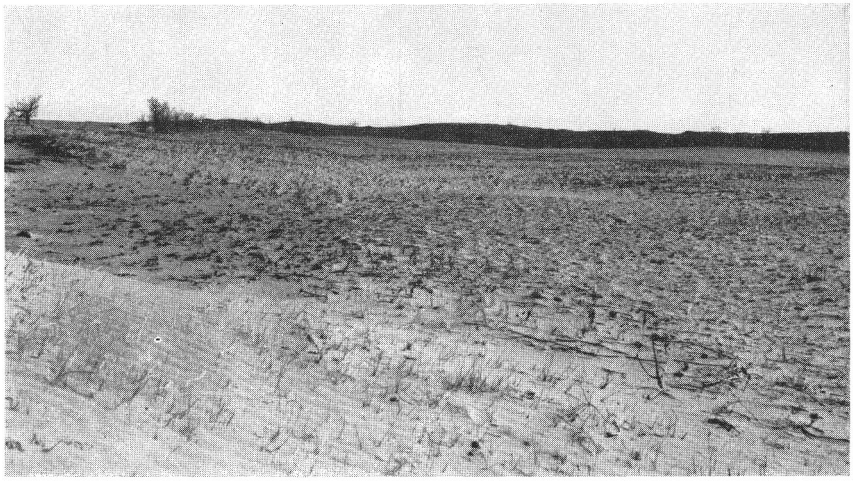

FIGURE 6.—Old cultivated field in north-central part of county; the soil is Valentine fine sand, undulating, severely eroded.

At a slightly lower elevation where the water table is near the surface and more water is available to plants, the surface soil is considerably darker and thicker. Here the Elsmere soils occur. Commonly, the eolian sand is underlain by sandy alluvium and the water table is high. The Loup soils have a dark-colored surface soil that is nearly black when wet. The Gannett soils have a thick dark-colored surface layer; they occur in closed depressions and usually have ponds in the lower parts. The Loup, Elsmere, and Gannett are the principal soils of the wet meadows. The Sarpy soils are much younger than the Loup soils; they have formed from more recent alluvium and are light-colored.

The Tripp, Cody, and Sparta soils formed in the alluvial materials of the stream terraces. The Tripp and Cody soils are dark-colored;

TABLE 2.—*Relationship of parent material and relief for soil series of Blaine County, Nebr.*

Parent material	Relief [1]				
	Hilly to steep	Rolling	Undulating or gently sloping	Level	Depressed
Eolian noncalcareous sands	Dune sand, stabilized	Valentine	Valentine (excessively drained). Elsmere (imperfectly drained).	Elsmere (imperfectly drained).	Gannett.
Sandy alluvium			Loup (poorly drained)	Loup (poorly drained)	
			Sparta	Sarpy	
			Cody	Sparta	
				Cody	
Calcareous loamy alluvium			Tripp	Tripp	
Eolian noncalcareous sands with some silt.			Anselmo	Anselmo	
Eolian sands over loess			Haxtun	Haxtun	
Calcareous loess	Colby [2]	Colby [2]			

[1] The series listed in 2 columns have the range in relief indicated by the 2 column headings.

[2] True Colby soils occur in drier climates than that of Blaine County. This soil series name was brought into Nebraska many years ago in the belief that calcareous loess soil on steep eroding slopes in this State was identical to soil from the same material on the gentle slopes in a drier climate. This now is known to be untrue, and in future correlations soils like the "Colby" of Blaine County will be given a new name.

the Sparta is light-colored and resembles the Valentine but its parent material is sandy alluvium that contains some gravel. The Tripp and Cody soils differ because the parent material of the Tripp is finer textured (loamy) and calcareous. The Anselmo and Haxtun soils also occur on level to gently sloping relief, but are on the uplands rather than the terraces. The Anselmo developed in eolian noncalcareous sand that is mixed with some silt; the Haxtun formed from a thin deposit of eolian sands over loess. The Colby is a thin soil formed in calcareous loess on rolling to steep slopes.

SOILS AND THEIR RELATIONS

The soils of Blaine County have been placed in 10 groups as shown in table 3. The soils in each group have many similar physical characteristics and similar responses to use and management. Table 3 is followed by a discussion of each group.

GROUP 1—SANDHILLS

In the sandhills group are three mapping units—Dune sand, rolling and hilly (a miscellaneous land type); Dune sand, stabilized, rolling; and Dune sand, stabilized, hilly and steep. These occur in all but the extreme southeastern corner of the county and together occupy a greater total area than all other soils in the county combined.

Dune sand, stabilized, rolling; and Dune sand, stabilized, hilly and steep; consist entirely of medium to fine sand, lime-free, with dark surface layers only an inch or two thick. Dune sand, rolling and hilly, is not stabilized; it is loose and drifting sand, light-colored throughout, that supports little or no vegetation.

The wind-formed hills and ridges, or dunes, are at least 15 feet high. Most of them are considerably higher. The landscape is monotonous—a succession of hills or ridges separated by valleys and basins. The nearly level skyline is broken only by scattered higher dunes. Drainage courses are absent or only poorly defined, for the porous sand soaks up rain about as fast as it falls.

Most of the dunes have been stabilized; that is, grasses have become established on them and they are no longer moved by the wind (see fig. 2, p. 4). Blowouts are scattered throughout the sandhills. In these places the surface is bare or nearly bare and the loose sand is blown about by the wind. Where the blowouts have become large and sand from them forms new active dunes, they have been mapped as Dune sand, rolling and hilly. Small blowouts within areas of the two mapping units of Dune sand stabilized are included with those units on the map.

Trees are difficult to start on the sandhills, but some species thrive once they are established. A few kinds of both coniferous and deciduous trees are native to the sandhills. Demonstration plantings of conifers in the Nebraska National Forest in the west-central part of the county are growing vigorously. In many other places cedars, pines, elms, and cottonwoods are growing successfully on dune sand.

GROUP 2—THICK, DARK, FRIABLE SANDY SOILS OF SMOOTH UPLANDS

The thick, dark, friable sandy soils of the smooth uplands are Haxtun loamy fine sand; Colby-Anselmo loamy fine sands, gently undu-

lating; and Colby-Anselmo loamy fine sands, rolling. They occupy only a small percentage of the county, mainly in the southeastern part. Small areas also occur along the south sides of the Middle Loup and Dismal Rivers.

The characteristic topography is nearly level to gently rolling. The slope is sufficient to insure good drainage but not so great as to cause excessive water erosion. Moisture soaks into the sandy surface soils very rapidly, so there is little runoff, even on rolling areas. The moisture-holding capacity is higher than for Valentine soils or Dune sand.

The soils of this group have grayish-brown sandy loose or weak granular surface layers 12 to 18 inches thick and massive or prismatic subsoils of lighter color. They are of crumbly consistence throughout. The Haxtun soil is characterized by a thin deposit of wind-blown sand resting on silty and loamy loess deposits. It therefore has a finer textured subsoil than the Anselmo soils, which formed in a deposit of wind-blown sand with which a little silt and clay were mixed. The Colby soils form in the very fine sandy and silty deposits of the loess region.

Wind and water erosion are not serious on this group of soils if cultivation is done with reasonable care. Most areas are under cultivation and produce good crops of corn, rye, and forage.

GROUP 3—MODERATELY THICK, DARK, SANDY SOILS OF SMOOTH UPLANDS

The moderately thick, dark, sandy soils of the smooth uplands are Anselmo fine sandy loam, level; Anselmo loamy fine sand, gently undulating; Anselmo loamy fine sand, level; and Anselmo loamy fine sand, undulating. They occur largely in the southeastern part of the county in upland valleys between the sandhills and the loess hills (see fig. 7, p. 17). The topography is level to undulating. Drainage channels are weakly developed or absent, for the soils absorb nearly all the water that falls on them.

These soils have grayish-brown sandy surface layers, about a foot thick, of loose or weak crumb structure. Underlying are the lighter colored loamy subsoils, and below the subsoils, several feet of loose fine sand. Although they are immature, the Anselmo soils are better developed and more stable than many of the soils developed in wind-deposited sands.

The soils of this group are easy to till and may be farmed if given reasonable care to prevent wind erosion. They are commonly used for corn, rye, and forage crops.

GROUP 4—THIN, LIGHT-COLORED LOAMY SOILS OF ROLLING UPLANDS

The thin, light-colored loamy soils of the rolling uplands are Colby fine sandy loam, eroded undulating and rolling; and Colby fine sandy loam, severely eroded rolling. They are in the southeastern part of the county in rolling to hilly areas (see fig. 4, p. 6). Small gullies are common.

These soils have grayish-brown granular surface layers, 5 to 10 inches thick, underlain by lighter colored weakly prismatic subsoils about a foot thick. Generally there is a light grayish-brown layer high in lime carbonate in the lower subsoil. The parent material is the very fine sandy loam or silt loam of the loess deposits. Locally

the surface soils are composed mostly of wind-deposited sand from nearby sandhills.

Only small more level and protected patches of these soils are cultivated. Most areas will be severely eroded by wind and water if their protective grass cover is removed. Besides, the topography is generally unfavorable to the use of machinery. These soils are used mostly for pasture.

GROUP 5—THIN, LIGHT-COLORED VERY SANDY SOILS OF UPLANDS

The thin, light-colored very sandy soils of the uplands are Valentine fine sand, undulating; Valentine fine sand, level; and Valentine fine sand, undulating, severely eroded. They are extensive; together they cover about one-third of the county. They occur in and around sandhill areas, at places where the topography is level to gently undulating or, rarely, rolling to hummocky (see fig 3, p. 5).

The Valentine soils are closely related to Dune sand, stabilized, rolling, but occupy smoother sites, support a better grass cover, and are generally less exposed to severe wind erosion. They therefore have a somewhat thicker dark surface soil.

Little of the area occupied by these soils is cultivated. Nearly all of it is used for hay and pasture. The soils are quite stable if the native grass is not disturbed, but they lose humus, become lighter in color and less coherent, and drift badly when cropped. Their water-holding capacity and fertility are low.

GROUP 6—THICK, DARK, FRIABLE SANDY SOILS OF TERRACES

The thick, dark, friable sandy soils of the terraces are Tripp fine sandy loam; Cody fine sandy loam, gently undulating; Cody fine sandy loam, level; and Cody loamy fine sand, gently undulating. They are found on well-drained nearly level to gently undulating terraces along the larger streams (see figs. 5, *B* and 8, pp. 7 and 23). They are not subject to flooding.

These soils have developed in sandy and loamy water-deposited materials. They have dark-gray or grayish-brown surface soils of granular structure that range from 12 to 18 inches in thickness. The subsoils are generally weakly prismatic and slightly lighter in color. The Cody soils generally lack free carbonate of lime, but the Tripp soil has a layer rich in free lime carbonate below the subsoil. All these soils are underlain by loose sandy alluvium.

These are the best cropland soils in the county; almost all areas are under cultivation. Corn, small grains, and forage crops are commonly grown. Tripp fine sandy loam, level, and Cody fine sandy loam, gently undulating, have relief favorable for irrigation, though very little of their area is irrigated.

GROUP 7—THIN, LIGHT-COLORED VERY SANDY SOILS OF TERRACES

The thin, light-colored, very sandy soils of the terraces are Sparta fine sand, gently undulating; Sparta gravelly sand, gently sloping; and Sparta-Valentine fine sands, undulating. They are immature soils forming in sand and gravel on nearly level to undulating well-drained stream terraces. Most of the deposits are stratified, but in places their surfaces have been reworked by wind. These reworked areas are gently rolling to hummocky.

The surface layers of Sparta soils are grayish-brown, loose, sandy, or gravelly, and no thicker than 6 inches. They rest on light-colored stratified loose sand or a mixture of sand and gravel that usually coarsens with increasing depth. Valentine soils are forming in wind-reworked alluvium. They also have thin dark surface soils, but are underlain by loose wind-deposited sand rather than stratified sediments.

The soils of this group provide fair pasture for livestock and are also used for hay. They are too erodible and too low in fertility and water-holding capacity for crops.

GROUP 8—SUBIRRIGATED SOILS OF BOTTOM LANDS, UPLAND POCKETS, AND SWALES

The subirrigated soils—those in which plant roots are able to reach moist soil just above the permanent water table—are Loup fine sandy loam; Elsmere loamy fine sand; Elsmere-Valentine loamy fine sands, gently undulating; Sarpy loamy fine sand; Gannett fine sandy loam; Gannett loamy fine sand; and Gannett-Valentine loamy fine sands, gently undulating. They occur in many places—on bottom lands along streams, at the heads of drainageways in the sandhills, in valleys blocked by sand dunes, and in pockets and swales in the sandhills (see figs. 5*A* and 10, pp. 7 and 28). In most areas the topography is remarkably smooth and surface drainage is poorly established except along the larger streams. The areas occupied by Elsmere-Valentine and Gannett-Valentine complexes, however, have been roughened by drifting sand and small streams.

Ditch and tile drainage systems are used in some areas to prevent waterlogging and to make harvesting of hay easier. The water table lies 2 to 10 feet below the surface during most of the year. It is generally lowest in July, August, and early September. Locally the water table may rise to the surface in wet seasons.

There is considerable variation among the soils of this group. The Gannett, Loup, and Elsmere soils have dark-colored surface layers 8 to 10 inches thick. The Gannett, occupying undrained basins, is the most poorly drained and darkest soil of the group. The Loup and Elsmere soils are similar to the Gannett, but have surface drainage outlets. Their dark layers are not so thick as those of the Gannett, nor are the layers below the subsoil so highly mottled with dark colors.

The Sarpy are light-colored immature soils of the stream floodplains. They are subject to more frequent flooding than the Gannett, Elsmere, and Loup soils. The Valentine soils, included in this group only as parts of complexes, are described on page 15.

These subirrigated soils are used mostly for native and tame hay. Some meadows have been seeded, without tilling the land, to a mixture of timothy, clover, and redtop. This has increased the quantity and improved the quality of the hay produced. Some areas are pastured, and a few are used for home gardens. Grasses and legumes on these soils have responded to applications of nitrogen and phosphorus. The establishment and maintenance of legumes has been aided by phosphorus fertilizer.

GROUP 9—ROUGH BROKEN LAND

Rough broken land, Colby soil material, occupies a few areas in the loess hill region in the southeastern corner of the county. Deeply

cut drainage channels produce a rough surface characterized by many sharp divides and ridges separated by narrow steep-sided valleys and gullies. Vertical bluffs 10 to 60 feet high are common. Slumping of masses of loosened material is frequent on steep slopes. The slumping produces a series of short vertical exposures, called "catsteps." Runoff is rapid and nearly complete; erosion is severe. Soil development takes place only at the bases of slopes and in pockets, valleys, and other protected places. The cover of grasses and trees is sparse or lacking. Most areas are used only for grazing, but timber is cut for fence posts or fuel in some places.

GROUP 10—RIVERWASH

Riverwash occurs on stream bottom lands that are still frequently covered by water and subject to movement by water. It consists of various more or less stratified sediments deposited in bars, islands, cut-off meanders, and natural levees along the North Loup, Middle Loup, and Dismal Rivers. It is material in the first stage of soil development. It derives its organic matter, texture, and color directly from the soils and rocks that yielded the sediments. With the increase in stability and humus content that will come as vegetation establishes itself, Riverwash will eventually become a soil. Riverwash is not farmed, and its sparse cover of grass and small trees is of little value even for grazing.

SOIL TYPES AND PHASES

The soil types and phases of the county are described in the following pages, and their agricultural relations are discussed. Their approximate acreage and proportionate extent are given in table 4.

Anselmo fine sandy loam, level (Ab).—This imperfectly developed, moderately thick, dark sandy soil is forming in wind-deposited sand that contains enough fine material, chiefly silt, to give it slight coherence. It occupies a few level areas in the southeastern part of the county (fig. 7), mostly in association with other Anselmo soils

FIGURE 7.—Hereford cattle gathered near windmill on Anselmo fine sandy loam, level, in southeastern part of county; hills in background are Dune sand, stabilized, rolling.

