

**UNITED STATES DEPARTMENT OF AGRICULTURE  
BUREAU OF CHEMISTRY AND SOILS**

In cooperation with the University of Nebraska State Soil Survey  
Department of Conservation and Survey Division

**SOIL SURVEY**  
OF  
**ADAMS COUNTY, NEBRASKA**

BY

**F. A. HAYES, U. S. Department of Agriculture, in Charge  
and D. F. HYDE, Nebraska Soil Survey**



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# SOIL SURVEY OF ADAMS COUNTY, NEBRASKA

By F. A. HAYES, U. S. Department of Agriculture, in Charge, and D. F. HYDE  
Nebraska Soil Survey

## COUNTY SURVEYED

Adams County is in the south-central part of Nebraska, in the second tier of counties north of the Kansas-Nebraska line. Hastings, in the northeastern part of the county, is 90 miles west and 18 miles south of Lincoln. The county is square, each boundary being 24 miles long. It comprises an area of 565 square miles or 361,600 acres.

Adams County is in that part of central Nebraska known as Nebraska Plain by the State physiographers.<sup>1</sup> The plain throughout Adams County as a whole is gently undulating, with a very gentle southward slope. The dissection, except in the southeastern quarter of the county, is very slight. Little Blue River has cut a valley about 200 feet deep which is the maximum depth of dissection within the county. Along both sides of the river a belt several miles wide is rather thoroughly dissected, but the watersheds between the main tributaries consist mainly of undissected remnants of the plain. These remnants are commonly less than half a mile in width.

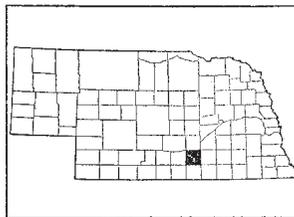


FIGURE 44.—Sketch map showing location of Adams County, Nebr.

The depth of dissection by the tributary streams decreases toward their heads. In the northern half of the county the greatest depth of dissection is rarely more than 50 feet, and only two or three of the streams have cut to that depth.

The Platte River Valley crosses the extreme northwestern part of the county. The floor of this valley is about 100 feet below the plain level. There is practically no dissection by tributary streams along the south side of the valley.

Nearly all the variations in the surface of the ancient plain are made by the valleys that have been cut into it. A belt along the western part of the county is slightly undulating, and sand dunes along the southern side of the Platte Valley have produced a hummocky relief. The northern part of the county is predominantly constructional in topography and is very young. The southern part is submaturely dissected.

The average elevation of the county is about 1,950 feet above sea level. The elevation ranges from approximately 1,750 feet where Little Blue River crosses the eastern boundary to about 2,120 feet in the uplands northwest of Kenesaw. The average elevation of the Platte River alluvial lands in the northwestern part of the county is 2,000 feet and of land along Little Blue River in the southern part is

<sup>1</sup> Condra, G. E., State geologist and director, State soil survey of Nebraska.

1,825 feet above sea level. The elevation<sup>2</sup> of Pauline is 1,773 feet, of Leroy 1,800 feet, of Brickton 1,830 feet, of Ayr 1,839 feet, of Halloran 1,881 feet, of Hastings 1,932 feet, of Hansen 1,945 feet, of Roseland 1,967 feet, of Juniata 1,947 feet, of Holstein 2,008 feet, and of Kenesaw 2,051 feet above sea level.

Drainage is effected through Little Blue River and its tributaries and through tributaries of Big Blue and Platte Rivers. Little Blue River drains the entire county with the exception of about two townships north of Hastings and a small area in the northwestern corner. All the streams are more or less intermittent, as even the larger ones go dry during seasons of abnormally low rainfall.

The first permanent settlement in the area now included in Adams County was made in 1857. The early settlers came chiefly from Iowa, Illinois, Missouri, and other States to the east. The county was established by an act of the State legislature in 1867. The northern boundary then extended to Platte River. In 1871 the county was organized and that part north of the second standard parallel was excluded, leaving the boundaries as they are at present.

According to the 1920 census, the population of the county is 22,621, of which 51.5 per cent is classed as urban. The density of the rural population is given as 19.4 persons to the square mile. The rural population is rather evenly distributed, although it is somewhat denser along the railroads and in the vicinity of towns.

Hastings, the county seat, has a population of 11,647. It is an important railroad, manufacturing, and distributing center and affords a good market for much of the surplus dairy and poultry products. Kenesaw, with 646 inhabitants, ranks second in population. Hansen, Flickville, Pauline, Leroy, Ayr, Juniata, Roseland, Holstein, Hayland, and Prosser are small towns and villages affording local markets for farm implements, supplies, and produce. Newmarch, Moritz, Farmer, Blaine, and Halloran are railroad points from which grain and hay may be shipped.

Adams County has good transportation facilities. The main line of the Chicago, Burlington & Quincy Railroad extends east and west across the northern part and branch lines of the St. Joseph & Grand Island, Chicago & North Western, Union Pacific, Missouri Pacific, and Burlington systems cross it in several directions. No point in the county is more than 9 miles from a railroad station.

The public-road system is excellent. The Detroit, Lincoln and Denver Highway, now known as U. S. Highway No. 38, crosses the county in an east-west direction, and State Highway No. 2 runs north and south through Ayr and Hastings. Practically all the public roads follow section lines. None of the roads is hard surfaced but the more important ones, including the highways and those between the several towns, are dragged as soon after each rain as the condition of the ground allows and are kept in good condition. Little attention is given the minor roads, although they are seldom allowed to become impassable. Cement or steel culverts and bridges are common on all roads. Telephone and rural-delivery routes reach all parts of the county.

The surplus products, consisting chiefly of wheat, cattle, and hogs, are usually marketed in Omaha. Most of the surplus dairy and poultry products are shipped to Lincoln.

<sup>2</sup> Gannett, Dictionary of Altitudes.

## CLIMATE

The climate of Adams County is marked by wide seasonal extremes. The winters are rather long and cold, and the summers are very warm. The spring is usually cool with considerable precipitation, and the fall season is long with moderate temperature and only occasional periods of rainy weather. The climate in general is well suited to grain growing and stock raising.

The average date of the last killing frost is April 26, and that of the first is October 8. This gives an average frost-free season of 164 days, which is ample for the maturing of ordinary farm crops. In the 20 years, from 1895 to 1914, inclusive, there were three seasons in which the last killing frost in the spring was 10 or more days later than the average and three seasons in which the first in the fall was 10 or more days earlier. The date of the latest recorded killing frost is May 15 and of the earliest is September 12.

Most of the rainfall in the summer comes as local thunderstorms. The precipitation in May and June is well distributed, but in July, August, and September the distribution is less favorable and droughts sometimes occur. In general, however, the rainfall is ample for the production of crops and is so distributed that crops seldom suffer severely if the soil moisture is properly conserved. The annual snowfall varies from a few inches to several feet, with an average of 29.9 inches.

From October 1 to June 1 the prevailing wind is from the northwest. During the summer it is from the southeast. Strong winds are common, but tornadoes are rare.

The data in the following table are compiled from the records of the Weather Bureau station at Hastings and are believed to be representative of local climatic conditions:

*Normal monthly, seasonal, and annual temperature and precipitation at Hastings*  
[Elevation, 1,932 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1922)	Total amount for the wettest year (1915)	Snow, average depth
	° F.	° F.	° F.	Inches	Inches	Inches	Inches
December.....	26.4	67	-21	0.81	0.20	0.65	4.8
January.....	23.8	70	-30	.51	1.25	.61	4.2
February.....	25.2	77	-30	1.06	Trace.	2.60	9.1
Winter.....	25.1	77	-30	2.38	1.45	3.86	18.1
March.....	36.9	90	-6	1.09	.10	2.34	7.4
April.....	49.3	93	17	2.93	3.91	1.46	2.0
May.....	60.1	98	17	3.55	1.68	5.19	.3
Spring.....	48.8	98	-6	7.57	5.69	8.99	9.7
June.....	70.3	105	41	4.24	1.15	11.71	0
July.....	75.8	108	45	3.52	4.90	6.58	0
August.....	74.1	108	41	3.41	2.42	5.66	0
Summer.....	73.4	108	41	11.17	8.47	23.95	0
September.....	65.3	103	28	2.75	1.39	3.15	0
October.....	52.6	93	9	1.85	.37	.22	.3
November.....	38.6	78	-5	.95	.10	.43	1.8
Fall.....	52.2	103	-5	5.55	1.86	3.80	2.1
Year.....	49.9	108	-30	26.67	17.47	40.60	29.9

## SOILS

## SOIL MAP AND REPORT

Soils are of many kinds, and it is necessary for purposes of convenience to group them with respect to similarities in one or more of their characteristics. The soils of Adams County have been grouped in series and types on the basis of properties that could be determined by examination or by simple tests in the field. The series is the broader group and includes in some cases a number of types. It is a group of soils that have certain physical properties in common. These properties include the arrangement and the thickness of layers from the surface downward; texture, except in the surface soil; color; consistence; structure; and chemical properties produced by various important components of the soil, such as humus, lime, acids, alkalies, and iron. The soil type, a subdivision of the series, is separated solely on the basis of the texture of the surface soils. The series is given a place name, in most cases the name of the place or county where the soils of the series were first described, and this name is given to each type of the series. For instance, near Holdrege, Nebr., soils having certain characteristics were placed in a series which was called the Holdrege series, and the silt loam of the group was called Holdrege silt loam. Slight variations from the typical soil as usually described are called phases. For example, any part of the area of a soil type with surface relief so rolling as to impair the agricultural value might be designated as a rolling phase of that soil type. If a quantity of gravel is present, the soil might be mapped as a gravelly phase.