TABLE 4.—*Approximate acreage and proportionate extent of soils in Blaine County, Nebraska*

Map symbol	Soil	Minor civil divisions (townships)								Total in county	Percentage of county area
		Brewster	Dunn	Dunning	Edith	Hardscrabble	Hawley	Hudson	Purdum		
AB	Anselmo fine sandy loam, level				363					363	(1)
	Anselmo loamy fine sand:										
AC	Gently undulating			960	567					1,527	0.3
AD	Level			167	456					623	.1
AE	Undulating				12					12	(1)
	Cody fine sandy loam:										
CA	Gently undulating	222	91				137		1,061	1,511	.3
CB	Level		245							245	(1)
CC	Cody loamy fine sand, gently undulating	826	517				807		1,202	3,352	.7
	Colby-Anselmo loamy fine sands:										
CD	Gently undulating		6	1,593	708	31			7	2,345	.5
CE	Rolling	32		241	55					328	(1)
	Colby fine sandy loam:										
CF	Severely eroded rolling	223			11					234	(1)
CG	Eroded undulating and rolling				60					60	(1)
	Dune sand:										
DA	Rolling and hilly	30	39	227	12	48	17		49	422	(1)
DB	Stabilized, hilly and steep	2,903		10,257		7,202	1,086	21,787		43,235	9.5
DC	Stabilized, rolling	28,082	7,490	67,610	35,955	13,124	28,227	5,604	23,493	209,585	46.0
EA	Elsmere loamy fine sand	90	28	702			1,583	15	243	2,661	.5
EB	Elsmere-Valentine loamy fine sands, gently undulating	2,310					100			2,410	.5
GA	Gannett fine sandy loam	174		14	16		88			292	(1)
GB	Gannett loamy fine sand	23		73			37			133	(1)
GC	Gannett-Valentine loamy fine sands, gently undulating	150		14			50			214	(1)

HA	Haxtun loamy fine sand	15	10	403	5				3	436	(1)
LA	Loup fine sandy loam	1,945	484	1,437	378	26	1,804	8	724	6,806	1.4
RA	Riverwash	42		81	49		5			177	(1)
RB	Rough broken land, Colby soil material				766					766	.1
SA	Sarpy loamy fine sand	130	164	797	1,401	367	116		169	3,144	.6
SC	Sparta fine sand, gently undulating	3,661	2,402	3,000	1,355	684	3,918		1,476	16,496	3.6
SD	Sparta gravelly sand, gently sloping	134	1						98	233	(1)
SE	Sparta-Valentine fine sands, undulating	388	876				1,004		2,098	4,366	.9
TA	Tripp fine sandy loam	311					257		1,375	1,943	.4
	Valentine fine sand:										
VA	Level	2,736	663	42	984		192	1,512	78	6,207	1.3
VB	Undulating	28,331	4,772	46,729	23,617	5,327	15,993	5,060	10,536	140,365	30.8
VC	Undulating, severely eroded	139	1	564	220	14	119	181	636	1,874	.4
	Area occupied by rivers	408	101	962	520	143	313		228	2,675	.5
	Total area of county									455,040	[2] 98.4

[1] Less than 0.1 percent.
[2] Areas with proportionate extent of less than 0.1 percent total 1.6 percent of the county.

and Valentine soils. The Anselmo parent material has been derived from the sandhill and the loess-hill areas. Drainage channels are absent because rainfall is rapidly and usually completely absorbed. Internal drainage is rapid. The natural vegetation consists of grasses, mostly of tall coarse species.

Profile [3] description:

0 to 10 inches,[4] grayish-brown soft fine sandy loam of weak granular structure; first 3 inches matted with grass roots; high in organic matter; 8 to 15 inches thick.[5]

10 to 30 inches, pale-brown heavy fine sandy loam to loam of weak irregularly prismatic-blocky structure; friable; becomes somewhat finer textured in lower part; low in organic matter; 12 to 25 inches thick.

30 inches+, light brownish-gray or light-gray loose fine sand, a few to many feet thick.

This soil is nearly everywhere free of carbonate of lime; it is usually about neutral in reaction. In some small depressions the surface soil is slightly darker than indicated in the foregoing profile description, and the subsoil is somewhat finer textured. Also, in some slight depressions where water stands for a short time after rains, the first 2 or 3 inches of the surface soil is much finer textured—a clay loam or clay.

Use and management.—Anselmo fine sandy loam, level, is fertile and moderate in water-holding capacity. It can be worked easily under all moisture conditions but is subject to wind erosion unless it is protected by crop residue or a cover crop. Many cultivated fields have a light-and-dark spotted appearance because the dark topsoil has been removed in places. This soil is fairly good for corn, rye, and forage crops.

If fields are carefully handled, there is no reason why this soil should erode severely. If continuously cropped, it gradually declines in fertility unless organic matter and fertilizers are added to replace those removed by crops. As fertility declines susceptibility to erosion tends to increase. The use of rotations that include grass and legumes is one good way of protecting and gradually improving the cultivated areas. Putting manure on the soil is another way. Stubble mulches will do much to prevent excessive wind erosion.

Anselmo loamy fine sand, gently undulating (Ac).—Except for its coarser textured surface soil, this soil is much like Anselmo fine sandy loam, level. Like other Anselmo soils it occurs mainly in the southeastern corner of the county. It occupies numerous gently undulating areas surrounded by higher land on which Valentine soils and the phases of Dune sand, stabilized, predominate. Its parent material and drainage are the same as described for Anselmo fine sandy loam, level.

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[3] Soil terms used throughout this report are defined in the section on Soil Survey Methods and Definitions.

[4] Average depths at which top and bottom of each horizon occur. In this profile, for example, the top of the second horizon is 10 inches below the surface, and the bottom 30 inches.

[5] Soil horizons vary in thickness. For example, this horizon, though it averages 10 inches thick, may be only 8 inches thick in some places and 15 inches thick in others.

Profile description:

0 to 14 inches, grayish-brown loose loamy fine sand, well supplied with organic matter; surface 2 or 3 inches matted with grass roots; 10 to 16 inches thick.
14 to 30 inches, pale-brown slightly coherent fine sandy loam that becomes lighter in color and somewhat finer in texture in the lower part; low in organic matter; gradually changes to layer below; 12 to 24 inches thick.
30 inches+, light brownish-gray or light-gray loose fine sand.

Like Anselmo fine sandy loam, level, this soil is neither very acid nor very alkaline. It usually lacks free carbonate of lime.

Use and management.—Almost all of Anselmo loamy fine sand, gently undulating, is cultivated, principally to corn and rye. It absorbs water rapidly and readily gives it up to plants. It has a higher water-holding capacity than very sandy light-colored upland soils such as the Valentine, but grasses, and particularly cultivated crops, are damaged by lack of moisture during dry seasons. The coarse texture makes the soil susceptible to wind erosion if the natural cover of grass is removed. Forage crops are grown in a few places.

More care is required to handle this soil successfully under cultivation than is needed for Anselmo fine sandy loam, level. More emphasis on grass-and-legume rotations, stubble mulch, or both, is desired. In general, however, the tillage and management practices suitable for Anselmo fine sandy loam, level, may be used.

Anselmo loamy fine sand, level (AD).—This soil occurs mostly within areas of Anselmo loamy fine sand, gently undulating, in the southeastern part of the county, and it has essentially the same profile characteristics as that soil. The topography on which it occurs is the same as that occupied by Anselmo fine sandy loam, level.

Use and management.—This soil, like others of the Anselmo series, occurs on topography suitable for cultivation. Most of it is used for corn and rye. Its strong points are the ease with which it can be tilled and the rapidity with which it absorbs water. Its weaknesses—low water-holding capacity and susceptibility to wind erosion—make it only a fair agricultural soil for this county.

Anselmo loamy fine sand, undulating (AE).—This inextensive soil occupies a few hummocky to rolling areas in the southeastern part of the county, mostly in association with Valentine soils. Its profile does not differ significantly from that of Anselmo loamy fine sand, gently undulating.

Use and management.—This soil is used almost entirely for grazing because it occurs mostly in small bodies in association with Valentine soils and has hummocky to rolling topography. No management practices other than those regularly employed on pastures are used, nor are they necessary.

Cody fine sandy loam, level (CB).—This is a dark moderately thick sandy soil of the stream terraces. The parent material is fine sandy alluvium that in places contains some gravel. This material was deposited by flowing water and subsequently left high and dry when the streams cut to a lower level. The soil lies above the flood-plain and is associated with Sparata, Valentine, and other Cody soils.

A large area of it is on the south side of the North Loup River in Township 23, North, Range 21, West. The soil is well drained; rain usually soaks in as fast as it falls. Originally there was a good cover of tall and short grasses, the needlegrasses predominating.

Profile description:

0 to 6 inches, grayish brown friable fine sandy loam of weak granular structure; well supplied with organic matter; grass roots numerous; 4 to 8 inches thick.

6 to 20 inches, brown friable sandy loam to loam of prismatic-blocky structure; lower in organic matter than layer above; few grass roots; 10 to 29 inches thick.

20 to 48 inches, very pale-brown loose loamy fine sand containing little or no organic matter; 20 to 35 inches thick.

48 inches+, light brownish-gray loose fine sand or a sand-gravel mixture, a few to many feet thick.

The soil is neutral or slightly alkaline; it does not contain free carbonate of lime.

Use and management.—Most of this soil is cultivated. Corn is the principal crop, but rye is also grown, and other crops common to the region will do well. Some hay is produced.

In physical characteristics this soil is similar to Anselmo fine sandy loam, level. It occupies terraces instead of uplands, however, and is therefore in a position where it receives some extra water through runoff and seepage. Like the Anselmo soils, it is susceptible to wind erosion whenever its surface is left bare. Strip cropping, use of rotations emphasizing grasses and legumes, and stubble mulch cultivation will aid in controlling erosion and preventing rapid loss of organic matter.

Cody fine sandy loam, gently undulating (CA).—This soil occupies the higher terraces along the North Loup River. Most of it is on the gently undulating Hawley Flats. Associated are Tripp fine sandy loam, Loup fine sandy loam, Sparta fine sand, and other Cody soils.

The soil is well drained. Its profile does not differ in any important respect from that of Cody fine sandy loam, level. In places where it occurs near Valentine and Sparta soils, the surface soil texture may be a little coarser than fine sandy loam. In low spots the surface soil texture may be as fine as a loam.

Use and management.—The greater part of this soil is cultivated. The principal crops are corn, oats, rye, and sorghums. The management practices necessary to prevent wind erosion and soil depletion are the same as those mentioned in the discussion of Cody fine sandy loam, level.

Cody loamy fine sand, gently undulating (CC).—Strips of this soil occur on sandy terraces 20 to 50 feet above the channel of the North Loup River (fig. 8). Associated with it are mainly Cody fine sandy loam, gently undulating; Sparta fine sand, gently undulating; Valentine fine sand, undulating; Loup fine sandy loam; Elsmere loamy fine sand; and Sarpy loamy fine sand.

The soil is nearly level to undulating and somewhat hummocky. Its profile resembles that of Cody fine sandy loam, level, except for being coarser textured throughout. Tall grass once covered all

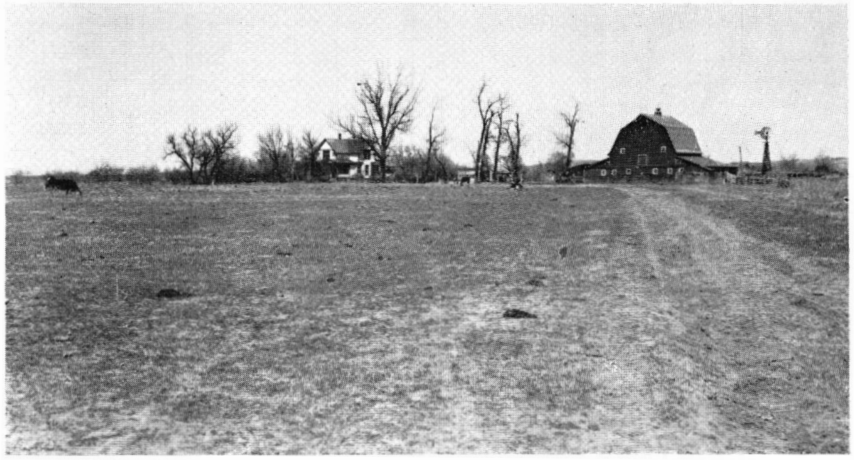

FIGURE 8.—Buildings on a diversified farm occupying a terrace along the North Loup River between Brewster and Purdum; soil is Cody loamy fine sand, gently undulating.

areas, but much of the soil is now cultivated. Some areas once cultivated have grown up to grass and weeds. The soil rapidly absorbs rainfall, so no drainage channels have formed.

Profile description:

0 to 9 inches, brown or grayish-brown loamy fine sand of single grain or weak granular structure; moderate amount of organic matter; 8 to 10 inches thick.

9 to 24 inches, slightly lighter colored brown loose fine sand with a little gravel; 10 to 18 inches thick.

24 inches+, light yellowish-brown mixture of loose fine sand and gravel.

The soil everywhere lacks free lime carbonate; it is neutral, slightly acid, or slightly alkaline.

Use and management.—This loose sandy soil is low in both fertility and water-holding capacity and is susceptible to wind erosion; consequently, it is not good for cultivated crops. When first plowed, the grass roots and decayed organic matter in it act as binders. After a few years of cultivation the grass roots disappear, the organic matter is oxidized, and the soil becomes unstable and unable to resist wind erosion. Once in this condition, it may take several years to get grass started again for pasture.

About 60 percent of this soil was cultivated at one time, but much of this is now idle or has been reseeded to grass. In years when the amount and distribution of rain are favorable, fair to good yields of corn and rye are obtained, provided fertility is adequate and wind erosion is controlled.

This soil is doubtless most profitably used for hay and pasture. If it must be cultivated because of need for arable land, the greatest care should be taken to keep the amount of soil humus as high as possible. This may be done by tilling the soil infrequently and by using rotations that keep grasses or legumes on it most of the time.

Colby fine sandy loam, eroded undulating and rolling (Cg).—This soil occupies only a few acres, mostly within areas of Rough

broken land, Colby soil material, in the southeastern corner of the county. It has a thin dark surface soil overlying light-colored sandy and silty wind-deposited material (see fig. 12, p. 51). The parent material is a loamy calcareous deposit called loess. The topography is undulating to strongly rolling (see fig. 4, p. 6). Runoff is rapid; internal drainage is medium. Erosion has prevented the development of a thick surface soil. In places gullies have formed and exposed the light-colored loess. The vegetation is mainly short and tall grasses, although a few elm, ash, or hackberry trees grow in favored locations.

Profile description:

0 to 5 inches, grayish-brown soft friable fine sandy loam of fine granular structure; 4 to 8 inches thick.
5 to 10 inches, light grayish-brown soft friable, prismatic fine sandy loam; usually calcareous; 4 to 16 inches thick.
10 inches+, very pale-brown firm massive calcareous floury loam or silt loam.

Use and management.—The rolling surface and occasional gullies make this soil generally unsuitable for cultivation. Nevertheless, a few small areas are cropped, mainly to corn and small grains. Special care is required to prevent severe water erosion on the cultivated areas, and it would no doubt be better to return them to grass.

Areas in virgin grass produce good pasture and require no special management practices. Grazing should be controlled to prevent damage to the grass cover.

Colby fine sandy loam, severely eroded rolling (CF).—This severely eroded rolling soil occupies only a few areas, and those are within larger areas of Rough broken land, Colby soil material, in the southeastern corner of the county. It is rolling or strongly rolling, so runoff is excessive and erosion is active. Some areas are gullied. The grass cover is not so thick as on Colby fine sandy loam, eroded undulating and rolling, and the surface soil is usually thinner. Aside from the thinner surface soil, the profile of this severely eroded soil does not differ appreciably from that of Colby fine sandy loam, eroded undulating and rolling.

Use and management.—None of the Colby fine sandy loam, severely eroded rolling, is used for crops, and much of it has little value even for grazing. Care must be taken to avoid overgrazing, for if the grass cover is destroyed, gullying is accelerated and erosion soon begins to cut into areas of better soils.

Colby-Anselmo loamy fine sands, gently undulating (CD).—Two soils, Colby loamy fine sand, gently undulating, and Anselmo loamy fine sand, gently undulating, occur in complex pattern in some places at the boundary between the loess hills and the sandhills in the southeastern part of the county. The two are mapped together because the size, shape, and intricate association of the individual areas are such that separate delineation is impractical. The complex occurs in association with Rough broken land, Colby soil material; Valentine and Anselmo soils; and Dune sand, stabilized. The topography is gently undulating.

This complex occurs where the old eroded loess plain has had only a thin covering of wind-blown sand. Loess underlies all areas of

the complex. In most places the loess deposit consists of gray or grayish-brown calcareous silt, 2 to 6 feet thick, underlain by older brown or reddish-brown clayey loess that is free of lime carbonate. The younger loess was eroded away in some spots, however, and in these, recent sandy deposits rest directly on the brown heavy-textured layer.

The Colby loamy fine sand of this complex is similar to Colby fine sandy loam, eroded undulating and rolling, except that its upper horizons are coarser textured, or largely a loamy fine sand. For a description of the other member of this complex, see Anselmo loamy fine sand, gently undulating, on page 20.

Use and management.—Most areas of this complex are included in pastures, largely because they are in locations isolated from cropland. Otherwise, most of the complex probably would be cropped, for both of the soils are relatively fertile, moderately high in water-holding capacity, easy to till, and less subject to wind erosion than the more sandy soils of this region.

Cultivated areas are used mainly for corn, rye, and oats, though some are planted to forage crops such as sorghums and Sudangrass. During years of average rainfall this complex is nearly as productive of these crops as the finer textured soils of the county, and in dry years it is more productive.

Colby-Anselmo loamy fine sands, rolling (CE).—In this mapping unit are the limited areas of intricately associated Colby and Anselmo loamy fine sands on rolling slopes (7 to 12 percent gradient). This complex has been subject to greater wind action than the complex of Colby and Anselmo loamy fine sands, gently undulating. The soil pattern results from alternating exposure of silty and sandy materials at the surface. The profiles of the two soils in this complex are the same as those of Colby-Anselmo loamy fine sands, gently undulating.

Use and management.—The very small part of this complex in cultivation is used for forage crops, and the productivity is not greatly different from that of Colby-Anselmo loamy fine sands, gently undulating. This rolling complex supports a good growth of pasture grasses. Prevention of overgrazing is the most important part of range management.

Dune sand, rolling and hilly (DA).—In the true sense, this is not a soil; it is merely a light-colored loose sand that may be parent material for soil after it has been stabilized by vegetation. It includes the areas commonly called blowouts, which support little or no vegetation and drift freely with the wind. These areas are enlarging where measures have not been taken to control them. Small patches of this sand occur in all parts of the county—around many water tanks, along trails, and along strips once plowed as fire guards. Wind action has produced a ridge-and-dune topography.

Use and management.—Dune sand cannot be put to any practical use in its present condition. In fact, it is a serious problem in some places. It threatens to move onto areas of Valentine soils and Dune sand, stabilized, and destroy their vegetation.

The first step is to try to prevent further drifting by piling straw, manure, or other absorbent organic materials into blowouts. Once

drifting is stopped, there is a possibility of getting a plant cover established by seeding grasses and setting out small trees. Feeding native prairie hay to cattle a few times in blowouts has been helpful. The cattle tramp the loose hay into the sand, which tends to prevent drifting and also provides the native grass seeds necessary for starting a sod cover. Once the grass is started, blowouts must be fenced to keep out livestock until vegetation forms a complete cover.

Dune sand, stabilized, rolling (Dc).—This mapping unit occurs in all parts of the county except the extreme southeastern corner. It consists of sand dunes, hills, and ridges that no longer shift and blow with the wind because they are covered with grass (fig. 9). In

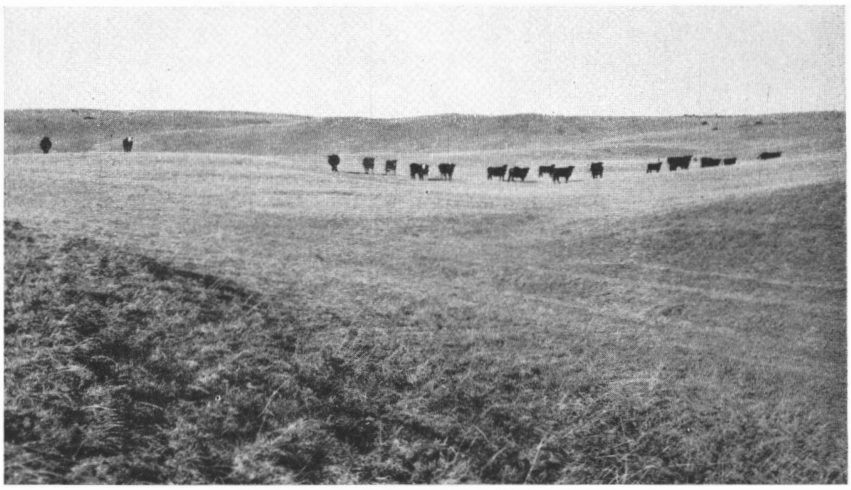

FIGURE 9.—Aberdeen-Angus cattle grazing on Dune sand, stabilized, rolling, between Dunning and Brewster.

most places there are hills and ridges 50 to 100 feet high, with some interspersed low hummocky areas and occasional basins and narrow valleys. Near streams the dunes are nearly symmetrical in contour, and apparently young, whereas in interstream areas they are distinctly elongated in a northwest-southeast direction and produce a ridge-and-trough kind of topography.

The sand making up the dunes and ridges accumulated mostly through breaking down and wearing away of soft sandstone of the Ogallala formation. It is likely that much of the sand was first loosened by water erosion and later picked up from the river flood plains by wind. Finer materials in the sandstone were separated from the sand during the erosion process, carried farther away from the river by wind, and deposited as loess.

The important vegetation is a sparse but almost complete cover of tall grasses. Trees grow naturally in a few low spots in the sandhills, and plantings have been made in other places. Drainage channels are few and indistinct, for the rain and most of the melted snow soaks in. Internal drainage is rapid. The water table in the basins and valleys is generally within 10 feet of the surface.

The soil is very young—a thin dark surface layer underlain by a few to many feet of loose fine sand. It usually contains no free carbonate of lime.

Profile description:

0 to 3 inches, brown loose fine or medium sand, open and porous; grass roots are most numerous in this layer; 2 to 4 inches thick.
3 inches+, pale-brown or light yellowish-brown loose porous fine or medium sand containing very little organic matter; a few to many feet thick.

This soil is most extensively associated with Dune sand, stabilized, hilly and steep, and with Valentine fine sand, undulating. The Valentine soils occur within and around the edges of the sandhill areas. Basins, swales, and valleys between the sandhills are occupied by members of the Gannett, Loup, and Elsmere series.

Use and management.—Dune sand, stabilized rolling, is highly susceptible to wind erosion. The sand itself cannot store much water, and there is not enough humus in the thin dark surface layer to provide adequate storage. The soil cannot be used successfully for crops, because the sand drifts freely as soon as it loses the protection afforded by grasses and their roots. Small patches are plowed and seeded from time to time, but the crop usually fails and the soil is allowed to go back to grass. Pasture is the best use for this soil. The amount of grass it produces is not large, but quite dependable. Grass is sometimes cut for hay; the yield is low.

The important practices are those that will protect and improve the grass cover. Among these are stocking the land so as to get the most of the pasture without overgrazing, stabilizing blowouts, preventing the killing of grass along roads and paths and around water tanks, and preventing range fires.

Dune sand, stabilized, hilly and steep (Db).—Hilly and steep topography is the principal difference between this soil and Dune sand, stabilized, rolling. The soil occupies stabilized dunes, hills, and ridges of greater relief and steeper slope than Dune sand, stabilized, rolling, supports a thinner stand of grass, and has more numerous blowouts. It is largely on irregularly distributed hills and ridges 100 to 150 feet high. Many sharp cone-shaped dunes and cup-shaped cavities (blowouts) on the north and west sides of the hills add variety to the landscape. Areas occur in all parts of the sandhill section. In fact, this soil and Dune sand, stabilized, rolling, cover more of the county than all the other soils combined.

Profile description:

0 to 2 inches, brown loose porous fine or medium sand; grass roots most numerous in this layer; 1 to 3 inches thick.
2 inches+, pale-brown or light yellowish-brown loose porous fine or medium sand containing very little organic matter; 20 to 200 feet thick.

This soil absorbs nearly all the rainfall. It generally has no lime carbonate in any part.

Use and management.—This soil has the limitations of Dune sand, stabilized, rolling, plus unfavorable hilly and steep topography. It is therefore valueless as cropland. None of it is cultivated, and very little hay is cut. Grazing is the principal use.

This soil needs management similar to that for Dune sand, stabilized, rolling, but is potentially less stable; therefore, even greater care is required to prevent overgrazing and other causes of erosion.

Elsmere loamy fine sand (EA).—This dark-colored immature soil is forming on broad basins, narrow valley floors, and long gentle slopes in the sandhill areas (fig. 10). The parent sands were laid down largely by wind, though in a few places they were water-laid and later

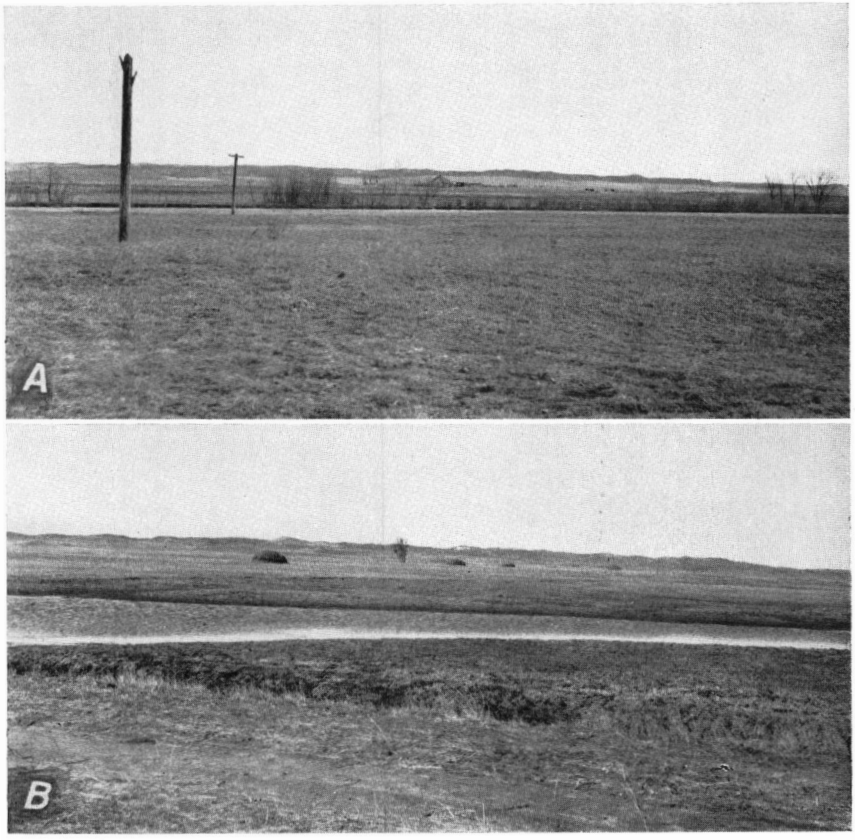

FIGURE 10.—Bottom lands: *A*, Elsmere loamy fine sand on both sides of the Middle Loup River near Dunning (river channel indicated by trees); strip of Sparta fine sand, gently undulating, on terrace in background separates Elsmere soil from Dune sand, stabilized, rolling, in far background. *B*, Part of Hawley Flats—Elsmere loamy fine sand with pond and haystacks in foreground; Valentine fine sand, undulating, just beyond haystacks; Dune sand, stabilized, rolling, in background.

reworked by wind. The surface is nearly level to gently sloping, except where it is crossed by old stream channels. The important soils occurring in association with this one are the Valentine and Loup and Dune sand, stabilized. The soil supports a rank growth of coarse prairie grasses; important species are big bluestem, switchgrass, Indiangrass, western and slender wheatgrasses, and needlegrasses.

Profile description:

0 to 9 inches, dark grayish-brown loose loamy fine sand with abundant organic matter; slightly acid to alkaline; 8 to 12 inches thick.

9 to 14 inches, light grayish-brown loose fine sand; slightly acid to slightly alkaline; 4 to 6 inches thick.

14 inches+, light grayish-brown or light-gray loose fine sand or mixture of sand and gravel, with scattered dark-brown stains; may have a little free carbonate of lime in lower part; a few to many feet thick.

This soil is similar to the Loup soil but somewhat less poorly drained. It absorbs water easily and quickly, so surface drainage channels are few. Most of the drainage is subterranean. As explained in the section on Physiography, Relief, and Drainage, the sheet of underground water below the sandhills section is not stagnant, but moving. Consequently, surface water soaks through this porous Elsmere loamy fine sand, unites with the ground water a few feet below the surface, and then flows away with it. In very wet seasons the water table approaches the surface, and it seldom falls lower than 8 feet. In spite of their low position, areas of this soil on the bottom lands are seldom flooded.

Use and management.—The large quantity of decayed plant remains mixed in the surface layer gives this soil a fairly high water-holding capacity in spite of its coarse texture. The low protected position occupied by most bodies of this soil safeguard against severe wind erosion. Nevertheless, it is not a good soil for cultivated crops. After it is tilled a few years the soil humus is largely exhausted, and consequently the water-storage capacity is reduced and the susceptibility to wind erosion is greatly increased.

Some strips have been plowed, but almost all this soil is now used for hay. The high water table provides ample moisture for grasses in nearly every season, and the smooth surface makes it easy to operate mowing machines. Many ranches have seeded timothy, redtop, and alsike or red clover in the native grass, thereby increasing yields about 50 percent and also improving the quality of the hay.

It is not likely that this soil will ever be extensively used for anything but grass. Certainly, over a period of years, returns from hay production will be more dependable than those to be had from attempts at tillage.

Elsmere-Valentine loamy fine sands, gently undulating (EB).—In some valleys in the sandhills Elsmere loamy fine sand and Valentine loamy fine sand, undulating, are so intricately mixed that it is not practical to map them separately. They are therefore shown on the map as a complex. Numerous areas, ranging from 10 to 100 acres, occur in the north-central part of the county, most of them within larger areas of typical Valentine soils.

The complex is characterized by many mounds or hummocks of light-colored Valentine loamy fine sand, undulating, separated by swales occupied by dark-colored Elsmere loamy fine sand. The mounds are not more than 3 feet high nor more than a few square rods in extent; the swales are generally less than 100 feet wide. The sand for the soils of this complex was deposited by wind and blown into low hummocks. The porous sand permits subsurface drainage of water. Surface drainage is imperfectly developed or absent. The vegetation on the hummocks is somewhat different from that on the swales. Valentine loamy fine sand, undulating, which occupies the hummocks, has a thin cover of sand reedgrass, needlegrass, little bluestem, and other grasses. Elsmere loamy fine sand, in the swales, has a rank grass cover that includes more of the tall species.

The profiles of these two soils must be considered separately. That of Elsmere loamy fine sand is described on page 28, and that for Valentine fine sand, undulating, on page 37.

Use and management.—The alternating patches of the two soils making up this complex are so small that they cannot be managed separately. Both soils are sandy and erodible and better suited to grazing than to cultivated crops. The complex is used almost exclusively for production of native hay. The hay in the swales is coarser and less palatable than that on the mounds, but in harvesting, the hay from the two sources is mixed and the product of the mixing is hay of fairly good quality. Ranchers seed timothy and clover on some of this land, which improves both the yield and quality of the hay.