On the map which accompanies this report the areas occupied by the different soils of Adams County are represented according to type and phase. Each soil type is shown on the map by a separate color or pattern and is labeled by a special letter symbol. Phases are represented either by symbols or crosslining. On the margin of the map is a legend which is the key to the map.

In Adams County 13 soil series, including 21 soil types and 1 phase, and dune sand a miscellaneous class of material, have been mapped. In the following pages of this report are given brief descriptions of each soil series. In these only the most obvious and important soil characteristics are brought out. Each series description is followed by a description of each soil type in that series and by a discussion of the extent, location, and agricultural value of the various soils. Hall County adjoins Adams County on the north. Marshall loam, as mapped in Hall County, is shown as Holdrege very fine sandy loam in this county, owing to the small area of the Marshall soil extending into Adams County and to its close resemblance to the Holdrege soil. For a similar reason Cass clay loam is not extended into Adams County, Judson fine sandy loam is combined with Cass fine sandy loam, and O'Neill sand is mapped with Sparta sand.

For soil scientists and others who may desire more detailed descriptions of the soils and a discussion of the soil-forming processes which have produced them, a chapter on the subject has been placed in the back of this report.

The following table shows the acreage and proportionate extent of the soils mapped in Adams County:

*Acree and proportionate extent of soils mapped in Adams County, Nebr.*

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Crete silt loam .....	123,968	34.3	Waukesha very fine sandy loam...	4,736	1.3
Holdrege silt loam .....	32,576	16.4	Cass fine sandy loam .....	2,944	.8
Rolling phase .....	26,880		Cass very fine sandy loam .....	2,816	.8
Holdrege very fine sandy loam .....	9,088	2.5	Cass loamy fine sand .....	384	.1
Hastings silt loam .....	52,608	14.5	Sparta sand .....	2,496	.7
Colby silt loam .....	28,800	8.0	Sparta gravelly sandy loam .....	896	.2
Colby very fine sandy loam .....	24,960	6.9	Sarpy sand .....	2,368	.7
Colby fine sandy loam .....	11,200	3.1	Nuckolls loam .....	1,024	.3
Colby loamy sand .....	1,620	.5	Dune sand .....	2,368	.7
Fillmore silt loam .....	3,520	1.0	Scott silt loam .....	640	.2
Hall silt loam .....	9,984	2.7			
Valentine sand .....	9,728	2.7			
Waukesha silt loam .....	5,696	1.6	Total .....	361,600	.....

SOIL SERIES AND TYPES

CRETE SERIES

The surface layer common to the soils of the Crete series is about 16 inches thick, is rich in organic matter, and is very dark grayish brown or almost black in color. It is friable, the upper part being loose and powdery and the lower part granular. The upper part of the subsoil is grayish-brown rather compact silty clay loam or silty clay. This layer is heavier and more compact than the corresponding layers of the Hastings soils but is less compact than the upper part of the subsoils of the Fillmore soils. The lower part of the subsoil, below an average depth of about 40 inches, is loose, floury, silty material, the upper part of which is rich in lime.

CRETE SILT LOAM

Crete silt loam occurs on the nearly level but well-drained upland of the county. The surface soil is very dark grayish-brown or almost black mellow silt loam 16 inches thick. In uncultivated areas this surface soil consists of three layers, differing mainly in structure. There are a loose surface mulch from one-half inch to 2 inches thick; a faintly plated or laminated layer; and a granular layer. In cultivated fields these layers become mixed and the structure is destroyed.

Below the dark-colored surface layers is a brown, compact heavy upper subsoil layer which continues to an average depth of 40 inches. It has a large clay content and is plastic when wet but hard and tough when dry. Crete silt loam is readily identified by the brown color and density of this claypan.

The lower part of the subsoil, or the light-gray layer, is composed largely of loose floury silt. It is a zone of lime concentration. White specks, splotches, and concretions of lime are abundant, especially to a depth of 10 or 12 inches in the layer. The quantity decreases gradually with depth, and concretions do not appear below a depth of 70 inches.

Below the lime layer is the loose, yellow, floury silt or loess from which the soil has weathered. This material is very uniform to a depth of many feet.

Crete silt loam is fairly uniform throughout the areas of its occurrence, but some variations of minor importance are present. The surface soil in the larger area east of Thirty-two Mile Creek and north of Little Blue River contains considerably more very fine sand than

is typical, and locally the texture approaches very fine sandy loam. In the more undulating areas, the compact upper subsoil layer is much thinner than typical, being only from 4 to 6 inches thick, and in places on low ridges or around drainage ways it is entirely lacking. Where such areas are of sufficient size to warrant separate mapping, they were included with Hastings silt loam. Crete silt loam and Hastings silt loam differ only in that the upper subsoil layer of the former has a more compact claypanlike structure than that of the latter and is commonly darker in color. The two soils merge so gradually into each other that it is necessary in many places to draw arbitrary lines in separating them on the soil map. Small areas of the Hastings soils are included with Crete silt loam. Narrow strips of colluvial material, too small to be indicated separately on the map, occur along intermittent streams throughout areas of this soil.

Crete silt loam is the dominant soil throughout the smooth uplands in the eastern half of the county and occurs rather extensively in the south-central and southwestern parts. The larger areas are broken by round or oval areas of poorly drained soils and by narrow strips of slope soils that penetrate their borders and give the areas a ragged appearance. No areas of Crete silt loam occur in the west-central and northwestern parts of the county.

The surface of Crete silt loam varies from nearly level to gently undulating and is locally modified by shallow valleys, low, broad, flat-topped ridges, and slight depressions. The surface in general is more nearly level than that of the Holdrege, Hastings, or Colby soils.

Practically all land of this kind has surface drainage adequate for crop production. The heavy, compact subsoil prevents free under-drainage, but there is commonly sufficient slope to carry off the moderate rainfall of the region, and crops seldom suffer from excessive moisture. During periods of prolonged drought crops, especially corn, suffer from lack of moisture.

Crete silt loam is the most important soil in Adams County, its large extent, high fertility, and level surface making it the leading soil for general farming purposes. It was originally covered with a luxuriant growth of prairie grasses including grama grass, big and little bluestem, and buffalo grass. All of it is now under cultivation, except a few small patches used for pasture. Wheat, corn, oats, and barley are the principal crops, named in the order of their acreage, and rye, millet, sorghum, Sudan grass, alfalfa, and other grain and hay crops common to the region are grown to a less extent. Alfalfa does not do so well on this soil as on Holdrege silt loam, probably on account of the less accessible moisture supply and the heaviness and compactness of the upper part of the subsoil. Alfalfa is valuable, however, in rotations. Wheat is the main cash crop. The winter varieties lead in acreage. The raising of hogs is an important industry. Only a few cattle are raised on account of the small areas of pasture, but many farmers ship in livestock for winter fattening. Most of the corn, oats, and barley are fed on the farms where they are produced or are sold locally for feed.

The yields of all crops vary widely with the seasons and state of improvement of the land. Wheat yields range from 5 to 30 bushels to the acre, with an average of about 15 bushels. The average yield of corn is about 25 bushels to the acre. Oats yield from 25 to 40 bushels and barley from 10 to 25 bushels to the acre.

Because of its smooth surface, silty texture, and freedom from stone, this soil is easily managed and can be worked under a rather wide range of moisture conditions. It is rather heavy and requires strong machinery and heavy draft animals if the largest returns are to be realized. More tractors are used each year, as the contour of the land is favorable to their use. The soil responds readily to good farming methods.

Current prices of Crete silt loam range from \$125 to \$175 an acre, depending on improvements and location with respect to towns.

Although this soil is naturally strong and fertile and withstands severe cropping to one crop, it is advisable to rotate crops more frequently and to bring alfalfa into the rotation as often as possible. Deeper plowing results in increased yields, and more thorough cultivation would be beneficial on most farms. As the soil contains considerable organic matter, it is necessary to alternate cereal crops with legumes only every four or five years.

#### HOLDREGE SERIES

The surface soils of the members of the Holdrege series to an average depth of about 14 inches are very dark grayish brown. The material is loose and friable but is either not at all or only faintly granular. The dark color grades downward through grayish brown, and below a depth varying from 24 to 30 inches the material is yellowish gray. The upper part of the subsoil is slightly heavier than the surface soil, but it is friable and is nowhere cemented into a claypan. The lower part of the subsoil is grayish-yellow silt loam which in most places contains a large quantity of lime. These soils differ from the Colby soils principally in the darker color and greater thickness of their surface soils. Two members of this series, Holdrege silt loam, with a rolling phase, and Holdrege very fine sandy loam, have been mapped in Adams County.