Gannett fine sandy loam (GA).—This thick, dark, wet soil occurs in enclosed basins, valleys, and swales in the sandhill section, largely in the northern part of the county (fig. 11). The lower parts of the

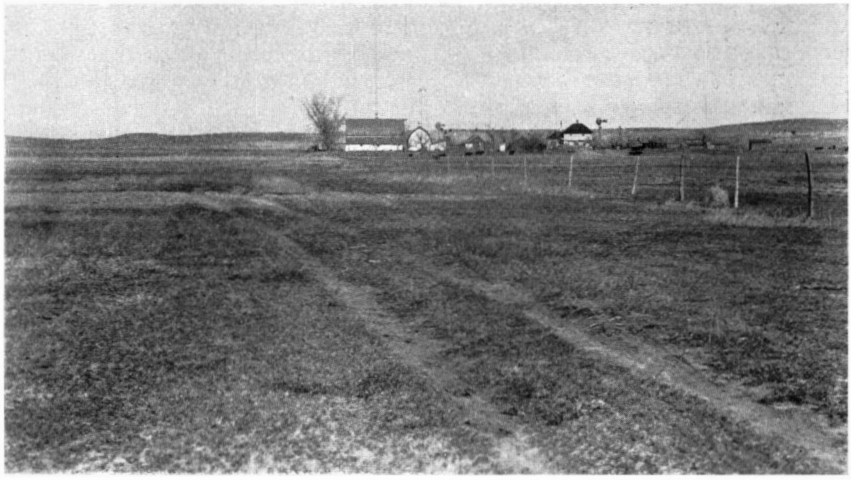

FIGURE 11.—Ranch buildings in north-central part of the county: Gannett fine sandy loam in foreground; buildings on Valentine fine sand, undulating; Dune sand stabilized, rolling, in background.

depressions in which this soil occurs are commonly marshes, ponds, or lakes. Most areas are surrounded by Valentine soils. The better drained areas have a rank growth of tall grasses of about the same species as are characteristic of Elsmere soils. Sedges and rushes predominate in the wetter places.

The soil is largely composed of sand deposited by wind in the same way that the sand composing Valentine soils and Dune sand, stabilized, rolling, was laid down. More vegetation grows in the wet places; this is one of the reasons that this soil of the depressions is darker and deeper than soils from similar material on higher ground. Another reason is that decomposition of organic materials is slower.

Profile description:

0 to 11 inches, dark grayish-brown fine sandy loam of single grain or weak granular structure; matted with grass roots and contains abundant organic matter; easily penetrated by roots, water, and air; neutral in reaction; 8 to 14 inches thick.
11 to 30 inches, grayish-brown or gray loose fine sand with many dark-brown streaks and spots; fewer roots and much less organic matter than in first layer; neutral to slightly alkaline; 12 to 25 inches thick.
30 to 34 inches, light bluish-gray or light greenish-gray plastic sandy clay mottled with pale yellow and yellowish brown; neutral to slightly alkaline; moisture and roots penetrate with difficulty; 2 to 6 inches thick.
30 inches+, pale-brown or light yellowish-brown loose fine sand similar to that in the substratum of Dune sand, stabilized, rolling; a few to many feet thick.

Use and management.—This soil has good water-storage capacity, is high in organic matter and capable of easy tillage, and lies in positions protected from the wind. These factors favorable to cultivation are offset by poor drainage and sometimes waterlogging. It is generally impractical to attempt drainage. Hay is cut from almost all areas; the yield is good but the quality is rather poor. This soil is best used for hay, particularly if the wild grasses are supplemented by seedings of tame grasses and legumes. Many ranchers now practice such seeding.

Gannett loamy fine sand (GB).—This is another deep, dark soil of the enclosed wet basins, valleys, and swales. It occurs mostly in the northern part of the county. From Gannett fine sandy loam it differs principally in texture of its surface layer. It occurs in level or nearly level slightly better drained sites around the edges of depressions in association with Gannett fine sandy loam and Valentine soils. Like Gannett fine sandy loam, it has no surface drainage and is kept almost continuously moist by seepage from surrounding sandhills. It supports the same grass species as Gannett fine sandy loam but has no areas so wet as to be favorable for rushes.

Profile description:

0 to 10 inches, dark grayish-brown loose loamy fine sand matted with grass; high organic-matter content; easily penetrated by roots, water and air; 8 to 14 inches thick.
10 to 30 inches, yellowish-brown loose fine sand highly stained with dark-brown streaks and splotches; fewer roots and much less organic matter than in layer above; 15 to 25 inches thick.
30 to 34 inches, light greenish-gray or light bluish-gray plastic sandy clay not easily penetrated by roots or water; 2 to 6 inches thick.
34 inches+, pale-brown or light yellowish-brown loose fine sand like that underlying Dune sand, stabilized; a few to many feet thick.

Salts that injure growing plants have accumulated at the surface in some locations. In these places the top 1- or 2-inch layer is gray and loose, and the rest of the surface soil is dark grayish brown and cloddy. These salty areas are indicated on the soil map by a special symbol; they commonly support only a sparse vegetation.

Use and management.—None of this soil is drained well enough for cultivated crops. Even if it were, it probably would deteriorate rapidly under cultivation because it is so loose and sandy. Almost all the areas are used for hay. Yields of hay are nearly as much as on Gannett fine sandy loam, but, as for that soil, the hay is not of high quality unless tame grasses and legumes have been sown among the native grasses.

Gannett-Valentine loamy fine sands, gently undulating (Gc).—Where the surface of some of the undrained sandhill valleys, basins, and pockets have been reworked by wind into low hummocks or mounds separated by narrow swales, light-colored Valentine loamy fine sand has developed on the mounds, and dark-colored Gannett loamy fine sand in the low wet swales. The two soils are mapped as a complex because they occur as small bodies in such intricate pattern that it is not practical to map them separately. The few small bodies of this complex are in the sandhills section of the county. They usually occur within areas of Valentine soils and are associated with Gannett soils.

This complex has no outlets for surface drainage. Gannett loamy fine sand has inadequate subsurface drainage, is often waterlogged, and is usually moist throughout the profile. Valentine loamy fine sand is better drained, at least in the upper few feet. Descriptions of Gannett and Valentine soils will be found on pages 31 and 37, respectively.

Sand-loving grasses dominate in the vegetation on both soils of this complex. The grasses in the low places are generally taller and thicker growing than those on the mounds.

Use and management.—The areas of the two soil types in this complex are too small to be used and managed separately. Anyway, neither soil is well suited to cultivation; one has poor drainage, the other is droughty and tends to erode easily. The complex is used almost exclusively for hay. Grasses taken from the mounds (Valentine loamy fine sand) are more palatable, though smaller in amount, than those from the swales (Gannett loamy fine sand). By mixing during harvesting, hay of fair quality is obtained. The practice of sowing timothy and clover in hay meadows produces better hay and more of it.

Haxtun loamy fine sand (Ha).—This thick dark-colored friable sandy soil developed on smooth nearly level uplands in association with Valentine soils and Colby-Anselmo loamy fine sands. Only one area of it occurs in the county; it is just south of the Middle Loup River in Township 21 North, Range 23 West.

The soil has very slow runoff because it is level and rapidly absorbs water. Water stands in low places after heavy rains. Internal drainage is medium. The native vegetation was mixed grasses, chiefly grama grass, buffalograss, needlegrass, and western wheatgrass. Nearly all the soil is now cultivated.

Profile description:

0 to 15 inches, grayish-brown, single grain loamy fine sand, well supplied with organic matter; 10 to 17 inches thick.
15 to 30 inches, brown heavy sandy loam or sandy clay loam; massive or blocky; friable; somewhat lighter colored in the lower part; calcareous in the lower few inches; 10 to 20 inches thick.
30 inches+, pale-yellow or light-gray calcareous floury silt; 2 to several feet thick.

In a few places the surface soil texture is a loam, and in a few others it is fine sand.

Use and management.—With only reasonable care, this soil will continue to be productive. It is well adapted to most of the common crops of this region. The principal crops grown are corn, rye, and oats. Sweetclover does well. Alfalfa is not particularly successful on this soil, and it is too sandy to be well suited to oats.

Loup fine sandy loam (La).—This dark-colored immature soil occupies broad basins, narrow valley floors, and long very gentle slopes in the sandhills (see fig. 5, *A*, p. 7). Its generally level to very gently sloping surface is locally modified by low mounds, small shallow depressions, and shallow drainage channels. The most extensive areas occur along sandhill streams in association with Valentine and Elsmere soils. The Loup soil is wetter than either the Valentine or Elsmere. Gannet fine sandy loam, which resembles Loup fine sandy loam, occurs in undrained basins and valleys and is consequently a wetter soil.

The drainage of Loup fine sandy loam is everywhere adequate for grasses, but the water table rises during wet periods. There is little runoff, for the soil soaks up water rapidly. The water table is high; it is 2 to 4 feet below the surface most of the year and seldom as low as 6 feet, even in dry seasons. Plant roots can reach moist soil at all times.

The native vegetation consists of coarse grasses and other herbaceous plants. Among the plants represented are big bluestem, switchgrass, western and slender wheatgrasses, wild timothy, Indiangrass, needlegrasses, and small sedges and rushes.

Profile description:

0 to 8 inches, beneath a thin dark mulch of decomposed and partly decomposed plant remains, a dark grayish-brown friable fine sandy loam of soft granular structure that contains abundant organic matter; 6 to 10 inches thick.

8 to 12 inches, slightly coherent grayish-brown loamy fine sand containing much less organic matter than the surface layer; 2 to 6 inches thick.

12 inches+, loose light grayish-brown or light-gray fine sand or mixture of sand and gravel; shows many dark-brown streaks and spots; a few to many feet thick.

In places, the second layer is absent. A thin gray limy layer sometimes occurs at the surface. It is thought that this limy layer appears and disappears according to water movements in the soil and evaporation, which, in turn, are regulated by weather. A few small patches of Loup fine sandy loam have a more limy and more silty subsoil than is generally characteristic. Included with this soil are small areas of Loup loam and Loup very fine sandy loam.

Use and management.—The water table rises so high in Loup fine sandy loam during wet periods that cultivated crops drown out in most fields. Most areas are therefore used for hay.

Grass grows in thick luxuriant stands that yield good crops of hay. The native hay is coarse and less nutritious than that cut from better drained upland soils. The common practice of sowing timothy and alsike and red clovers in meadows improves both the quality and the yield of hay.

Riverwash (Ra).—This land type consists of sand bars and islands in the North Loup, Middle Loup, and Dismal Rivers. It is not a soil but a recent, unstable, and variable accumulation of sand. Its surface lies only a few inches above the normal water level. During floods it is eroded and its boundaries move. Then, as floods subside, more sand is deposited and the boundaries are changed again. Essentially all the organic matter it contains, and that is a very small amount, comes from eroded soil areas and is deposited with the sand.

Riverwash is the first stage in the development of an alluvial soil such as Sarpy loamy fine sand. It now supports an open growth of small willows and cottonwood trees. A soil will develop as these trees grow larger and grass comes in to further bind the surface layer and add organic matter.

Use and management.—Because of its position, size of individual areas, and danger of flooding, none of the Riverwash is farmed. It is of little value even for pasture.

Rough broken land, Colby soil material (RB).—This land type occurs as small strips in the southeastern part of the county where steep or very steep slopes have been cut into the soft loess hills. The total area is relatively small. The areas lie along deeply entrenched drainageways. Narrow intermittent stream valleys, gullies, sharp ridges, knobs, and bluffs characterize the landscape. In some places the surface is bare or nearly so. The slope is generally so steep that the rate of erosion equals or exceeds the rate of weathering and organic-matter accumulation; consequently, no soil can develop. A few patches included with Rough broken land have Colby-like soils developed to depths of 12 to 18 inches, but most areas of this land type have either barren loess exposures or a thin dark-colored surface soil overlying nearly raw loess.

The phrase "Colby soil material" is attached to the name of this land type because the loess in which it has formed is the same as that in which Colby soils develop. If the relief were a little less, Colby soils would doubtless develop in these areas now called Rough broken land.

Runoff is excessive; on some slopes during heavy rains it is nearly complete. The land absorbs only a little water, and that rather slowly. Water erosion is severe during nearly every rain. Wind erosion is active at all times when the surface is not moist.

Most of this land has an open stand of trees and an undercover of grasses. The trees are predominantly cedars and elms; blue grama predominates among the grasses.

Use and management.—This land type is used for grazing. It is too steep and too cut up by erosion to be cultivated, even if there were good soils on it.

There is little the farmer or rancher can do to protect or improve this land other than control grazing and prevent grass fires. Some of the trees are used locally for fence posts and fuel.

Sarpy loamy fine sand (SA).—This is a light-colored sandy alluvial soil developing on bottom lands along the North Loup, Middle Loup, and Dismal Rivers and other larger streams. The bottom lands are generally nearly level. Locally, old stream channels, low mounds, and shallow depressions mark their surfaces. Soils of several other series occur in association with the Sarpy. Among these are Loup fine sandy loam, a much darker, more poorly drained soil; Sparta fine sand, gently undulating, a loose very sandy light-colored soil of higher terraces; and Anselmo loamy fine sand, gently undulating, a dark-colored well-drained soil of uplands.

Sarpy loamy fine sand is forming in sands recently deposited on flood plains by streams; that is, the same material of which Riverwash is composed. Surface drainage is slow to very slow. The soil

is occasionally flooded, but surplus water drains off or is absorbed by the porous sands soon after the streams subside. The water table lies within 10 feet of the surface in most places; it fluctuates with the stages of the adjacent stream and rises enough in wet seasons to produce temporary marshes in some of the low spots. Willow, cedar, and cottonwood trees and coarse grasses grow on this soil.

Profile description:

0 to 5 inches, grayish-brown loose loamy fine sand containing only a little organic matter; easily penetrated by air, water, and plant roots; medium water-holding capacity; neutral reaction; 4 to 6 inches thick.

5 inches+, pale-brown, light grayish-brown, or light-gray incoherent fine sand with many dark-brown stains and streaks; very low in organic matter; easily penetrated by roots, air, and water; neutral to slightly alkaline; a few to many feet thick.

This soil is generally low in free carbonate of lime. If any carbonate exists, it is usually below a depth of 30 inches. In places the lower part of the soil is constantly moist because of the high water table.

Use and management.—This soil is not a good one for cultivated crops; it is loose, sandy, and sometimes flooded. A few patches are used for corn, rye, and sweetclover, but the yields are low. Most of the soil is in pasture or woodland. Trees are cut for fuel and fence posts. The grazing capacity is only fair.

Sowing of tame grasses on the better drained, higher areas will improve the quality and increase the quantity of forage. Providing artificial drainage probably would not be practical for most places. Prevention of fire and of overgrazing will permit the soil to develop greater stability and productivity.

Sparta fine sand, gently undulating (Sc).—This is a young light-colored soil forming on level to undulating sandy and gravelly terraces (see fig. 10, *A*, p. 28). It occurs in many places along the North Loup, Middle Loup, and Dismal Rivers. The terraces (or benches) on which it occurs are 10 to 50 feet above the bottom lands. The surface of some of the terraces has been reworked by wind. This reworking has produced areas in which a complex pattern of Sparta and Valentine fine sands, undulating, has developed (see page 36 for description).

On the upland side, Sparta fine sand, gently undulating is usually adjoined by Valentine soils, Dune sand, stabilized, or Sparta-Valentine fine sands, undulating. On the bottom-land side, it is generally bordered by Sarpy loamy fine sand or Loup fine sandy loam.

Water that falls on or runs onto Sparta fine sand, gently undulating, is rapidly absorbed; consequently, there are few surface drainage channels. Internal drainage is very rapid, and the water-holding capacity is low. A moderate growth of tall grasses, such as sand reedgrass and the needlegrasses, covers this soil.

The profiles of Sparta fine sand and Valentine fine sand are hard to tell apart. The Sparta soils are developing in water-laid stratified sand and gravel, whereas the Valentine are on wind-blown deposits. Sparta soils generally occur on smoother topography than the Valentine soils. The following is a profile description of Sparta fine sand, gently undulating:

0 to 6 inches, grayish-brown loose fine sand with enough organic matter to have a somewhat darker color than the rest of the soil; slightly to medium acid; 3 to 10 inches thick.