#### HOLDREGE SILT LOAM

The surface soil of Holdrege silt loam is very dark grayish-brown or almost black loose, mellow silt loam from 8 to 20 inches deep but with an average depth of about 18 inches. It contains only a small percentage of very fine sand and has a smooth, velvety feel. The material is rich in organic matter, which imparts the dark color. The upper part of the subsoil, to an average depth of 26 inches, is grayish-brown or gray silt loam, slightly heavier in structure than the surface material but in no place attaining the compact claypan character of the corresponding layer in Crete silt loam. The lower part of the subsoil, between depths of about 26 and 40 inches, is light-gray or yellowish-gray loose, floury silt or silty clay, in many places mottled with white splotches and in a few places containing angular lime concretions from one-sixteenth to one-fourth inch in diameter. This material is typically highly calcareous, but in some of the more nearly level areas the lime has been largely removed to a depth of 3 or more feet. The lower part of the subsoil merges gradually with the underlying parent loess from which the soil has weathered. The transition in texture and structure between the different soil horizons is very gradual. The structure of the surface soil is open and granular, whereas that of the two subsoil layers is columnar. The change in color between the surface

soil and the upper part of the subsoil is rather abrupt, but between the lower part of the subsoil and the substratum it is scarcely noticeable. The percentage of organic matter present decreases with depth, only slight traces occurring below a depth of 30 inches.

This soil is fairly uniform in Adams County, but there are a few variations on the more level areas and around the margins of areas bordering Hastings silt loam. In these areas the upper part of the subsoil is considerably more compact than typical and in places resembles that of Hastings silt loam. The two soils, where typically developed, differ from one another in the relative compaction of their upper subsoils, the upper subsoil of the Holdrege being rather friable while that of the Hastings is moderately compact. However, the two soils merge so gradually into one another that they are extremely difficult to separate in mapping. It is possible that small areas of the Hastings soils are included in mapped areas of Holdrege silt loam. Locally the surface soil of Holdrege silt loam contains so much sandy material that it approaches very fine sandy loam in texture, and small areas of Holdrege very fine sandy loam are included with mapped areas of this soil.

Holdrege silt loam, together with its rolling phase, ranks next to Crete silt loam in total extent. It is the dominant soil in the central part of the county and also occurs rather extensively on low ridges and along valley slopes throughout the areas of Crete silt loam in the western and southern parts. It occurs only locally in the extreme western part of the county. It has weathered from the eroded loess plains that at one time covered the entire region.

The surface relief of this soil varies from nearly level to undulating and in places to steeply sloping. The surface is more undulating than that of Crete silt loam or Hastings silt loam but is not so uneven as that of the Colby soils. The greatest relief occurs on the valley slopes of drainage ways in the southeastern part of the county.

This land is well drained. A few of the more nearly level areas have insufficient surface drainage, but the loose porous surface soil and subsoil absorb the surplus moisture as fast as it accumulates. Locally, on the valley slopes throughout areas of this soil, surface drainage is excessive, and erosion is severe. The soil retains moisture well, owing to its high organic-matter content, friability, and silty texture, so that it withstands drought over prolonged periods of time. Little moisture is lost through subterranean drainage.

Holdrege silt loam is one of the best upland soils of the county and on account of its more accessible moisture supply and the absence of the heavy claypanlike horizon in the upper part of the subsoil it is considered superior to Crete silt loam for general farming purposes. In natural productiveness it equals the leading upland soils of the Mississippi Valley, but crop yields, on account of the lower rainfall, are seldom so large as those obtained in States farther east. In seasons of ample precipitation, yields of corn and alfalfa are about twice those of normal years.

This soil originally supported a thick growth of grasses and was extensively used for grazing. The grazing industry, however, was never so highly developed in Adams County as in the western part of Nebraska. The native vegetation consists of buffalo and grama grasses, with small admixtures of bluestem, western wheatgrass, wire grass (a sedge), and other species which furnish excellent hay and

pasture. The soil was originally treeless, but scattered groves of cottonwood, ash, box elder, and maple were planted by the early settlers. Many small tracts of the original prairie sod still remain, although about 90 per cent of this soil is under cultivation. Corn, wheat, oats, rye, barley, and alfalfa are the leading crops, and many farmers grow small acreages of millet, Sudan grass, cane, and kafir for feed. Cattle raising is not practiced extensively, although the fattening of livestock is becoming a highly specialized industry. All the native cattle, except a few kept to supply the dairy needs, are fattened for market, and in addition many feeders are imported. The native cattle are chiefly grade Herefords and Shorthorns. Hogs are raised on every farm, a few farmers having large herds. The principal breeds are Poland China and Duroc-Jersey. Purebred herds of both cattle and hogs are raised on a few farms. All livestock intended for market is fattened on corn and alfalfa and is shipped to Omaha, Kansas City, or Chicago.

The yield of crops varies widely from year to year depending on the rainfall. Good yields are obtained in normal years and even in dry seasons yields probably average slightly higher than on Crete silt loam on account of the better moisture-retaining power of this soil. Corn yields, on the average, about 30 bushels to the acre, wheat 18 bushels, oats 30 bushels, rye 20 bushels, barley 25 bushels, and alfalfa between 2 and 3 tons from three cuttings.

Owing to its extremely favorable physical structure, Holdrege silt loam may be cultivated under a wide range of moisture conditions. It retains moisture well but is seldom too wet for cultural operations. Where it is properly tilled it resists drought for long periods of time. Four-horse teams perform most of the farm work, but tractors are sometimes used on the more level areas.

Crop rotation is not systematically practiced, although a few farmers use a rotation consisting of corn, one or two years, followed by oats or wheat, two years, then by alfalfa, from three to five years or as long as the stand remains profitable. Many farmers grow the same grain crop for several years in succession. No commercial fertilizer is used, but barnyard manure is spread on the fields, usually during the late fall or early spring. The supply is seldom sufficient to materially increase the total crop yields.

The current selling price of Holdrege silt loam ranges from \$100 to \$175 an acre, depending on the location, surface features, and improvements.

Soil of this type is fertile, and every means should be used to maintain its productivity. Under the present inadequate system of crop rotation, it can not long maintain its high producing power. Alfalfa, which is now grown on less than 2 per cent of the land, should be grown more extensively. More livestock should be kept and the greater quantities of manure thus produced should be returned to the land. On the steeper slopes erosion is becoming a serious factor, but the building of brush or rubbish dams along incipient drainage channels, would retard hillside erosion and check the removal of the fertile surface soil.

*Holdrege silt loam, rolling phase.*—On valley slopes and in the vicinity of areas of the Colby soils, the dark-colored surface soils are thinner and in many places lighter in color than in the typical

Holdrege soils. The thickness of the surface soils ranges from 4 inches to that of the typical Holdrege silt loam. The color varies from moderately dark grayish brown to almost black. The surface is underlain by grayish-yellow floury silt loam similar to that which underlies the typical Holdrege soils. In most places the subsoil, below a depth of 10 or 12 inches, is rich in lime and contains numerous lime concretions ranging in size from one-sixteenth to one-fourth inch in diameter. Over small areas on the steeper valley slopes, erosion has entirely removed the dark-colored surface soil and exposed the light grayish-yellow calcareous silt. These patches have been included with the rolling phase of Holdrege silt loam, but had they been of sufficient size to justify a separation they would have been mapped with the Colby soils. The agricultural value of this soil grades from that of the best of the typical Holdrege soils to that of the Colby soils. The greater part of this land is not suitable for farming and is used for pasture.

#### HOLDREGE VERY FINE SANDY LOAM

The surface soil of Holdrege very fine sandy loam is very dark grayish-brown smooth, silty, very fine sandy loam which, to a depth of 6 inches, contains large quantities of organic matter. In most places there is no well-marked change in texture between the surface soil and subsoil, but at a depth varying from 10 to 14 inches the material becomes lighter in color and slightly more compact, and at a depth varying from 24 to 30 inches the subsoil grades to ash-gray or pale yellowish-gray, highly calcareous, loose floury silt or silty clay. The substratum consists of light yellowish-gray or light buff-colored loess of great thickness. Lime concretions are abundant below a depth of 36 inches.

The color and depth of the surface soil differ somewhat with the surface relief of the areas. On the more level areas and gradual slopes where conditions have favored deep soil weathering and the accumulation of organic matter, the soil in places is almost black and is somewhat deeper than typical. Around the margins of areas bordering the Colby soils, the depth of the surface layers and their organic-matter content gradually decrease, and in many places it is difficult to separate this soil from Colby very fine sandy loam. Locally the soil contains so much silt as to approach silt loam in texture, and small areas of Holdrege silt loam are included in mapped areas of this soil. North of Leroy, on the north side of Little Blue River, there is a small area in which there are very deep patches of coarse sand and gravel. This coarse material is probably derived from small exposed pockets of the western gravel sheet underlying the loess and is included with this soil in mapping, being distinguished on the soil map by gravel symbols. In a few small areas along the northern county boundary the texture varies from very fine sandy loam to fine loam or fine sandy loam. These areas were mapped as Marshall loam in Hall County but were included with Holdrege very fine sandy loam in Adams County on account of their small extent and variability.