6 to 14 inches, somewhat lighter colored loose fine sand with only faint traces of organic matter; slightly acid; 6 to 10 inches thick.
14 inches+, light grayish-brown loose fine sand; slightly acid to neutral; a few to many feet thick.

Water-worn pebbles are scattered throughout the soil. Some of the pebbles are coated with carbonate of lime, but the sand contains no carbonates in free form.

Included with this soil are a few patches of Sparta sand, which is not mapped separately in this county. Also, there are some small areas where the water table is high, or only 4 to 6 feet below the surface; these places support a more abundant growth of grasses.

Use and management.—This soil drifts badly with the wind if it is not protected by a plant cover. Also, its droughtiness makes it unsuitable for cultivation. It is used for pasture and hay. It should not be plowed. Bare areas that develop from overgrazing or other causes should be reseeded.

Sparta gravelly sand, gently sloping (SD).—The few acres of this soil in the county are found on sloping faces of terraces. It is developing in the gravelly sands that commonly underlie all Sparta soils of this region. Except for its gravelly texture, its profile is essentially the same as that of Sparta fine sand, gently undulating. Water erosion, however, is much more active than on Sparta fine sand, gently undulating. The soil supports only a sparse growth of tall grasses, cactus, and shrubs.

Use and management.—The topography, very low water-holding capacity, and erodibility of this gravelly sand make it unsuitable for cultivation. It is used principally for pasture. Gravel for road surfacing is taken from a few places.

Sparta-Valentine fine sands, undulating (SE).—This complex occurs along most of the larger streams where wind has reworked the surface of the terraces to produce rolling to hummocky relief. In these wind-reworked areas Valentine and Sparta sands occur in patches so small they cannot be mapped or farmed separately. This is in contrast to most terrace areas in the county, which have not been reworked by wind and on which soils usually can be mapped separately; for example, as Sparta fine sand, gently undulating; Valentine fine sand, undulating; Cody fine sandy loam, level; or Cody loamy fine sand, gently undulating.

Surface drainage is generally lacking on the high benches where this complex occurs. Rain is absorbed as rapidly as it falls. Internal drainage is very rapid, and the water-holding capacity is low. The soils are droughty. The native vegetation is a rather sparse cover of tall grasses, including sand reedgrass, needlegrass, big bluestem, and little bluestem.

In appearance, the two soils of this complex are little different. Both have thin dark surface layers underlain by light-colored nonlimy loose fine sand. In parent material and topography they differ. Sparta fine sand is on rather smooth more or less stratified alluvial deposits, whereas Valentine fine sand is on hummocky or rolling wind deposits. This complex differs from Sparta fine sand chiefly in topography. The two soils of the complex are described on page 35 and 37, respectively.

Use and management.—This complex is not cultivated. The soils are too droughty and too erodible. Some areas are used for hay, but more for pasture. Hay has about the same yield and carrying capacity as on Sparta fine sand, gently undulating. Range management practices suggested for Valentine fine sand, undulating, and Sparta fine sand, gently undulating, are appropriate for this complex.

Tripp fine sandy loam (TA).—This is a thick dark loamy soil on nearly level to gently undulating and sloping terraces that lie above the flood level of present streams. Many areas of it occur along the south side of the North Loup River (see fig. 5, *B*, p. 7). Dune sand stabilized, and the Valentine soils usually lie on the upland side of the terraces on which this soil occurs. Cody soils may occupy parts of the same terraces. Adjoining flood plains commonly have Elsmere and Loup soils on them.

Before streams cut down to their present levels, the terraces occupied by this soil were flood plains. Rivers and creeks deposited sand, silt, and clay on these flood plains, and this loamy alluvium is the parent material for Tripp fine sandy loam.

Surface and internal drainage are good but not rapid. The soil lies 20 to 50 feet above the bottom lands and has sufficient slope to carry off excess water. Virgin areas have good cover of blue grama, buffalo, and bluestem grasses.

Profile description:

0 to 14 inches, grayish-brown friable fine sandy loam of fine granular structure; contains an abundance of organic matter; high water-holding capacity; easily penetrated by plant roots, air, and water; neutral in reaction; 10 to 16 inches thick.

14 to 24 inches, light grayish-brown friable weak blocky loam or heavy fine sandy loam; neutral in reaction; 8 to 14 inches thick.

24 to 34 inches, very light grayish-brown or nearly white friable massive loam or fine sandy loam; contains finely divided free lime carbonate; 8 to 14 inches thick.

34 inches+, very light grayish-brown slightly limy coherent fine sandy loam; 10 to 80 or more inches thick.

As mapped in this county, Tripp fine sandy loam includes a few small patches of very fine sandy loam.

Use and management.—This is one of the more fertile soils of the county. It does not erode badly when cultivated. It lies in positions where it receives some extra moisture from higher land through runoff and seepage. It has great ability to absorb and store moisture, and is easy to till. For these reasons it has no particular management problems and is one of the best soils for crops in the county.

Practically all areas are cultivated. All the crops commonly grown in the region yield well. More corn is grown than any other crop. Wheat, rye, barley, and alfalfa rank next in order of acreage.

Valentine fine sand, undulating (VB).—This immature light-colored very sandy soil is forming in wind deposits on nearly level to rolling uplands. Some areas are level, gently sloping, or undulating; others are on rounded hummocks and ridges 5 to 20 feet high, between which there are depressions. The characteristic surface appearance of this soil is shown in figure 3, page 5.

This soil occurs everywhere except in the extreme southeastern corner of the county. Next to Dune sand, stabilized, rolling, it is the

most extensive soil in the county. There is hardly another soil that is not somewhere associated with it. Many areas of it are in and around large bodies of Dune sand, stabilized, rolling. This soil also borders strips of Loup and Elsmere soils, which are in basins and valleys.

The sand in which this soil is developing had the same origin as that in the sand dunes. It was blown out of the river bottoms and from areas of sandstone and sandy soils and redeposited. Any fine material, such as silt and clay, that may have been in the sandstone or soils being eroded was separated and deposited farther away from the source.

There are no surface drainage channels because all water falling on Valentine fine sand, undulating, is absorbed almost immediately. Internal drainage is rapid, and the water-holding capacity is low. Tall coarse grasses provide a sparse cover. The dominant species are sand reedgrass, big and little bluestems, and needlegrass.

Profile description:

0 to 4 inches, grayish-brown loose or slightly coherent fine sand containing little organic matter; easily penetrated by water, air, and plant roots; low water-holding capacity; neutral in reaction; 2 to 8 inches thick.

4 to 12 inches, light grayish-brown loose fine sand with little or no organic matter; 6 to 12 inches thick.

12 inches+, loose fine sand, slightly lighter colored than layer above; 3 to many feet thick.

There is no free carbonate of lime in this soil.

Use and management.—This soil has little value for cultivated crops; it tends to blow severely when the grass cover is destroyed. Grass is cut for hay on a few areas in sandhill valleys; the rest is used for pasture. The soil is more valuable than Dune sand, stabilized, rolling, for both hay and pasture.

Blowouts develop quickly where the grass has been killed by overgrazing and trampling. These bare spots spread and damage nearby soils. A serious problem in erosion control involving many acres may develop. It is therefore important to prevent overgrazing and to protect the grass around water tanks and wells. Blowouts that develop in spite of these precautions can be fenced, covered with straw, manure, or brush, and reseeded to grass. The necessity of preventing loss of range cover through fires is generally recognized.

Valentine fine sand, undulating, severely eroded (Vc).—Small patches of this fine sand occur in nearly all parts of the county—in old cultivated fields and around water tanks, windmills, and abandoned farmsteads. The native grasses were destroyed by plowing or by livestock and vehicle traffic. The unstable sands soon began to drift and blow about, thus extending the size of the original spots. The present surface consists of low flat ridges and shallow swales (see fig. 6, p. 11). Some areas have partly revegetated with grasses and weeds; many are still actively eroding and increasing in size.

The soil profile is about the same as that of Dune sand, stabilized, rolling. In many places the surface dark layer is very thin or lacking, and the entire soil section consists of light-colored loose sand.

Use and management.—Actively eroding areas of this soil will be useless until they have been stabilized. By fencing them, applying some protective cover such as straw, hay, or manure, and seeding

grasses, they may eventually be useful grazing land. Farmers have set out cottonwood seedlings on some places, and this appears to be a good way of preventing further erosion. Areas that have grown up to grass and weeds provide mediocre pasture.

Valentine fine sand, level (VA).—This fine sand occurs near the centers of the larger dry valleys and basins in the sandhills. Except for level instead of undulating topography, it is essentially the same as Valentine fine sand, undulating. The profiles of this soil cannot be distinguished from those of Valentine fine sand, undulating.

Use and management.—Practically none of Valentine fine sand, level, is cultivated. More of it than of Valentine fine sand, undulating, is used for hay, but grazing is still its important use. The weaknesses and limitations of this soil are the same as those of Valentine fine sand, undulating. In carrying capacity and productivity for hay, this soil is little if any better than Valentine fine sand, undulating.

USE, MANAGEMENT, AND PRODUCTIVITY OF BLAINE COUNTY SOILS

This section points out the general problems of soil management in Blaine County, and to some extent their intensities. It is intended as a general guide to good soil management, not as a plan of management for individual farms. The individual farmer or rancher can achieve the most efficient management only if he considers many factors in addition to those strictly related to the soils. He will need to interpret the management practices and yield estimates given in this report in terms of economic conditions on his particular farm and in terms of changes in general economic conditions. He will also consider new information constantly becoming available from research conducted at State experiment stations and other places. Farmers can obtain much specific information on new methods of management from the Nebraska Agricultural Experiment Station, the Extension Service, the Soil Conservation Service, and other State and Federal agencies concerned with agriculture. Soil tests provide some guide to fertility needs.

LAND CLASSIFICATION AND SOIL MANAGEMENT

The soils of Blaine County have been placed in three agricultural suitability classes: (1) Soils suited to cultivation, (2) soils suited mainly to hay, and (3) soil and land types suited mainly to pasture.

SOILS SUITED TO CULTIVATION

The soils suited to cultivation are the well-drained dark-colored friable ones on terraces along larger streams and on the smoother uplands in the southeastern corner of the county near the loess hills. These soils cover only a small percentage of the county but are the most productive for cultivated crops. In comparison with soils in eastern Nebraska, however, they produce low yields. The soils are listed as follows:

Anselmo fine sandy loam, level
Anselmo loamy fine sand, gently undulating
Anselmo loamy fine sand, level
Cody fine sandy loam, gently undulating
Cody fine sandy loam, level
Colby-Anselmo loamy fine sands, gently undulating
Haxtun loamy fine sand
Tripp fine sandy loam

These soils generally are sandy and low to moderately low in fertility. Water moves into them rapidly and is held mainly below the surface few inches. The result is lower evaporation losses. Although the water-holding capacity is low to medium, most of the water is available to plants. For these reasons, during periods of low rainfall, crops are often better on these soils than on the more silty soils. These soils are highly susceptible to wind erosion when cultivated. Providing a vegetative cover, stubble mulching, and other practices that aid in control of wind erosion are desirable. The popularity of rye in this region results partly from the fact that it provides cover for the soil for a long period during the year. A high level of fertility is important in maintaining a good cover. Applying manure is a means of increasing the fertility. Little commercial fertilizer has been used on these soils in the past, but in the future it may become an important means of maintaining a high level of fertility.

SOILS SUITED MAINLY TO HAY

The soils suited mainly to hay cover most of the subirrigated bottom lands and upland swales. They generally are not suited to cultivated crops because their water table is too high during much of the year. Nevertheless, this water table, usually within 2 to 4 feet of the surface, is the reason they are very productive for hay crops. The soils of this group are the following:

Elsmere loamy fine sand
Elsmere-Valentine loamy fine sands, gently undulating
Gannett fine sandy loam
Gannett loamy fine sand
Gannett-Valentine loamy fine sands, gently undulating
Loup fine sandy loam

Management of these soils for hay production is simple, but there are possibilities that improved management will increase productivity. Recent work by the Nebraska Agricultural Experiment Station indicates that productivity can be increased by seeding clovers in the meadows and by using nitrogen and phosphate fertilizers. The adoption of these two practices may increase yields of hay much above those given in this report (see table 5, page 42). Also, the quality of the hay can be improved by sowing clovers or other legumes in the native hay meadows. Weeds are a problem in some meadows.

SOILS AND LAND TYPES SUITED MAINLY TO PASTURE

Soils and land types suited mainly to pasture cover most of Blaine County and are the principal land resource in this part of Nebraska. They are too sandy or too steep for cultivation. Sarpy loamy fine sand and Riverwash, in addition to being sandy, are flooded occasionally. All these soils and land types are used principally for cattle grazing. They are listed as follows:

Anselmo loamy fine sand, undulating
Cody loamy fine sand, gently undulating
Colby-Anselmo loamy fine sands, rolling
Colby fine sandy loam, eroded undulating and rolling.
Colby fine sandy loam, severely eroded, rolling
Dune sand, rolling and hilly
Dune sand, stabilized, hilly and steep
Dune sand, stabilized, rolling
Riverwash
Rough broken land, Colby soil material
Sarpy loamy fine sand
Sparta fine sand, gently undulating
Sparta gravelly sand, gently sloping
Sparta-Valentine fine sands, undulating
Valentine fine sand, level
Valentine fine sand, undulating
Valentine fine sand, undulating, severely eroded

Four soils of this group have limited possibility for cultivated crops: Cody loamy fine sand, gently undulating; Anselmo loamy fine sand, undulating; Colby-Anselmo loamy fine sands, rolling; and Colby fine sandy loam, eroded undulating and rolling. Nevertheless, the hazard of wind erosion, water erosion, or both, is generally considered too great.

PRODUCTIVITY

The soils of Blaine County vary a great deal in carrying capacity, but for all of them the problems are essentially those concerning range management. Proper grazing and prevention of fires are important. Not only the number and kind of livestock but also the proper distribution of the grazing animals within the pastures is important. Proper distribution can be achieved by various means such as placement of salt and location of watering tanks. Overgrazing is one of the greatest dangers, as well as one of the greatest temptations.

The importance of range management is well recognized by the ranchers and farmers in the sandhills. Old cattlemen report that the range will now carry 25 to 50 percent more cattle than it would 50 years ago. This is the result of better range management, including the prevention of grass fires.

The productivity of soils mapped in this county can be judged from table 5, which gives estimated average acre yields for field crops and native hay and the carrying capacity of native pasture. Productivity of the soils is measured primarily in terms of hay and pasture production, because this is cattle country. The early settlers fortunately recognized that most soils in the county are sandy and that they drift soon after the native sod is broken.

In table 5, the estimates of pasture carrying capacity are based on fair to good range conditions. The estimates for hay are based on ordinary native meadows, which have little legume growth and receive no fertilizer. These native meadows supply some grazing after hay is harvested. The estimates for cultivated crops are based on average management, which included some rotation of crops but limited use of legumes, no application of fertilizer, and addition of only a little manure. In the sandhill district much of the manure is used to control wind erosion of roads.

The yield predictions in table 5 are based on information from many sources. State and Federal census data provided excellent information on general yield levels. Much information came from research work conducted by the Nebraska Agricultural Experiment Station and other stations. Additional information on the relative productivity of different soils was obtained by agricultural workers who observed crops on different soils. Many farmers and ranchers consulted by soil survey personnel provided estimates and judgments concerning the differences among soils on their holdings.

AGRICULTURE

The early settlers soon realized that few of the soils in Blaine County were suitable for cultivated crops. The few fields of sandy land they cultivated started to drift. In general, crops produced low yields

TABLE 5.—*Predicted average acre yields of important crops and pasture on soils of Blaine County, Nebr., under average management*

Map symbol	Soil	Corn	Rye	Forage sorghums	Oats	Barley	Native hay	Native pasture
		Bu.	*Bu.*	*Tons*	*Bu.*	*Bu.*	*Tons*	*Cow-days per acre* [1]
AB	Anselmo fine sandy loam, level	20	10	2.2	24	22	0.5	20
	Anselmo loamy fine sand:							
AC	Gently undulating	16	9	1.8	20	18	.5	20
AD	Level	16	9	1.8	20	18	.5	20
AE	Undulating	14	8	1.6	16	14	.5	20
	Cody fine sandy loam:							
CA	Gently undulating	22	12	2.3	24	22	.6	25
CB	Level	24	13	2.4	26	24	.7	30
CC	Cody loamy fine sand, gently undulating	12	7	1.4	12	10	.4	17
	Colby-Anselmo loamy fine sands:							
CD	Gently undulating	18	10	1.8	22	20	.6	25
CE	Rolling	14	9	1.6	20	18	.5	20
	Colby fine sandy loam:							
CF	Severely eroded rolling						.1	15
CG	Eroded undulating and rolling	14	9	1.6	20	18	.5	20
	Dune sand:							
DA	Rolling and hilly						(2)	1
DB	Stabilized, hilly and steep						.2	10
DC	Stabilized, rolling						.2	13
EA	Elsmere loamy fine sand						1.0	45
EB	Elsmere-Valentine loamy fine sands, gently undulating						.7	30
GA	Gannett fine sandy loam						1.2	55
GB	Gannett loamy fine sand						1.1	50
GC	Gannett-Valentine loamy fine sands, gently undulating						.8	35
HA	Haxtun loamy fine sand	20	11	2.2	24	22	.8	40
LA	Loup fine sandy loam						1.2	55
RA	Riverwash						(2)	5
RB	Rough broken land, Colby soil material						(2)	10
SA	Sarpy loamy fine sand						.2	15
SC	Sparta fine sand, gently undulating						4	15
SD	Sparta gravelly sand, gently sloping						(2)	5
SE	Sparta-Valentine fine sands, undulating						.4	16
TA	Tripp fine sandy loam	26	14	2.4	30	28	.8	40
	Valentine fine sand:							
VA	Level	8	6	.8			.5	20
VB	Undulating						.4	17
VC	Undulating severely eroded						(2)	1

[1] A cow-day represents the forage consumed by 1 cow in 1 day; 30 cow-days is equal to 1 animal unit per acre a month.

[2] Hay generally not harvested on this soil.

on them and commonly failed during drought years. In many of the wet sandhill valleys and basins the soils were fertile but yields were low because moisture conditions were favorable for cultivated crops during only a part of the growing season. In many of these localities the water table rose to or nearly to the surface so frequently that grain production was extremely uncertain. Good yields of grain were obtained only on the finer textured more stable soils of the uplands and on the better drained soils of the lowlands. Farming was generally most successful on the medium-textured terrace soils, but the acreage of these is very small. Before long, farmers recognized the difficulty of growing crops on the very sandy soils that covered most of the county. They either left the county or confined their operations to the limited acreages of more suitable soils. Many of them became ranchers.

The present agriculture of the county is in harmony with the soil resources. It centers about production and marketing of livestock, principally beef cattle, for the land is better suited to grazing and production of hay than to cultivated crops. The United States census for 1950 reported that more than 94 percent of the farmland was in pasture or wild hay in 1949.

LAND USE

The land use pattern has changed very little since the county was organized. The people first attracted to the county came to raise livestock. As the need for winter feed became apparent, the better lands were used to produce the cultivated crops needed to feed livestock. Some of the land was plowed during years of high rainfall. When the native sod had decayed and drier cycles occurred, the land was allowed to go back to native grass. Much land is still in the process of reseeding, as it takes years to replace the native sod once it is destroyed. All of the farmland in the very sandy areas has been more or less severely eroded by wind and is not so productive as when first cultivated.

The 1950 census tabulates land in farms according to various uses as follows:

	Acres
Cropland:	
Harvested [1]	116,597
Used only for pasture	2,164
Not harvested and not pastured	4,102
Woodland:	
Pastured	2,109
Not pastured	1,207
Other land pastured (not cropland and not woodland)	357,674
Other land (house lots, roads, wasteland, and so on)	2,796
Total	[2] 486,649

[1] Most of the acreage classified as cropland harvested consists of land in wild hay.
[2] The total acreage for land in farms is more than the approximate land area of Blaine County (455,040 acres) because the entire acreage of each farm was tabulated as in the county in which the farm headquarters was located.

TYPES AND SIZES OF FARMS

Cattle ranches dominate in the agriculture of this county. In 1950, the 186 farms were classified as follows:

Type of farm:	Number
Livestock	147
Dairy	5
Poultry	10
General (crop and livestock)	6
Miscellaneous and unclassified [1]	18

[1] In this county all miscel'aneous and unclassified farms are residential; that is, farms on which the total value of all products sold is less than $250 a year.

The farms and ranches are big and getting bigger. The increase in size is attended by a decrease in number of farms. In 1930 there were 278 farms in the county; in 1940, 276; and in 1950, 186. In 1950 there were 117 farms containing more than 1,000 acres in the county; their average size was 3,864 acres, and they occupied 93 percent of all the land in farms. In 1945, there were 139 farms more than 1,000 acres in size, but their average size was 2,926 acres and they occupied only 89 percent of the land in farms.

In 1950 the farms of the county were classified by size as follows:

Size range:	Number
3 to 259 acres	18
260 to 499 acres	17
500 to 999 acres	34
1,000 and over	117

FARM TENURE

Most of the land in this county is held by full owners or part owners. According to data from the 1950 census, the tenure for the 186 farms of the county was as follows:

Tenure of operator:	Number of farms	Percentage of farms
Full owners	80	43
Part owners [1]	61	32.6
Managers	7	4
All tenants	38	20.4

[1] Part owners usually have full ownership of some land and rent additional acreage.

The number of farms operated by tenants rose from 13 percent of all farms in the county in 1900 to 40 percent in 1935, after which there was a decline to the 20.4 percent reported for 1950. Both share and cash rental systems are used, and sometimes a combination of the two. Most of the cropland is leased by cash tenants. Share tenants are second to cash tenants in number, and share-cash tenants are third. Share tenants furnish machinery, seed, livestock, feed, and labor; they take two-thirds of the grain harvested and have the privilege of pasturing the grain stubble.

Pasture land is generally rented for cash. The rate is based on the area or on the number of livestock grazed. Hay land is usually harvested on a 50–50 basis.

CROPS AND PASTURE

The principal crops are hay, corn, rye, oats, barley, wheat, and sorghums, all grown mainly for feeding livestock. Exclusive of wild hay, the total acreage of crops has never been large; it has averaged about 15,000 acres through the years. From World War I until the middle thirties, the acreage of crops other than wild hay was larger, or 20,000 to 25,000 acres. The acreages of principal crops harvested in 1949 are reported by the United States census as follows:

Crop:	Acres
Wild hay	101,995
Alfalfa	182
Clover or timothy	1,090
Small grains cut for hay	3,178
Other hay	1,783
Corn harvested for grain	4,276
Sorghums for all purposes	863
Rye threshed	3,103
Oats threshed	164
Wheat, barley, and other small grains threshed	65
Total	115,836

Hay.—The acreage of wild hay far exceeds the acreage of all other forage crops and grains combined. The acreage of wild hay is now considerably larger than it has been in the past because more range lands are being cut over for hay. The acreage of wild hay cut varies radically from year to year, depending on the supply of moisture and the need for hay.

Large areas of wild hay are harvested every year in the sandhills, in upland pockets and swales, and in poorly drained places along stream bottoms (see fig. 10, *B*, p. 28). Most of it comes from wet meadows—Loup, Gannett, Elsmere, and Sarpy soils—and from the more level areas of the Valentine soils. The grass is mowed in July and August and raked into bunches or windrows. The work is usually done with tractor-drawn machinery. Some ranchers stack the hay in the meadows, others leave it in the windrow or bunches in the meadows, and yet others haul it in and feed it on the farmstead. A relatively new practice is to bale the hay in round bales and to leave these in the meadows. The quality and quantity of hay vary considerably, depending on soil moisture conditions. Much of the hay is rather coarse, but the average yield is relatively high. Some ranchers have sown timothy and clover among the wild grasses and thereby improved the quality and increased the quantity of hay.

Part of the hay is sold, but most of it is used to carry cattle through the winter. Some hay is fed to horses in all months.

Grains and other cultivated crops.—Grains and forage crops are grown mainly on the finer textured soils of the terraces and undulating loessal uplands. Corn and rye are the most important cultivated crops in this county, partly because they can be grown more profitably on the sandier soils than most other grains.

Corn is much less important in this county than in those of eastern and southern Nebraska where sandy soils are less extensive. The largest part of the corn acreage is on soils of the well-drained terraces and those of the broad sandhill basins.

Corn is planted in the latter part of May, usually with a lister, on land that has been disked to loosen the surface and kill weeds. The crop is cultivated at intervals of 2 or 3 weeks until early in July, after which it receives little attention until harvest. The corn matures late in September or early in October. Much of the crop is picked by hand. All of the corn is consumed in the county, and it generally is necessary to ship additional amounts into the area.

Rye is grown on nearly all soils and in all parts of the cultivated areas. It is usually planted in fall between the rows of corn to prevent soil blowing (see fig. 5, *B*, p. 7). Rye is a good cover crop, and

in addition furnishes pasture late in winter and early in spring. It is grown in rotation with almost every other crop in the county and is the principal crop in all rotations practiced on the very sandy soils. The grain is commonly ground and mixed with corn for livestock feed. Some, however, is usually shipped out of the county.

Oats, wheat, and barley occupy a small part of the cultivated land, usually about 1,000 acres. The acreages of these crops reported in the 1950 census are somewhat lower than in previous years.

Land for oats is usually prepared by disking. The crop is planted in April with a press drill or is broadcast. Oats mature in July. Wheat is adapted only to the fine-textured soils; both the winter and spring varieties are grown. Small grains are frequently cut for hay. Nearly all the small grains harvested are cut and threshed by combines. The commonly grown forage crops are sorghums, millet, Sudan grass, clover, and timothy.

Most farmers and ranchers have small home gardens planted to potatoes and other vegetables, and a few have fruit trees and berry patches.

Native pasture.—Most of the land used for pasture is on the mapping units of Dune sand, stabilized, and on the Valentine soils. Nearly all the range land is fenced, and the major part is privately owned. Some public land is leased. Ranchers estimate that 15 to 20 acres of range land is required to support a cow for a year; the actual acreage in a given year depends on the weather.

LIVESTOCK

Blaine County is cattle country, though other kinds of livestock are raised, especially in the areas that have better cropland soils. The numbers of various kinds of livestock on farms and ranches in the county were reported in the 1950 census as follows:

Livestock:	*Number*
Cattle and calves	29,012
Milk cows	1,018
Calves born since January 1	6,139
Horses, colts, and ponies	1,338
Mules and mule colts	13
Sheep and lambs	145
Hogs and pigs	1,147
Chickens [1]	10,389
Turkeys [1]	1,891

[1] 4 months or more old.

The number of cattle has increased somewhat through the years, but the number of all other kinds of livestock except hogs has decreased. The number of hogs varies considerably from year to year. Sheep are not popular in the sandhills, and their number has decreased continually for many years.

The cattle are high quality locally raised beef breeds. Nearly all the ranchers use purebred bulls, and a few have purebred herds. Grade Herefords predominate, though some Aberdeen Angus are raised (see figs. 7 and 9, pp. 17 and 26). Ranchers usually run cattle on the range the entire year. They supplement the range forage in winter with hay or cottonseed meal, or both. Cottonseed cake is fed at the rate of about 1 pound per head per day, except during very cold and snowy

weather, when the amount is increased. Depending on weather, from 1 to 2 tons of hay per head is required to winter cattle.

A large number of cattle are sold as yearlings and as 2- and 3-year old animals. The practice of selling calves in the fall to be fattened and marketed as "baby beef" has also become common. Few animals are grain fattened in this area, for there is a scarcity of locally grown corn.

Dairy cattle are of minor importance. Nearly all ranchers keep a few dairy animals of mixed breeds. They sell surplus cream and butter at local markets.

Many horses and mules have been replaced by tractors, but they are still essential in carrying out the work on most holdings. The principal breeds are Belgian, Percheron, Thoroughbred, and Arabian and crosses of these breeds with the western bronco. Horses are raised on nearly all farms and ranches but are not important as a source of cash income. Nearly all the horses are raised to maturity on grass and hay. Grain is fed only to the work animals.

Chickens are raised on nearly every farm and ranch. Local demand for poultry products is good, and chicken raising receives considerable attention. Flocks range from 50 to several hundred birds. The principal breeds are Plymouth Rock, Rhode Island Red, Leghorn, and Orpington.

Some farmers annually raise several hundred turkeys for fall and winter markets. Turkeys usually do well in the sandhills, provided they are protected from coyotes. They are fed some milk and grain but subsist largely on insects.

ADDITIONAL FACTS ABOUT THE COUNTY

TRANSPORTATION AND MARKETS

Rail transportation facilities are not well distributed. Parts of the county are more than 25 miles from a shipping point. A line of the Chicago, Burlington, and Quincy Railroad Company crosses the southwestern part of the county and furnishes good shipping connections for Linscott and Dunning, but Brewster, the county seat, and Purdum are without railroads.

The only hard-surfaced road is State Highway No. 2, which parallels the railroad through Linscott and Dunning. State Highway No. 7 connects Dunning and Brewster, and part of it is graveled. The other roads are little more than trails through the sandhills. They are not surfaced, and most of them are not graded. Cattle guards have been built in fences on some of the important sandhill roads, including the mail routes, but on most of the sandhill roads the traveler has to stop and open gates to get through the fences. In 1950 only 7 farms were on a hard-surfaced road, and 26 on a graveled road. The average distance from the farms to an improved road was 5 miles.

COMMUNITY, HOME, AND FARM FACILITIES

The public school system of this county must serve a small scattered population. Most of the schools are small and offer 8 grades. A few larger ones offer 10 or 12 grades. There are six churches in the county. Rural mail routes reach almost all parts of the county.

Farm and ranch buildings are generally painted and kept in good repair (see figs. 8 and 11, pp. 23 and 30). Most of the houses are built of wood, but a few of sod or stones. Barns and outbuildings are usually large enough to store all the crops except hay, which is stacked in the field. The larger cattle ranches generally have better improvements than others in the county. In 1950, nearly 55 percent of the farms and ranches had electricity, and 58 percent had telephones.

Most of the farms and ranches are fenced, usually with barbed wire. The larger ranches have board corrals, branding chutes, dipping vats, and other labor-saving improvements needed in this part of the country.

WATER SUPPLY

Excellent well water in quantity sufficient for family use and livestock is readily obtained in all parts of the county. Throughout most of the uplands, well water is obtained at depths of 40 to 200 feet. The depth to water at any particular location depends on the relief and the thickness of the deposit of sandy and loessal materials over the underlying water-bearing gravel. On the alluvial lands abundant well water can be obtained from sandy stream-laid sediments at depths of 20 to 40 feet.

Rivers, creeks, and ponds are used for watering livestock. There is no extensive irrigation. A few springs issue from the gravelly sands along the three main rivers, and the water is of good quality. Nevertheless, the principal source of stream water in this area is seepage. Underground flow of water keeps streams at a relatively uniform level throughout the year, though there are brief rises during the spring months.

FORESTS AND WILDLIFE

The county has no important forested areas. Creeks and rivers are bordered by irregular patches of deciduous trees such as willow, cottonwood, elm, ash, and hackberry. Shrubs, grasses, and herbs also grow along these streams. The trees grow both on the stream bottoms and on the valley sides, especially on Elsmere, Loup, Sarpy, and Valentine soils and on Riverwash and Rough broken land, Colby soil material. No special effort is made to protect and conserve the native stands of timber. Trees are cut to clear bottom lands for farming or hay production or whenever they are needed for fuel and fence posts.