Holdrege very fine sandy loam occurs chiefly in small irregular areas throughout the northern and western parts of the county. One of the largest areas, covering about 2 square miles, is west of Kenesaw, and smaller, though fairly uniform, areas are northwest of Holstein.

Typical areas occur along the Kearney County line in the southwestern part of the county. The remaining areas are small and scattered. The soil has weathered from the loessial deposit which once covered the entire county, and sandiness of its surface soil results largely from the presence of wind-blown material from the more sandy soils of the region.

Areas of this soil range from almost flat to steeply sloping, but the greater part of the land is gently rolling. Drainage is everywhere good but, except on the steeper slopes, is not excessive. The slope is in general sufficient, even on the flatter areas, to carry off the surplus moisture, and the porous subsoil affords ample underdrainage.

On account of its small extent, Holdrege very fine sandy loam is not an important agricultural soil in Adams County, but it is fertile and all crops common to the region yield well in favorable seasons. Owing to its sandier surface soil, it can be tilled under a somewhat wider range of moisture conditions than can Holdrege silt loam. The soil is very stable, the large organic-matter content preventing excessive wind erosion even in the driest seasons.

About 80 per cent of the Holdrege very fine sandy loam is under cultivation to corn, oats, wheat, and alfalfa. The remainder is occupied by farm buildings and pasture land. A few farmers feed cattle during the winter, though this industry is not practiced so extensively as it is on Holdrege silt loam. Hogs are raised for market on every farm.

Crop yields are about the same as those obtained on the heavier upland soils. The loose, porous soil lends itself admirably to the formation of a surface mulch, and moisture is retained well. During dry seasons crops often withstand droughts better than on Holdrege silt loam.

This land is tilled in much the same manner as is Holdrege silt loam, but it is somewhat easier to manage and can be cultivated with less power and lighter machinery. The current selling price ranges from \$100 to \$150 an acre.

#### HASTINGS SERIES

The surface soils of the Hastings soils, to a depth ranging from 18 to 28 inches, are very dark grayish brown or almost black. They are friable and are loosely granular in the lower part. The upper part of the subsoil is moderately compact grayish-brown heavy silt loam or silty clay loam. This layer is heavier in texture than the corresponding layer in the Holdrege soils but is less heavy and compact than that of the Crete soils. The lower part of the subsoil is loose grayish-yellow silty loam which continues to a depth of many feet. In the upper part of this layer, at a depth ranging from 30 to 60 inches below the surface, is a layer rich in lime. Only one member of this series, Hastings silt loam, has been mapped in Adams County.

#### HASTINGS SILT LOAM

The surface soil of Hastings silt loam is very dark grayish-brown or almost black silt loam. It consists of three layers ranging in thickness from 18 to 28 inches but averaging about 24 inches. In uncultivated areas the upper layer, which is from one-half to 2 inches thick, consists of the structureless mulch common to soils of this region. It is underlain by a laminated layer from 2 to 4 inches thick.

The next lower layer consists of granular silt loam. The granules vary in size up to one-fourth inch and are very distinctly developed. This layer is from 9 to 20 inches thick. The fourth layer is the one of maximum compaction in this soil. It is about 12 inches thick and consists of grayish-brown or brown heavy silt loam or silty clay loam. The material is moderately compact, being less dense than the corresponding layer in the Crete soils and more compact than that in the Holdrege. When dry this material is columnar and breaks up into cubelike blocks. The next lower layer, between depths of about 33 and 47 inches, consists of grayish-yellow silt loam. This material is firm but not compact and is structureless. Below an average depth of about 48 inches is a zone of lime concentration. This material is similar in texture and structure to that of the layer above. The lime occurs in several forms, but concretions and disseminated lime are abundant. The depth to lime and the thickness of the lime layer vary considerably, but the layer is usually present above the 5-foot depth and is from 10 to 20 inches thick. The next lower layer is the loose, friable, structureless loess from which this soil has developed. It contains less lime than the layer above, although it is moderately calcareous to depths below 8 or 10 feet.

Hastings silt loam occurs mainly in a broad belt extending north and south through the central part of the county. The largest area, which covers more than a township, lies on a smooth upland just northwest of the center of the county. Toward the southern part the soil occurs in long, parallel strips and makes up the surface of the uneroded remnants of the original plain. A few small areas are scattered over the southeastern and southwestern parts of the county.

The surface of this soil is a little less even than that of Crete silt loam but averages more nearly level than that of the Holdrege soils. It varies from nearly level to very gently rolling. Drainage is good. The subsoil is not sufficiently compact to hinder free downward movement of soil moisture, and there is usually sufficient slope even on the more nearly level areas to carry off the surplus surface water.

Probably 90 per cent of this soil is under cultivation. The remainder is included in small pastures and building sites. Corn, wheat, oats, and alfalfa are the leading crops, ranking in acreage in the order named. The soil is one of the best upland soils in Adams County, being equal to Holdrege silt loam in productiveness. In fact, the farmers recognize no difference in crop yields or sale values between Hastings silt loam and Holdrege silt loam, and the two soils are managed in the same way. The surface relief of Hastings silt loam, as a whole, makes it better suited to the use of large machinery.

#### COLBY SERIES

The Colby series includes soils having loose grayish-brown surface layers which grade abruptly to grayish-yellow highly calcareous subsoils. The subsoils have a silty texture and a loose, open structure. The Colby soils occur on the upland where erosion has removed the dark-colored surface soil.

#### COLBY SILT LOAM

The surface soil of Colby silt loam is ash-gray or grayish-brown silt loam from 6 to 8 inches deep. In places it contains a rather high percentage of very fine sand. The material is ordinarily loose in

structure, but it becomes moderately compact if it is worked when wet. The upper part of the subsoil is of similar texture but is commonly slightly lighter in color than the layer above, and the lower part, below a depth varying from 12 to 15 inches, consists of light-yellow or gray floury silt loam which grades with depth to the very light colored unweathered parent loess. The subsoil and in many places the surface soil are highly calcareous, and lime concretions are commonly abundant below a depth of 24 inches.

The surface soil is variable in thickness and color, being shallow and light gray or yellowish on the more eroded slopes but darker in color on the more nearly level areas where it is fairly well supplied with organic matter. Locally the surface soil contains so much clay as to approach silty clay loam in texture. Colby silt loam differs from Holdrege silt loam chiefly in the lighter color and lower content of organic matter in its surface soil. It has weathered from loessial material under conditions unfavorable for the accumulation of organic matter in the surface soil.

Colby silt loam occurs chiefly in the western half of the county in large, irregular areas on the nearly level upland and in narrow strips on the slopes along drainage channels. One of the largest and most typical areas, comprising about 12 square miles, borders the northern county line in the vicinity of Prosser and Hayland; another large area extends southeastward from the western county boundary west of Cottonwood Creek; a third area of considerable size is between Kenesaw and Holstein in the west-central part of the county; and the remaining areas occur as narrow strips or small patches on slopes bordering drainage ways. This soil is inextensive throughout the eastern half of the county.

The surface of Colby silt loam ranges from almost level to steeply sloping. The larger areas are slightly uneven, with low, rounded hillocks or ridges and intervening level depressions. The narrow strips along stream valleys are characterized by moderate or steep slopes and are rather deeply eroded in places. On the steeper slopes the uneven surface renders plowing and harvesting of crops very difficult and detracts from the agricultural value of the land.

Drainage is everywhere adequate, and along most of the narrow elongated areas surface run-off is excessive and erosion is severe. Throughout the larger areas surface drainage is poorly established, but the loose porous subsoil affords ample underdrainage.

The native vegetation on Colby silt loam consists chiefly of prairie grasses, such as grama, buffalo, and bunch grasses. On the more level areas the first two species predominate, but on the steeply sloping areas subject to erosion bunch grass is most abundant.

Owing to its rather large extent Colby silt loam is an important agricultural soil in Adams County. The steeper slopes in the more eroded areas are included in pasture land. Of the cultivated crops, corn, wheat, alfalfa, oats, rye, and barley are the most important. Many farmers grow wheat on the same land continuously for as long as five years. Small patches of sorghum, millet, and Sudan grass are occasionally grown. Orchard fruits do well in favorable seasons. Crop yields are governed largely by moisture conditions, the condition of the soil, and the care used in cultivation. The general crop yields are a trifle lower than those obtained on the Holdrege, Hastings, and Crete soils, owing largely to the lower organic-matter content of

this soil. Corn yields range from 15 to 50 bushels, averaging about 20 bushels to the acre. The average yield of wheat over a period of years is about 12 bushels to the acre, but in favorable seasons from 20 to 30 bushels are obtained. The average yield of oats is about 20 bushels, of rye 15 bushels, and of barley 20 bushels to the acre. Alfalfa yields from 2 to 3 tons to the acre from three cuttings. This soil is exceptionally well adapted to alfalfa on account of its looseness, friability, and high lime content. The crop is an excellent soil improver since it prevents erosion, adds nitrogen, and increases the naturally low supply of organic matter.

Cattle, principally Hereford, are grazed on the rougher areas of this soil. From 5 to 7 acres of pasture are considered sufficient to support a horse or cow the year around if the animal is fed some grain during the winter months. Hogs are raised on every farm.

Land of this kind is easily managed and can be cultivated without serious injury under a rather wide range of moisture conditions. It has a tendency to clod if plowed when wet, but the lumps are easily reduced. Care should be taken to prevent soil washing on the steeper slopes. No commercial fertilizer is used, though all available barnyard manure is applied. Definite crop rotation is not practiced, though most farmers change their crops with reasonable regularity and grow alfalfa frequently.

The current selling price for this land ranges from \$50 to \$125 an acre, depending on improvements, surface features, and distance from markets.

For the improvement of Colby silt loam organic matter should be added. The growing of alfalfa, sweet clover, or other legumes frequently is a means to this end, and old straw piles should be hauled and spread over the land each year instead of being burned as is the custom. In the more steeply sloping areas erosion can be retarded by building brush or rubbish dams in incipient drainage channels.

#### COLBY VERY FINE SANDY LOAM

The surface soil of Colby very fine sandy loam, to an average depth of about 7 inches, consists of grayish-brown loose friable very fine sandy loam. The upper part of the subsoil, to a depth of about 12 inches, is slightly lighter in color though very similar in texture and structure. Below this depth the material gradually becomes lighter in color and finer in texture until, at a depth of about 24 inches, it grades to the loose, nearly white silt of the parent loess. The subsoil and, in many places, the soil itself are highly calcareous, and the lower strata contain numerous lime concretions.

This soil includes several variations which range from loam to silt loam and from dark grayish brown to light grayish brown. On the less eroded areas the dark grayish-brown surface layer extends to a depth of 10 inches in places. On the steeper slopes where erosion is severe, the soil is light grayish brown and in very few places is more than 5 inches deep. In many areas the surface soil has been entirely removed, exposing the almost white, highly calcareous silt of the parent loess. Over large areas the surface soil contains so much silt that it approaches silt loam in texture. Colby silt loam and Colby very fine sandy loam merge so gradually into each other that in many places it is necessary to draw arbitrary lines in separating them on

the soil map. Around the margins of the areas where they border more sandy material, the surface soil has accumulated large quantities of fine sand, and small patches of Colby fine sandy loam are included.

This soil occurs chiefly in the western part of the county, where it occupies large areas north and south of Kenesaw and in the vicinity of Holstein. It occurs only locally south of Little Blue River and west of Sand Creek. It has been formed by weathering from loess, the surface of which has been considerably modified by sands blown from surrounding soils and by sandy material washed from the parent loess.

Areas of this soil vary from almost level to steeply sloping. The larger areas, in the vicinity of Kenesaw and Holstein, are gently undulating and are characterized by low, rounded knolls and ridges with intervening level tracts of land. The smaller areas, which occur as narrow strips or small patches along drainage slopes, have a moderately or steeply sloping relief and are, in places, considerably dissected by intermittent stream channels.

Drainage is everywhere good. In many places on the steeper slopes it is excessive and erosion is a serious factor. In the more nearly level areas where stream channels are poorly developed, the surplus moisture is readily absorbed by the loose porous surface soil and subsoil, and underdrainage is good. This soil is fairly retentive of moisture, though it does not withstand drought so well as the Holdrege soils on account of its lower organic-matter content.

Colby very fine sandy loam was originally covered with prairie grasses similar to those on Colby silt loam, but most of the virgin sod has been broken for crop production and at present about 85 per cent of the soil is under cultivation. The remainder, including the steeper slopes along drainage ways, is included in pasture land. The grazing of beef cattle is practiced to some extent on the rougher areas, but this industry is not so well developed as on the more sandy soils of the county.

Corn, wheat, alfalfa, oats, rye, and barley are the leading cultivated crops. Yields vary widely, depending on the rainfall, but average about the same as those obtained on Colby silt loam. In this county Colby very fine sandy loam and Colby silt loam contain so much silt and are so nearly alike in physical characteristics that they are cultivated in the same way and are about equally favored for general farming purposes. The very fine sandy loam, where it is typically developed, is somewhat easier to till, on account of its larger sand content and the fact that it can be cultivated under a slightly wider range of moisture conditions.

Current prices of Colby very fine sandy loam range from \$50 to \$125 an acre, the character of the surface features and the improvements being the governing factors in the sale price.

#### COLBY FINE SANDY LOAM

The surface soil of Colby fine sandy loam, to an average depth of 6 inches, is grayish-brown, loose, friable fine sandy loam. With depth the soil material gradually becomes lighter in color and finer in texture until, at a depth of about 12 inches, it grades to grayish-yellow very fine sandy loam. This is underlain, at a depth of about 30 inches, by the light-gray or almost white very fine sandy loam lower subsoil

layer which continues to a depth greater than 3 feet. In color the soil is similar to Colby very fine sandy loam, but the surface soil is coarser and slightly looser and the subsoil is more porous and sandy. The substratum, which occurs at a depth varying from 38 to 48 inches, is similar to the light-colored silt that underlies Colby very fine sandy loam and Colby silt loam. The surface soil contains a small percentage of lime, the subsoil and substratum commonly are highly calcareous, and lime concretions are abundant in many places below a depth of 30 inches.

The organic-matter content of the surface soil varies with the relief. On the more nearly level areas there is a moderate supply of humus and the soil is very dark in color, whereas on steeper slopes and crests of knolls and ridges where the surface is exposed to erosion by wind and water, the supply of organic matter has been greatly reduced or entirely removed, leaving the soil light gray or almost white. Some areas of Colby very fine sandy loam and Colby loamy sand, all too small to separate on a map of the scale used in this survey, are included with Colby fine sandy loam. As a rule the knolls and slopes are fine sandy loam or loamy sand, whereas soil in the intermediate depressions is finer in texture. In the northwestern and southwestern parts of the county, in association with Valentine sand, the soil in places consists of light-brown or yellowish loose fine sandy loam or very fine sandy loam, underlain by yellow friable loamy fine sand which grades rather abruptly, at a depth varying from 20 to 36 inches, to yellow friable silt. Here and there throughout areas of this soil the material above a depth of 3 feet does not effervesce with dilute hydrochloric acid. This is especially true in areas along the western county boundary west of Kenesaw, but even in this locality there is no evidence of a deficiency in lime.

This soil is not so extensive in Adams County as either the silt loam or very fine sandy loam members of the series. It occurs chiefly in scattered small patches along the northern boundary of the county and in a few large areas and narrow strips throughout the western part, chiefly in close association with Colby loamy sand and Valentine sand. The origin of this soil is difficult to determine, but it has apparently weathered from loessial material, the surface of which has been greatly modified by sandy deposits. The sand may have been accumulated in part through wind action on the coarser-textured Valentine soils and on dunes and in part by surface wash from sandy materials within the loessial deposit.

Areas in general are uneven or slightly undulating. Low, rounded hummocks, knolls, and ridges separated by intervening shallow depressions cause the greater part of this soil to have a choppy surface. Locally, along intermittent drainage ways, the land is moderately or steeply sloping. It is well drained but is not subject to serious erosion, except in a few places on the steeper valley sides.

Colby fine sandy loam is of only moderate agricultural importance in Adams County on account of its rather small extent. It is a fair farming soil and when carefully managed produces moderate yields of most crops common to the region. About 70 per cent of it is under cultivation, and the remainder is used for grazing land. The soil is subject to slight drifting when the native sod is broken and requires more careful management than either Colby silt loam or Colby very fine sandy loam. The native vegetation consists of the

same grasses as grow on Colby silt loam, and, in addition, considerable sand grass and *Stipa* are present. Corn, wheat, oats, and alfalfa are the principal cultivated crops. Yields of crops, with the possible exception of corn, are somewhat lower than on the heavier soils of the Colby series. Farming methods are similar to those practiced on the heavier soils.

Current prices of Colby fine sandy loam range from \$50 to \$75 an acre, depending on surface features, improvements, and location with respect to markets.

This soil is easily maintained in good tilth and can be cultivated under almost any moisture conditions without injury, provided care is taken to prevent it from drifting. It is advisable to list corn deeply, with the furrows at right angles to the prevailing winds, if possible. Coarse manure and rotted straw are beneficial in keeping the soil stable. The slightly hummocky character of the surface does not seriously interfere with cultivating and harvesting crops, but it detracts somewhat from the agricultural value of the land. Alfalfa does fairly well on this soil and when once established is an excellent crop for preventing soil drifting.

#### COLBY LOAMY SAND

The surface soil of Colby loamy sand is grayish-brown loamy sand 6 or 8 inches deep. It is underlain by almost pure gray sand of fine or very fine texture, which continues to an average depth of 18 inches and in many places extends to a depth greater than 2 feet. The lower part of the subsoil is very light grayish-brown silt or very fine sandy loam which gradually becomes lighter in color and finer in texture with depth until it merges with the light-gray or almost white parent loess at a depth of about 36 inches. The surface soil and the upper part of the subsoil in few places contain sufficient lime to react with dilute hydrochloric acid, but the lower part of the subsoil is commonly highly calcareous, and the substratum contains numerous lime concretions. Although the immediate surface soil is moderately well supplied with organic matter, the supply is commonly not sufficient to prevent the soil from drifting when the native sod is destroyed.