Tree plantings have been made in the Nebraska National Forest, a part of which extends into this county. These plantings were for demonstration purposes and to provide nursery stock for individual shelter-belt plantings and farmstead groves. Interest in establishing shelter belts has increased, and many plantings have been made, particularly around farm and ranch buildings and livestock feeding grounds. These plantings, aside from the beauty they add to otherwise treeless sandy lands, provide protection for livestock and buildings and afford a cover for wild game. They are particularly desirable for public picnic grounds and other recreational areas.

Experiments show that both deciduous and coniferous trees will grow well in this county if they are properly cared for when young. Cedar and Western yellow pine are probably best for this part of the State because they require no irrigation, stand drought well, and

provide cover in winter as well as summer. Conifers are difficult to start in dry years and grow slowly, but are hardy and require little or no care once they are established.

Deciduous trees are easily established and grow rapidly, but generally require irrigation because they cannot stand prolonged drought. They are best adapted to subirrigated soils such as the Loup, Elsmere, and Sarpy, and are not recommended for most areas on the high uplands.

The county has a considerable variety of wild animals, fish, and fowl. Along the streams and ponds live ducks, herons, coots, terns, cranes, killdeers, and sandpipers. Carp, bullheads, and catfish are in the streams. The uplands are inhabited by many kinds of birds, the most common of which are the horned lark, lark sparrow, and meadowlark. Game birds of the uplands are the ring-necked pheasant, sharp-tailed grouse, prairie chicken, bobwhite, and mourning dove. Rabbits, ground squirrels, mice, and many other small mammals abound on the uplands.

The population of game birds has increased because control of prairie fires has become better. Farmers and ranchers have become more careful; grass does not grow so high because livestock keep it cropped; and communications have improved so that people can be called together quickly to fight fires. Prairie fires used to sweep over the range lands and destroy everything in their paths.

MORPHOLOGY, GENESIS, AND CLASSIFICATION OF SOILS

Soils, like plants and animals, differ greatly in their mode of genesis and in their morphological characteristics. Physical and chemical characteristics of soils are partly inherited from the parent rocks and are partly acquired through the interaction of soil-forming processes.

Soil is the product of the forces of weathering and soil development acting on parent soil materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point depend on (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil material has accumulated and has existed since accumulation; (3) the plant and animal life in and on 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.

The mineral part of a soil is inherited almost entirely from the parent rock, but the inherited mineral materials are altered by chemical changes and become quite different from the minerals of the parent rock. The extent of alteration depends on the intensity of weathering and on the length of time of exposure. The mineral components of soils of the Colby series, for example, are partly inherited from the parent loess, which underlies the soil, but modification through processes of weathering has been sufficient to change their character considerably. Some colors of the parent rocks persist in the soil after a very long period of weathering and soil formation, whereas others are rapidly changed by soil-forming processes. Acquired soil colors are generally the result of the effects of temperature, rainfall, vegetation, and natural drainage on a soil. Other acquired soil character-

istics are acidity or alkalinity, structure, and the number and thickness of soil horizons.

The classification of soils, like the classification of all natural objects, is intended to show relations among individuals. It is concerned with putting like soils together into normal groups. Like other classifications, it changes, expands and improves as more and more knowledge is gained and new uses for the classification are discovered. The soils of Blaine County have been classified, that is, grouped and named, largely according to the scheme prepared in 1937 and 1938 (*1*), with minor changes at different times since then (*9*). A new scheme of classification is in the making now, and it is probable that many, if not all, of the names of the soil groups above the series level will be changed before long. It is not likely, however, that the soil units themselves will be grouped in a much different manner.

According to the 1938 soil classification scheme, soils are differentiated at the order level into zonal, intrazonal and azonal classes. These orders may be broken down into suborders, and the suborders into great soil groups. Great soil groups, in turn, may be subdivided into families, and they into soil series, types, and phases. Thus, all soils may be fitted into the scheme, whether they be well-drained upland soils or poorly drained bottom land soils, whether shallow or deep, whether developed in material weathered in place or transported. Zonal soils are those well-drained soils having parent materials and age favorable to the impression of climatic and biological influences. Intrazonal soils are those for which drainage or parent materials, or both, are not favorable to the complete expression of climatic and biological influences, and, therefore, show some characteristics not typical of the zonal soils. Azonal soils are so young, from the point of view of soil genesis, that their characteristics are largely inherited from their parent material, and they show only feeble evidence of climatic and biological influences.

FACTORS OF SOIL FORMATION AS RELATED TO BLAINE COUNTY

Blaine county is in north-central Nebraska, in the northern part of the High Plains Section of the Great Plains Province. Most of it lies within the region known as the sandhills of Nebraska (*8*) ; most of the soils are azonal, members of the Great Soil group called Regosols. There are some Chestnut soils, and the usual Alluvial soils along streams, as well as some Humic Gley soils associated with the Regosols.

PARENT MATERIAL

Before Tertiary time, this part of the North American continent was covered several different times by ocean waters, and great thicknesses of sandstone, shale, and limestone were deposited (*2*, *7*). The mineral materials in which the soils of the county have developed were derived almost entirely from limy Tertiary sandstones (Ogallala group) that were weathered, loosened, and reworked by wind and water. In the southeastern corner of the county the eolian deposits are silty, rather than sandy, and are called loess (fig. 12). In the sandhills the parent materials of soils are eolian sands and, locally, sandy alluvium reworked by wind. Along streams the soils have

formed in sandy alluvium of the flood plains and terraces; in some localities this alluvium also has been whipped about by wind. Small patches of alluvial-colluvial material occur at the bases of hills and ridges. The sands of this general region are mainly quartzose; the majority are noncalcareous or only slightly calcareous. The loess is generally strongly calcareous.

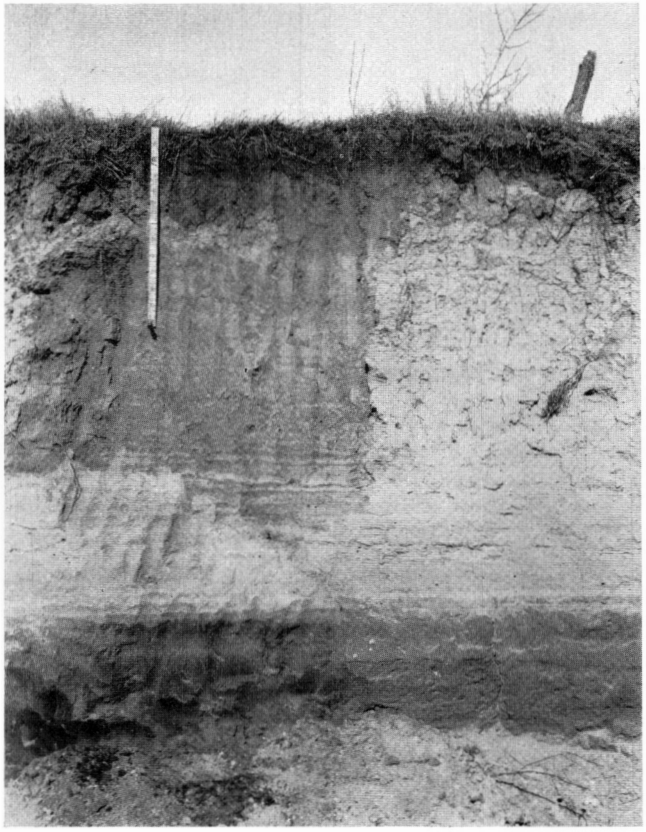

FIGURE 12.—Road cut in Colby fine sandy loam, eroded undulating and rolling, in southeastern part of the county. At the top a few feet of loess (scale is 37 inches long), then an old stream deposit, and at the bottom an old dark buried soil.

CLIMATE

The county has a microthermal subhumid climate characterized by extremes of summer and winter temperatures and low rainfall. At Purdum, in the northwestern part of the county, the average annual precipitation is 21.48 inches, and the average annual temperature is 48.7°. Winter temperatures below zero and summer temperatures above 100° F. are common. More than half the total annual precipitation falls during May, June, July, and August. Variable thicknesses of snow cover the land during a part of every winter.

RELIEF AND DRAINAGE

The sandhills are characterized by dunes, hills, and ridges, mostly of about the same height, separated by swales, valleys, and basins. The surface drainage pattern is weakly developed, or absent in many areas, because of high absorption of precipitation by the sandy soils. Underdrainage is rapid, and most of the excess water is carried off by subsurface flow. The land of the loess hills in the southeastern part of the county ranges in relief from rolling to hilly and broken; little of it is smooth enough for cultivation. Drainage in this area is well established; the North Loup River and its tributaries carry runoff water from the hills. Most of the rough land of the county is in this vicinity.

VEGETATION

The vegetation nearly everywhere consists primarily of grasses. Only a few places have trees, and the stand is usually thin. Tall coarse grasses predominate on very sandy soil; mixed tall and short species grow on less sandy and loamy soils of the loess hills and bordering areas. Pines and cedars grow mostly on the rough land along the North Loup River adjacent to the loess hills, and deciduous trees on bottom lands along streams. Nowhere have trees exerted a strong effect on soil genesis. Soils of this county are typical grassland soils. Decayed plant remains are responsible for the dark color of the surface layers of most soils here. The soils with light-colored surface horizons are those on which vegetation is sparse and erosion is severe, so that the accumulation of organic matter is very slow.

TIME

The soils vary in age from very young to mature or nearly mature. Not only do they differ in actual years of age, but in apparent age, as indicated by their degree of development. Dune sand, stabilized, for instance, is a young soil for two reasons: (1) The time that has elapsed since the sand was stabilized is short; and (2) the steeply sloping loose porous sandhills support only a sparse vegetation, so soil development proceeds slowly. Riverwash is an example of material deposited so recently that no true soil has had time to develop. Areas of Rough broken land, Colby soil material, and of Dune sand, rolling and hilly, may have had time enough to permit development of soils, but erosion is so rapid that weathered materials and organic matter cannot accumulate. The youngest group of soils are those in the sandhills; within this group Dune sand, stabilized, hilly and steep, is the youngest. (Active dunes—mapped as Dune sand, rolling and hilly—are not considered to be soil.) Valentine soils are somewhat older. The apparent age of the soils on terraces depends on the geologic age of the terrace itself; the recent changes that have affected it, such as wind and water erosion and deposition; and the nature of the terrace deposits. Tripp fine sandy loam is a nearly mature soil on terraces. Sparta soils are much younger. The soils developed in weathered loess in this county are young.

Zonal and intrazonal soils in this county all have dark-colored A horizons, and all are sandy—mostly fine sandy loams and loamy fine sands. Other soil characteristics such as structure, thickness of horizons, consistence, content of free calcium carbonate, amount of organic

matter, permeability, and kind of parent material are not the same for all series.

CLASSIFICATION OF BLAINE COUNTY SOILS

The zonal soils of Blaine County are all members of the same suborder; namely, dark-colored soils of semiarid, subhumid, and humid grasslands. Within this suborder, only one great soil group is represented—the Chestnut soils. The intrazonal order is represented by one suborder, hydromorphic soils of the marshes, swamps, seep areas, and flats; this suborder is represented by one great soil group—Humic Gley soils (Wiesenboden). The azonal order is represented by two great soil groups—Alluvial soils and Regosols. Table 6 differentiates the soil series according to great soil group and soil order and lists some of the important characteristics of each series.

MORPHOLOGY OF SOILS REPRESENTING THE GREAT SOIL GROUPS

ZONAL SOILS

CHESTNUT SOILS

Four of the soil series in this county are in the Chestnut great soil group: Anselmo, Cody, Haxtun, and Tripp. Cody fine sandy loam is a weakly developed Chestnut soil. Cody loamy fine sand is an Alluvial soil. A good example of a Chestnut soil is Tripp fine sandy loam as found about one-fourth mile south of the northeast corner of section 17, Township 24, North, Range 25, West.

Profile description:

A_1 0 to 6 inches, grayish-brown [6] (10YR 4/1.5, dry) to very dark-brown (10YR 2.5/2, moist) weak granular fine sandy loam; soft when dry, very friable when moist; top 2 inches very strongly matted with grass roots; neutral in reaction.

A_3 6 to 18 inches, dark-gray (10YR 4/1, dry) to black (10YR 2/1, moist) moderate fine prismatic-nuciform-granular light loam; soft when dry, friable when moist; grass roots numerous; neutral in reaction.

B_{ca} 18 to 28 inches, grayish-brown (10YR 5/2, dry; 3.5/2, moist) massive strongly calcareous fine sandy loam; soft when dry, friable when moist; grass roots abundant but fewer than in horizons above; medium alkaline reaction.

C_1 28 to 50 inches+, light-gray (10YR 7/2, dry) to pale-brown (10 YR 6/3, moist) massive calcareous fine sandy loam to loamy fine sand; soft when dry, friable when moist; few grass roots; calcium carbonate appears in finely divided disseminated form; medium alkaline reaction.

Brief profile descriptions of other Chestnut soils are given in the section on Soil Types and Phases. The reader will note the general similarity among profiles of Tripp, Cody, Anselmo, and Haxtun soils. The Cody and Anselmo soils are not typical Chestnut soils in that they have no horizon of carbonate accumulation; in fact, they lack free calcium carbonate in both solum and parent material.

Members of the Anselmo series have developed in sandy noncalcareous material on high upland areas. Cody soils are on sandy terraces along the streams. The Haxtun soil developed in a thin sandy deposit overlying calcareous loess on uplands.

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[6] Provisional Soil Survey color names as established in 1947, and based on Munsell color charts. Figures in parentheses are Munsell color notations.

TABLE 6.—*Soil series of Blaine County, Nebr., classified by soil order and great soil group, and their parent material, topography, and drainage*

Great soil group and series	Parent material	Topographic position	Runoff	Internal drainage
ZONAL				
Chestnut soils:				
Anselmo [1]	Eolian noncalcareous sand with some silt.	Nearly level to gently undulating uplands.	Very slow	Rapid.
Cody [2]	Noncalcareous sandy alluvium.	Nearly level to gently undulating terraces.	do	Do.
Haxtun	Thin layer of eolian sand over loess.	Nearly level to gently undulating uplands.	do	Medium.
Tripp	Calcareous loamy alluvium.	Nearly level, gently undulating, and sloping terraces.	Medium	Do.
INTRAZONAL				
Humic Gley (Wiesenboden):				
Gannett	Eolian sands	Nearly level and depressed	None	Very slow; high water table.

Regosols:				
Dune sand, stabilized	Eolian sands, noncalcareous.	Rolling to steep dunes and ridges	Very slow	Rapid.
Valentine	Eolian noncalcareous sands.	Nearly level to rolling	do	Do.
Elsmere	Eolian sands and windreworked alluvial sands	Nearly level and depressed to gently sloping swales, basins, and valleys.	do	Very slow; moderately high water table.
Alluvial soils:				
Loup	Eolian sands	Level to very gently sloping basins, valley floors, and gentle sandhill slopes.	do	Very slow; high water table.
Sarpy	Recent alluvial sands	Nearly level	do	Medium to slow; moderately high water table.
Cody [2]	Noncalcareous sandy alluvium.	Nearly level to gently undulating terraces.	do	Rapid.
Sparta	Sandy and gravelly alluvium.	Level to undulating and sloping stream terraces.	Medium to very slow.	Very rapid.
Colby [3]	Calcareous Peorian loess	Undulating to strongly rolling uplands.	Rapid	Medium.

[1] Intergrade to Regosol. In most other areas where they occur, the soils called Anselmo are darker in color and are Chernozem-Regosol intergrades.

[2] Cody fine sandy loam is a weakly developed Chestnut soil; Cody loamy fine sand is an Alluvial soil, so the name appears in two places in this table.

[3] The true Colby is a Brown (zonal) soil occurring in drier climates than that of Blaine County. This soil series name was brought into Nebraska many years ago in the belief that on steep, eroding slopes, the soil was identical to that of gentle slopes in a drier climate. This is now known to be not true, and in future correlations, soils like the Colby of Blaine County will be given a new name.