A few variations from the typical soil occur. In the more level areas where conditions have been most favorable for the accumulation of organic matter, the surface soil is considerably deeper than typical and in many places extends to a depth of 10 inches before it grades to the light-gray sand of the upper part of the subsoil. In the more exposed areas, as on the crests of low knolls and ridges, wind action has removed much of the organic matter, and the soil is lighter in color than typical. Locally the surface and upper subsoil layers have been entirely removed, exposing the light-gray, silty loessial material from which the soil has weathered. Colby loamy sand has weathered from loessial deposits, the surfaces of which have been so completely covered with wind-blown sand as to resemble aeolian material.

Colby loamy sand occurs chiefly in the western part of the county in a few small, isolated patches and narrow strips adjacent to areas of the Valentine soils. One of the largest areas, comprising about 320 acres, is west of Holstein on the north side of Sand Creek, and a

smaller, though typical area, is 3 miles south of Holstein on the south side of Sand Creek. The total area of Colby loamy sand in Adams County is 3 square miles.

Areas of this soil range from gently undulating to decidedly hummocky. The prevailing relief is choppy, resembling that of loose wind-blown sand. Surface drainage is poorly established, but the loose, porous surface soil and subsoil cause excessive underdrainage in many places, and during dry years crops sometimes suffer from lack of moisture.

This soil is not important agriculturally in Adams County on account of its small extent, somewhat droughty nature, and tendency to drift when brought under cultivation. About 70 per cent of it remains with its native covering of grasses, chief among which are bunch grass, bluestem, sand grass, and *Stipa* or needle grass, with some grama grass in the more level areas. The grazing of beef cattle, mainly Hereford, is the principal industry. The native grasses on from 5 to 7 acres will support a cow or horse during the summer grazing season. Of the cultivated crops, corn occupies the largest acreage. Yields range from 15 to 30 bushels to the acre, depending on the rainfall. Alfalfa yields from 1½ to 2½ tons to the acre from two cuttings. This crop does fairly well after a stand is obtained, but it is extremely difficult to produce a sufficiently compact seed bed to insure a maximum crop. Small grains are seldom grown, on account of the danger of soil drifting and consequent injury to the young plants.

The current selling price of Colby loamy sand ranges from \$30 to \$75 an acre, depending chiefly on surface relief.

The practicability of bringing more of this soil under cultivation is extremely doubtful. It is a fairly good grazing soil but is very difficult to manage when the native sod is destroyed. On the areas now cropped it is desirable to keep the land covered during as much of the year as possible. Coarse manure and rotted straw have proved beneficial in preventing excessive drifting and should be applied to the land. The soil should not be disturbed any more than is absolutely necessary when crops are planted and cultivated.

#### FILLMORE SERIES

The loose surface soils of the members of the Fillmore series vary in thickness from 6 to 14 inches. Their color is very dark grayish brown in the upper part and ranges from black to gray in the lower. The upper part of the subsoil is dense black clay which ranges in thickness from 6 to 24 inches and the lower part is gray or almost white loose silt loam containing an abundance of lime to a depth of 8 or 10 inches. The substratum or parent material from which these soils have weathered is loose yellowish-gray silt. The Fillmore soils occupy flat or depressed areas on the upland where drainage is poor. They differ from the Crete soils principally in the blackness and compactness of their heavy subsoil layer and from the Scott soils in the darker color of their subsoils. Fillmore silt loam has been mapped in Adams County.

#### FILLMORE SILT LOAM

Fillmore silt loam is an upland soil which has developed a black claypan in the upper part of the subsoil. The soil has weathered under conditions of poor drainage but has not been subjected to excess moisture so continuously or in such large quantities as the Scott soils.

The dark upper layers have a total thickness varying from 6 to 15 inches. The surface layer, to a depth of one-half or 1 inch, consists of the loose, structureless mulch common to soils of the region. The underlying laminated layer is about 4 inches thick. These layers are very dark grayish brown or black. The next lower layer is also very dark, particularly in the upper part, but in many places it is sprinkled with white floury silt in the lower part. This white material forms a coating around the dark-colored granules. In spots where very poor drainage prevails a thin layer of white, laminated silt may underlie the granulated layer. Small, black, nearly round concretions are nearly everywhere present in this white layer. The underlying heavy layer is a true claypan and is extremely dense black clay. It varies in thickness from 12 to 24 inches. The clay is structureless and breaks into irregular clods. Small black concretions are everywhere present. The next lower layer is gray, light-gray, or almost white, loose, structureless silt loam or silty clay loam 2 or 3 feet thick. It contains scattered rust-brown streaks and specks. Lime, occurring chiefly as concretions, is abundant. Below this layer the lime is disseminated through the material. The percentage decreases with depth, and lime does not appear at a depth of about 6 feet. Below the zone of lime concentration is the parent loess from which this soil has developed. It is grayish-yellow floury silt containing rust-brown stains and is not calcareous.

Fillmore silt loam occupies level or depressed areas on all parts of the more level upland. The largest areas are in the northeastern part of the county in depressions surrounding areas of the poorly drained Scott silt loam. Many patches of this soil too small to be indicated on the soil map occur over the flatter upland.

Fillmore silt loam grades in agricultural value from that of the poorly drained Scott silt loam which is not cultivated to that of Crete silt loam which is nearly all tillable. In the lower places and along the border of areas of Scott silt loam, poor drainage prevents cultivation, but some of the better-drained areas are included in cultivated fields. Crops on this land drown out in wet seasons, and average yields are low. The greater part of the soil is used for hay land or for pasture. In some places the land could be improved by artificial drainage, but over the greater part of it, owing to the density and imperviousness of the subsoil, the water is removed very slowly, and it is doubtful if the expense of drainage would be justified.

#### HALL SERIES

The soils of the Hall series typically have very dark grayish-brown or almost black surface soils from 12 to 18 inches deep. The upper part of the subsoils is slightly heavier in texture and is more compact. This is underlain, at a depth of about 30 inches, by friable lighter-textured material. The color of the subsoils is very slightly lighter than that of the surface soils. Lime is present below a depth ranging from 30 to 36 inches. The profile of the Hall soils is very similar to that of the Hastings. The Hall soils, however, occur on nearly level, well-drained terraces.

In this county Hall silt loam was mapped. This soil is not a good representative of the Hall series, as the dark-colored layers are deeper than they are in most soils of this series and the subsoil is not so compact.

## HALL SILT LOAM

The surface soil of Hall silt loam consists of very dark grayish-brown or black friable silt loam from 12 to 18 inches deep. The subsoil is similar to the surface soil in color and texture but is commonly slightly more compact. In many places a thin surface layer contains a large proportion of very fine sand and in some areas, especially along a few of the intermittent drainage ways south of Little Blue River, the texture is very fine sandy loam. The greater part of the soil, however, is either silt loam or contains very little more very fine sand than a silt loam. Both surface soil and subsoil are rich in organic matter, which imparts a dark color to a depth of 3 feet. The slightly heavier texture of the subsoil results from the downward movement and concentration of the finer soil particles. The soil material is generally well supplied with lime. In a few places light-gray, highly calcareous silt, which is everywhere present below an average depth of 3 feet, occurs below a depth of 30 inches. Locally the subsoil is brown or light-brown friable silt loam.

The soil described above is evidently not typical of soils of the Hall series as mapped in other counties of Nebraska. It lacks the heavy, compact, upper subsoil horizon, the lime of the lower part of the subsoil occurs at a greater depth than typical, and the entire soil is more uniform in color and texture than is characteristic of true Hall soils. The carbonates, however, have not been entirely removed from the lower subsoil horizons as they have in the Waukesha and Judson soils, which this soil closely resembles, but they seem to be actually accumulating below an average depth of 3 feet. For this reason this soil is correlated with the Hall series.

This soil occurs as narrow strips along intermittent drainage ways leading into Little Blue River, chiefly in the eastern half of the county. One of the longest areas is along Pawnee Creek and smaller areas may be seen along Ash and Crooked Creeks.

The soil has weathered on valley-filling material composed partly of sediment deposited by the intermittent streams during periods of heavy precipitation and partly of silty material brought down by colluvial action from the adjoining uplands. The parent material is of comparatively recent deposition, and sufficient time has not elapsed to develop the distinctly lighter-colored subsoil so characteristic of the older alluvial terraces.

Areas of Hall silt loam are smooth, with a decided slope toward the drainage channels. The surface lies from 5 to 15 feet above the normal flow of the streams along whose banks the soil lies. Drainage is good, but none of the soil is subject to rapid erosion.

Owing to its small extent, this soil is not important in the agriculture of the county. Its high content of organic matter and its friable structure tend to make it drought resistant and equal to Waukesha silt loam in productiveness. Only about 30 per cent of this soil is under cultivation, chiefly because of the unfavorable shape of the areas for farming operations. The greater part is used for pasture. All crops common to the region can be successfully grown, and the yields are about the same as those obtained on Waukesha silt loam.

Areas of this soil are too small to have a separate value in the sale price of the farms on which they occur, but the presence of this soil has a tendency to increase the general value of the land.

## VALENTINE SERIES

The Valentine series includes soils with grayish-brown surface soils underlain by grayish-brown or gray loose incoherent sand. The surface layers contain small quantities of organic matter and clay and in places have a loamy texture. The soils are poorly supplied with lime. They have developed from wind-blown sands which have become stable. Areas vary from choppy and hummocky to almost level. Soils of this series in most places occupy the lower situations, including the dry valleys within the sand-hill region, but in this county they include small areas of wind-blown sand on the uplands and terraces. Drainage is in most places excessive. Surface channels are not developed, but moisture seeps downward through the loose porous subsoil. Valentine sand is mapped in Adams County.

## VALENTINE SAND

The surface soil of Valentine sand consists of loose, incoherent gray or grayish-brown sand, from 6 to 14 inches deep. This material, to a depth of 4 inches, is generally somewhat darker than the lower part of the layer, owing to the presence of a small amount of organic matter, which, however, is nowhere present in sufficient quantity to prevent the soil from drifting when the protective vegetation is removed. The subsoil of loose, incoherent sand extending below a depth of 3 feet is commonly gray in color although locally it may be tinted with light brown or pale reddish brown. It is practically devoid of organic matter. Neither the surface soil nor subsoil is noticeably calcareous. The sand of which this soil is so largely composed is chiefly quartz and feldspar and consists of the medium, fine, and very fine grades, with the medium sand predominating.

The color, depth, and organic-matter content of the surface soil vary somewhat with the surface relief. In shallow depressions where conditions have been most favorable for the growth and decay of vegetation the soil is somewhat darker and deeper than typical. Locally it contains so much organic matter as to become loamy sand in texture. On the crests of the low, rounded knolls and ridges the organic matter has been largely removed by the wind, leaving the soil very shallow and prevailingly light in color. Around the margins of the areas which border the Colby soils, the lower part of the subsoil in many places is much lighter in color and is slightly finer in texture than typical. It consists of yellowish-gray or almost white fine or very fine sandy loam. The variations mentioned are of such small extent and local occurrence as not to warrant separation on the soil map.

Valentine sand occurs in the western, northwestern, and southwestern parts of Adams County. One of the most typical areas is northwest of Kenesaw along the southern edge of the alluvial lands along South Channel Platte River. A small area is near the head of Cottonwood Creek in Wanda Township, and narrow strips are south and west of Holstein on both sides of Sand Creek. Other areas are few and small.

Valentine sand has been formed by the partial weathering of wind-blown sand. The derivation of the sandy material is difficult to determine but it is probably derived in part from sands carried down from the west by Platte River and in part from sand beds in the loess.

The original material has been reworked and reassorted to such an extent that it is not possible to make any definite statement as to its origin.

Areas of this soil vary from almost flat to rolling, but the greater part presents a hummocky or billowy relief. Most of the flatter areas are modified by scattered low, rounded knolls and ridges. Drainage is everywhere thorough. There is no surface run-off, but the loose, porous sands absorb and carry off the water as fast as it accumulates.

Valentine sand is of little value for crop production on account of its low humus content, low water-retaining capacity, and tendency to drift when the native sod is destroyed. Probably not more than 20 per cent of it is under cultivation. Some corn, kafir, and sorghum are grown in the lower areas where moisture conditions are most favorable, but small grain is seldom grown on account of the looseness of the seed bed. Yields of all crops are generally low, except in the most favorable seasons.

Most of this land remains with its original covering of grasses and is used for cattle grazing and hay production. The native vegetation consists of sand grass, *Stipa*, big and little bluestem, and some grama grass. These grasses will support from 100 to 150 head of cattle to the square mile during the summer grazing season or, when cut for hay, yield about one-half ton to the acre.

Current prices of Valentine sand range from \$35 to \$50 an acre, depending on the surface features, improvements, and distance from markets.

In cultivating this soil great care must be taken to prevent drifting. Cultivation should be no more frequent than is necessary to control the weeds. Coarse manure and straw spread over the land have proved beneficial in preventing excessive drifting. Corn should be deeply listed. Most of the land should remain in pasture.

#### WAUKESHA SERIES

Soils of the Waukesha series are characterized by dark grayish-brown or black surface soils underlain by grayish-brown or yellowish-brown subsoils which are heavier in texture than the surface layers. The soils are only moderately calcareous, as most of the carbonates have been leached to a depth greater than 4 feet. The soils are derived from transported and reworked loessial material carried down and deposited by the streams when they were flowing at higher levels. Areas are flat or very gently undulating, and drainage is good though not excessive. These soils differ from those of the Holdrege series in their mode of formation, their more generally level surface, and their lower lime content. In Adams County, Waukesha silt loam and Waukesha very fine sandy loam are mapped.

#### WAUKESHA SILT LOAM

The surface soil of Waukesha silt loam is very dark grayish-brown, friable, silt loam from 12 to 15 inches deep. It contains a large percentage of organic matter and in a moist condition appears almost black. In many places it contains considerable very fine sand, but practically no coarser material is present. The subsoil is brown or grayish-brown, moderately compact silty clay which in places becomes slightly lighter in color and more friable with depth but over most

of the areas shows little change either in color or texture to a depth greater than 30 inches. The change from the surface soil to the subsoil is very gradual, both in color and texture. Lime concretions occur in places in the lower part of the subsoil, but their presence is not characteristic, and the soil as a whole is not noticeably calcareous within 3 feet of the surface. In the floury parent silt below an average depth of 4 feet, however, lime is abundant both in the finely divided form and as numerous angular concretions from one-sixteenth to one-fourth inch in diameter. The surface soil and upper part of the subsoil have a more or less granular structure, and that of the lower part of the subsoil and substratum is columnar. The deeper cuts along roads and slopes show a profile similar to that of the loess underlying the upland.

Numerous local variations, which are of such small extent and scattered occurrence as not to warrant separation on the soil map, are included with Waukesha silt loam. On the north side of Little Blue River in the southwestern part of Hanover Township and here and there along a few of the smaller drainage ways throughout the county, small patches of this soil closely resemble Judson silt loam in physical characteristics. The surface soil in these areas is dark-brown or black friable silt loam, and the material changes little in color or texture within a depth of 3 feet. Such a condition prevails only near the lower edge of slopes where the soil has received considerable surface wash from the adjoining uplands. In another variation north of Leroy on the north side of Little Blue River the material is highly calcareous below a depth of 18 inches. The surface soil here closely resembles that of Waukesha silt loam, but the subsoil, below an average depth of 12 inches, is light-gray loose floury silt which continues to a depth greater than 3 feet. Lime concretions are abundant below a depth of 24 inches. Had this condition prevailed over a sufficient area to warrant mapping, the soil would be classed as Hall silt loam, but owing to its small extent it is included with Waukesha silt loam. Along Thirty-two Mile Creek south of Juniata the subsoil is much more compact and heavier than typical and closely resembles that of the Crete silt loam. In a few places areas of Waukesha very fine sandy loam, which are not separated on the soil map on account of their local occurrence and small extent, are included in areas of this soil.

Waukesha silt loam occurs in a narrow, elongated strip along Thirty-two Mile Creek, in small broken strips along Little Blue River, and in a medium-sized area on the terrace bordering South Branch Big Blue River. The soil was derived from alluvial sediments deposited by the streams when they were flowing at high levels and from colluvial wash from the adjoining uplands, especially near the foot of the slopes. Prolonged weathering and accumulation of organic matter has changed the original deposits into the present soil.

Areas of this soil are smooth, commonly with a gentle slope down the valleys and toward the streams. The surface lies from 10 to 15 feet above the first bottoms. The transition to the bottom lands is marked by a rather short, steep slope, whereas that to the uplands is in many places long and gradual.

This soil is well drained, as the slope is generally sufficient, even on the flatter areas, to carry off the surplus moisture. After heavy rains water sometimes accumulates in shallow, isolated depressions, but the total extent of poorly drained land is almost negligible.

Owing to its small extent, this soil is not so important in the general agriculture of the county as many of the upland soils. It is very fertile, however, withstands drought well, and is adapted to all crops common to the region. Originally it supported a dense growth of prairie grasses including buffalo, grama, western wheat, and bluestem, but practically all of it is now under cultivation and is devoted to the production of corn, wheat, oats, and alfalfa. Dairying is practiced to some extent on a few farms. The milk cows are mostly grade Herefords and Shorthorns. Hog raising is practiced rather extensively, and many farmers fatten cattle during the winter. Most of the feeder stock is shipped in from Omaha.

Crop yields on Waukesha silt loam are slightly higher than on the upland soils, as this soil is more favorably situated for the accumulation of moisture from the higher levels and from the underlying water table. Corn yields from 35 to 50 bushels, wheat from 15 to 30 bushels, oats from 30 to 35 bushels, and alfalfa from 3 to 4 tons to the acre. Alfalfa is commonly cut three times, and a fourth cutting is occasionally obtained.

No commercial fertilizer is used, but all available barnyard manure is applied. Systematic crop rotation is not practiced, but most farmers change their crops with reasonable regularity and grow considerable alfalfa. The land is in no immediate danger of becoming exhausted. It receives considerable surface wash from the adjoining uplands. This tends to maintain its fertility.