INTRAZONAL SOILS

HUMIC GLEY SOILS (WIESENBODEN)

Humic Gley soils (Wiesenboden) are represented by one soil series, the Gannett. The following description of Gannett fine sandy loam was taken in the southeast quarter of the southwest quarter of section 12, Township 24, North, Range 23, West.

A_{11} 0 to 6 inches, dark-gray (10YR 4/1, dry) to black (10YR 2/1, moist) very weak granular fine sandy loam matted with grass roots; soft when dry, very friable when moist; neutral in reaction.

A_{12} 6 to 19 inches, grayish-brown (2.5Y 5.5/2, dry; 4/2, moist) weak-granular fine sandy loam; slightly hard when dry, very friable when moist; many less grass roots than in overlying horizon; slightly alkaline in reaction.

C_uG 19 to 29 inches, gray (5Y 4.5/1, dry) to very dark gray (5Y 2.5/1, moist) massive sandy clay loam; hard when dry, very plastic when wet; few grass roots; neutral in reaction.

CG_1 29 to 54 inches, light-gray (10YR 6.5/0.5, dry) to gray (2.5Y 4.5/1, moist) weakly coherent loamy fine sand; soft and friable; few grass roots; neutral in reaction.

CG_2 54 to 70 inches+, gray (5Y 4.5/1, dry) to very dark-gray (5Y 2.5/1, moist), mottled with yellowish-brown, weakly coherent loamy fine sand; soft and friable; neutral in reaction.

The Gannett soils have developed in sand occupying enclosed basins, valleys, and swales in the sandhills. The water table is ordinarily within a few feet of the surface, and in wet seasons it rises and temporarily waterlogs the entire soil. Internal drainage is slowed also by clayey layer in the lower subsoil. The resulting conditions of excessive moisture and deficient aeration tend to produce dark surface soils high in organic matter and mottled subsoils and substrata.

AZONAL SOILS

REGOSOLS (LOAMY)

The Colby soils, as mapped in the Chestnut and Chernozem soils zone, have been classified as Regosols. The true Colby soils of drier regions are Brown soils. Years ago, the name Colby was introduced into central Nebraska because it was believed that on steep, eroding slopes the soil was like that on gentle slopes in a drier climate. This is now known to be untrue, and in future reports soils like the "Colby" of Blaine County will be given a new name. They owe their light color to dryness engendered by rapid runoff from the steep slopes on which they occur. The profile of Colby fine sandy loam, eroded undulating and rolling, described below is in the northeast quarter of the southeast quarter of section 34, Township 21, North, Range 21, West.

A_1 0 to 6 inches, grayish-brown (10YR 4/2, dry) to very dark-brown (10YR 2/2, moist) fine sandy loam of moderate fine granular structure; soft when dry, very friable when moist; top 1-inch layer matted with grass roots; neutral in reaction.

C_{11} 6 to 11 inches, pale-brown (10YR 6.5/3, dry) to brown (10YR 5/3, moist) weak nuciform-granular fine sandy loam; soft when dry, friable when moist; grass roots much less numerous than in horizon overlying; neutral in reaction.

C_{12} 11 to 50 inches, light-gray (10YR 7/2.5, dry) to pale-brown (10YR 4.5/3, moist) massive calcareous fine sandy loam; exhibits vertical cleavage; hard when dry, very friable when moist; medium alkaline in reaction.

C_2 50 to 86 inches+, very pale-brown (10YR 7/3, dry) to pale-brown (10YR 6/3, moist) massive calcareous fine sandy loam to silt loam; slightly hard when dry, very friable when moist; exhibits vertical cleavage; very few grass roots; medium alkaline in reaction.

REGOSOLS (VERY SANDY)

Very sandy Regosols are azonal, very weakly developed soils of the well-drained sandy deposits. By far the greatest part of the area of Blaine County is occupied by such soils. The mapping units of Dune sand, stabilized, are the most extensive of the group but members of the Valentine and Elsmere series are also included. It is difficult to select a profile of any of these soils that can be called typical, because there is much variation in thickness of the dark surface soil, in thickness, color, and texture of subsurface layers, and in the amount of free carbonate of lime. The following description of Valentine loamy fine sand, undulating, however, is representative of a large number of profiles that occur in sandhills. The profile described was examined in the northwest quarter of the northeast quarter of section 17, Township 21, North, Range 21, West.

A_1 0 to 5 inches, grayish-brown (10YR 4/2, dry) to dark grayish-brown (10YR 2.5/2, moist) very weakly coherent soft and very friable loamy fine sand; grass roots matted and very numerous; slightly acid in reaction.

AC 5 to 13 inches, brown (10YR 5.5/3, dry) to grayish-brown (10YR 4/2, moist) weakly coherent soft and very friable loamy fine sand; few grass roots; neutral in reaction.

C_1 13 to 32 inches, pale-brown (10YR 6/3, dry) to brown (10YR 5/3, moist) loamy fine sand of single-grain structure; few grass roots; neutral in reaction.

C_2 32 to 60 inches+, very pale-brown (10YR 7/3, dry) to pale-brown (10YR 6/3, moist) fine sand of single-grain structure; very few grass roots; neutral in reaction.

There are indistinct horizontal bands of slightly darker colored material in the second horizon, which probably represent surface horizons of old soils that have been covered by fresh sand deposits.

Valentine soils, like Dune sand, stabilized, are forming in eolian sands. Valentine soils occur in nearly level to undulating and gently sloping areas, and also on low rounded hummocks and ridges. Their surface soils are thicker than those of Dune sand, stabilized, which occurs on higher and steeper hills and ridges. The Elsmere soils occur in moderately well drained basins and valley floors and on long, very gentle sandhill slopes. They have somewhat darker and thicker A_1 horizons than Valentine soils. They have formed in eolian sands under the influence of a relatively high water table.

ALLUVIAL SOILS

The Loup, Sarpy, and Sparta series are representative of the great group of Alluvial soils—soils developed in recently deposited alluvium characterized by weak profile development. The following description of Sarpy fine sandy loam was taken along the North Loup River in the northwest quarter of the southwest quarter of section 24, Township 24, North, Range 25, West:

A_1 0 to 6 inches, grayish-brown (10YR 4/1.5, dry) to dark grayish-brown (10YR 2.5/2, moist) very weak granular fine sandy loam; soft and friable; top 3 inches matted with grass roots; neutral in reaction.

C_1 6 to 9 inches, pale-brown (10YR 6.5/3, dry) to brown (10YR 4.5/3, moist) weakly coherent fine sandy loam; soft and friable; mildly alkaline in reaction; few grass roots.

A_{1b} (?) 9 to 11 inches, grayish-brown (10YR 5/2, dry) to dark grayish-brown (10YR 2.5/2, moist) massive loam; slightly hard when dry, very friable when moist; neutral in reaction.

C_{1b} (?) 11 to 33 inches, pale-brown (10YR 6/3, dry) to brown (10YR 4.5/3, moist) very weakly coherent soft friable loamy fine sand; very few grass roots; moderately alkaline in reaction.

D 33 to 60 inches+, very pale-brown (10YR 6.5/3, dry) to pale-brown (10YR 5.5/3, moist) loose weakly calcareous gravelly fine sand; very few grass roots; mildly alkaline in reaction.

Krotovinas (dark-colored soil filling gopher holes) are numerous in all horizons. There are a few yellowish-brown mottles and stains in the lower horizons. At this site the entire profile is noncalcareous.

Sarpy soils are in very early stages of development. Aside from the fact that they are forming in recent deposits, they are young soils because they support little vegetation, the source of organic matter. Also, they are occasionally flooded and their surfaces are thereby built up or eroded. The third horizon in the profile just described probably represents part of the A horizon of an older Sarpy soil that has been buried. The water table is high and impedes internal drainage. The material in which Sarpy soils are forming is low in colloids. The Sarpy soils of Blaine County differ only slightly from Riverwash. They are a little more stable and have developed a thin dark surface soil but otherwise their characteristics are those of Riverwash. Loup soils have a thicker and darker surface soil than Sarpy soils and are seldom flooded.

SOIL SURVEY METHODS AND DEFINITIONS

Soil surveying consists of examining, classifying, and mapping of soils in the field and of recording their characteristics, particularly in reference to the growth of various crops, grasses, and trees.

The soils and the underlying formations are examined systematically in many localities. Test pits are dug, borings are made, and exposures, such as those in road or railroad cuts, are studied at regular intervals. Each excavation exposes a series of layers, or horizons, and the entire section, from the surface down to the weathered but otherwise unmodified parent material, is known as the soil profile.

The soils are classified on the basis of such internal characteristics as thickness, color, structure, texture, consistence, reaction, lime and salt content, and content of organic matter, and such external features as drainage, relief, and stoniness. The plant cover—either native vegetation or farm crops—is observed, and its relation to the soils is studied. In this way the natural productivity of the soil can be determined or estimated with a fair degree of accuracy. In classifying virgin lands, which may be brought under cultivation, the observation of like soils now being farmed is an important part of the work.

Some of the terms mentioned in the preceding paragraph are in common use and need no explanation. Others have special meanings in soil science. For example, structure means the arrangement of the individual soil particles or grains within the soil mass. Hence, it affects the tilth of the soil and the rate at which moisture can be absorbed. The common soil structures are granular, blocky, platy,

columnar, and prismatic. Soil material having no definite structure is designated as single grain if incoherent and as massive if coherent.

Texture is concerned with the coarseness or fineness of the soil mass as determined by the relative percentages of sand, silt, and clay. All the soils in this county are sandy, varying from very fine sandy loam to sand. Consistence is concerned with the relative firmness or looseness of the soil mass and its resistance to crushing or distortion. Common consistence terms are: incoherent, as in sand; friable, as in most silt loam; and hard or firm, as in many clay soils.

The reaction of a soil is its degree of acidity or alkalinity expressed mathematically as in the pH value. A pH of 7 indicates precise neutrality, higher values alkalinity, and lower values acidity. The pH value is roughly determined in the field by means of a solution previously prepared for that purpose or is precisely determined in the laboratory by more refined methods. Phenolphthalein solutions may be used to detect a strong alkaline reaction. The presence or absence of lime is determined by means of dilute hydrochloric acid. The total content of readily soluble salts is determined, when necessary, by the use of the electrolytic bridge.

On the basis of their internal and external features the soils are grouped into classification units. These are (1) series, (2) type, and (3) phase. In places two or more of these units may be in such intimate or mixed pattern that they cannot be indicated clearly on the map, but must be mapped as (4) a complex. Areas of land that have no true soil are called (5) miscellaneous land types, as, for example, Riverwash, and Rough broken land, Colby soil material.

The soil series includes soils that have developed from similar, although not necessarily identical, kinds of parent material, and that have the same genetic horizons, arranged alike in the soil profile. Thus, a series includes soils having essentially the same color, structure, and other important internal characteristics and the same natural drainage conditions and range in relief. The texture in that part of the soil commonly plowed may differ within a series. The series are given geographic names taken from localities near which they were first identified. Anselmo, Cody, Valentine, Tripp, Sparta, Loup, Elsmere, and Sarpy are names of some soil series in Blaine County.

Within a soil series are one or more soil types, defined according to the texture in the upper part of the soil, generally to about the depth of plowing. The name of the soil texture to this depth, such as silt loam, loam, silty clay loam, or fine sandy loam, is added to the series name to give the complete name of the soil type. For example, Anselmo fine sandy loam and Gannett loamy fine sand are types within the Anselmo and Gannett series, respectively. Except for differences in the texture of the surface layers, all soil types of the Anselmo series have quite similar external and internal characteristics. The same holds true for all types of Gannett, Valentine, or any other series. The soil type is the principal unit of mapping, and because of its specific character is usually the unit to which agronomic data are definitely related.

A phase is a subdivision of a soil type, each phase of a type differing from the others in some feature, generally external, that may be of special practical significance.

A soil type may be very uniform, throughout its distribution, in all important profile features, but slight variations in its gravel content

or in its relief may cause marked differences in the use capabilities of the soil in different localities. For example, within the range of relief of a soil type, there may be areas that have slopes suited to the use of machinery and the production of cultivated crops and other areas that are not. Even though there may be no important differences in the soil profile or in its ability to produce the native vegetation, there may be important differences in respect to the growth of cultivated crops caused by variations in the relief. In such an instance, the different kinds of relief may be segregated on the map as level, sloping, or hilly phases. Similarly, soil types having differences in stoniness may be separated into phases, even though these differences may have no apparent effect on the growth of native plants.

The soil surveyor makes a map of the county on an accurate base—usually aerial photographs. The map shows the location of each of the soil types, phases, complexes, and miscellaneous land types in relation to roads, houses, streams, lakes, section and township lines, and other cultural and natural features of the landscape.

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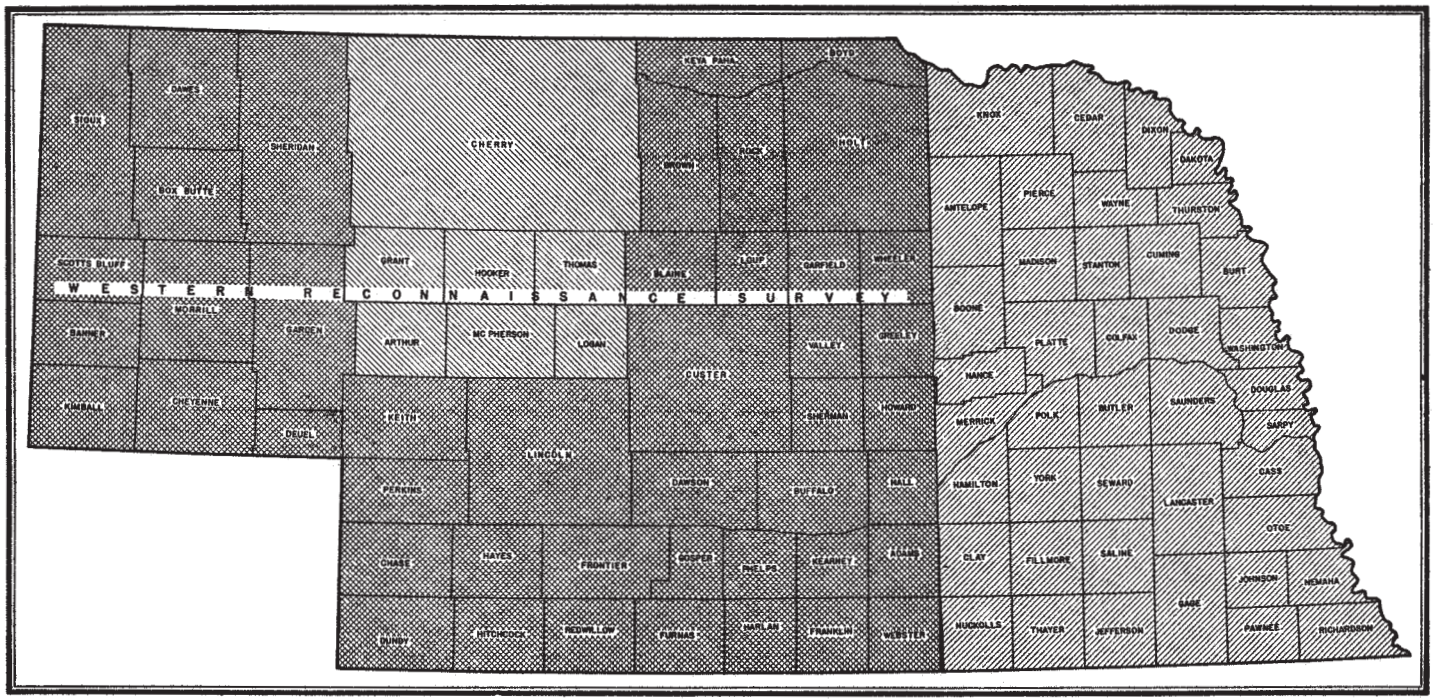

Areas surveyed in Nebraska shown by shading. Detailed surveys shown by northeast-southwest hatching; reconnaissance surveys shown by northwest-southeast hatching; crosshatching indicates areas covered by both detailed and reconnaissance surveys.

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