The current selling price of Waukesha silt loam ranges from \$150 to \$200 an acre, depending on improvements and location with respect to markets.

#### WAUKESHA VERY FINE SANDY LOAM

The surface soil of Waukesha very fine sandy loam is dark grayish-brown very fine sandy loam from 10 to 14 inches deep. It is loose and friable and contains a high percentage of decayed organic matter. The upper part of the subsoil is grayish brown and ranges in texture from silt to silty clay containing a small percentage of very fine sand. It is slightly more compact than the surface material and in most places continues to a depth greater than 3 feet, though in some places it grades, at a depth of about 24 inches, to more compact and slightly lighter colored silty clay. In some areas the material is slightly mottled with light-gray splotches and scattered iron stains. It is very sticky and plastic when wet but becomes brittle and breaks down easily on drying. The soil is in few places noticeably calcareous within 3 feet of the surface, but lime is very abundant below a depth of 4 feet. The structure of the lower part of the subsoil is similar to that of the loess underlying the uplands.

Around the outer margins of this soil, where it borders the uplands, colluvial wash from the higher levels has greatly thickened the surface soil and increased its silt content. In such areas the soil extends to a depth of 24 inches and in small areas to a depth greater than 3 feet with little change in color or texture. Had such areas been of sufficient size to warrant mapping, they would have been classed as Judson silt loam or Judson very fine sandy loam, depending on their surface texture. The areas of Waukesha silt loam and Waukesha very fine sandy loam in many places merge so gradually into one

another that it is extremely difficult to accurately separate them and undoubtedly small areas of the silt loam soil are included with the very fine sandy loam and vice versa.

This soil occurs along Little Blue River, in narrow broken strips on both sides of the stream, and in a small area along South Branch Big Blue River in the northeastern part of the county. The soil has weathered from alluvial materials deposited by the streams when they were flowing at a higher level, but subsequent deepening of the channels has left the deposits as terraces or benches considerably above the present flood plains.

Areas of Waukesha very fine sandy loam are flat, usually with a gentle slope down the valleys and toward the stream channels, and drainage is good. The surface lies from 10 to 15 feet above the present flood plains, and the areas are not subject to overflow from the main streams.

Owing to its rather small extent this is not an important agricultural soil in Adams County. It is fertile, however, and is considered equal to Waukesha silt loam for farming purposes. In fact, the farmers show no preference between the two soils. The yields, methods of managing the land, and current sale prices are about the same for this soil as for the silt loam.

#### CASS SERIES

The Cass soils have dark grayish-brown or black surface soils underlain by gray sandy subsoils which in many places grade to coarse sand and gravel below a depth of 30 inches. The soils occupy first-bottom or flood-plain positions along the larger streams. They have developed from the weathering of sandy alluvial deposits. They are, in general, poorly supplied with lime, though in many places they give a calcareous reaction when acid is applied. The fine sandy loam, very fine sandy loam, and loamy fine sand members of the series are mapped in Adams County.

#### CASS FINE SANDY LOAM

The surface soil of Cass fine sandy loam, to a depth varying from 6 to 12 inches, consists of dark grayish-brown fine sandy loam containing a large percentage of organic matter. The subsoil is gray, incoherent fine or medium sand which commonly continues to a depth greater than 3 feet, although in many places it grades, at a depth of about 30 inches, to coarse sand and fine gravel. The soil is in few places noticeably calcareous, although here and there both the surface soil and subsoil contain sufficient lime to effervesce with dilute hydrochloric acid. The subsoil is very deficient in organic matter and locally is faintly mottled with rust-brown stains. The transition in color between the surface soil and subsoil is typically very abrupt. The sand of which the soil is so largely composed consists chiefly of the fine and medium grades, together with considerable of the very fine grade.

The total area of Cass fine sandy loam in Adams County is 4.6 square miles. The largest areas are on the flood plains of Platte River in the extreme northwestern part of the county. Small areas and narrow, broken strips are scattered throughout the bottom lands along Little Blue River in the southern part. The soil consists of sandy

flood-plain material deposited by the streams during comparatively recent times. Subsequent weathering and the accumulation of organic matter has greatly modified the surface of the original deposit.

Areas of this soil are generally flat, though locally they are characterized by slight depressions, low rounded hummocks, and old stream channels. The surface lies only a few feet above the normal stream flow, but the land is seldom inundated except during periods of exceptionally high water. In wet years, the underlying water table frequently rises to within 3 feet of the surface, and parts of the soil become too wet for profitable farming. In very dry years the underdrainage is excessive, and crops do not do so well as on soils with heavier subsoils.

On account of its uncertain drainage, only about 50 per cent of this soil is used for crop production. The remainder is included in pasture and hay land. Corn and alfalfa are the chief crops. The native vegetation consists of a rank growth of prairie and marsh grasses which will support a cow or horse on about  $1\frac{1}{2}$  acres during the summer grazing season or which, when cut for hay, yields from three-fourths to 1 ton to the acre, depending on the rainfall. The hay on land of this kind is commonly coarser and has a lower feeding value than that obtained on the better-drained soils, but its larger yield tends in a measure to offset its inferior quality. Beef cattle, including grade Shorthorns and Herefords, are grazed over much of the land. Hog raising is not practiced extensively, although a few hogs are raised on farms where alfalfa and corn can be produced.

The average yield of corn on this soil ranges from 15 to 25 bushels to the acre and of alfalfa from  $1\frac{1}{2}$  to  $2\frac{1}{2}$  tons from three cuttings. During exceptionally wet or dry years yields are sometimes below these figures, whereas during favorable seasons as high as 40 bushels of corn and 4 tons of alfalfa to the acre have been obtained.

This soil is easily managed and can be cultivated with lighter machinery and work animals than are required on the heavier soils of the county. It can be plowed under almost any moisture conditions without injury to its structure. It is seldom plowed more often than once in three or four years, since double disking the surface is sufficient for either a corn or alfalfa seed bed. Small grain is seldom planted on account of the loose, sandy texture of the soil.

The current selling price of Cass fine sandy loam ranges from \$30 to \$60 an acre, depending on the drainage and adaptability of the soil to crop production.

#### CASS VERY FINE SANDY LOAM

The surface soil of Cass very fine sandy loam, to a depth varying from 6 to 10 inches, consists of dark grayish-brown very fine sandy loam containing a large percentage of silt and a comparatively small percentage of particles coarser than fine sand. The dark color is due to the organic matter present. The subsoil is yellowish-gray incoherent fine or very fine sand which in most places continues to a depth greater than 36 inches, though in some places it becomes lighter in color and coarser in texture with depth and locally, below a depth of 30 inches, is either almost white medium sand or a very light grayish-brown mixture of coarse sand and fine gravel. Brownish iron stains occur in many places below a depth of 24 inches. The organic-matter content decreases with depth, and this material is lacking in

the lower part of the subsoil. In few places is the soil noticeably calcareous, though locally the surface soil and upper part of the subsoil contain sufficient lime to react with dilute hydrochloric acid.

The largest area of this soil, covering about  $1\frac{1}{2}$  square miles, occurs on the bottom lands of Platte River in the northwestern part of the county, and small narrow strips occupy parts of the flood plains along Little Blue River in the southern part. The soil has weathered from sandy alluvial materials deposited in the bottom lands along streams during periods of high water. The high organic-matter content of the surface soil results from the subsequent growth and decay of plant life.

This land is prevailingly flat except where it is relieved by old stream channels, cut-offs, and scattered low mounds. Drainage is, in general, poor. The area in the northwestern part of the county is not subject to overflow from the main stream, but the water table is everywhere near the surface, and during seasons of heavy rainfall it rises so high as to prevent crop production. Many of the areas along Little Blue River are inundated annually. In a few small areas of marshy land, underdrainage is insufficient to allow cultivation.

Owing to its small extent and poor drainage, this soil is unimportant agriculturally in Adams County. Practically all of it is used for pasture and hay land, although some alfalfa and corn are grown on the better-drained areas. During favorable seasons the yields are good, but in wet years crops are often drowned out by the excessive moisture. The native vegetation consists chiefly of a rank growth of prairie and marsh grasses, but where the land borders the channel of Little Blue River there are narrow strips of scrub willow, elm, ash, cottonwood, and box elder trees. The native grasses will support a cow or steer to the acre during the summer grazing season or, when cut for hay, yield from three-fourths to  $1\frac{1}{4}$  tons to the acre. All the hay is stacked or stored for winter feeding.

It is difficult to obtain land values for this soil, as it seldom comprises entire farms. It probably has a current sale value equal to that of Cass fine sandy loam.

The chief need of this land is adequate drainage. It is very fertile and easily managed and when drained is well adapted to corn and alfalfa. Ditching or tiling the land would increase its producing power. Although the yield of hay is high, the coarser texture renders the feeding value lower than that of hay cut from the better-drained upland and terrace soils. The land is well adapted to timothy and clover, and the quality of the hay now cut could be greatly improved by sowing mixed timothy and clover seed among the native grasses.

#### CASS LOAMY FINE SAND

The surface soil of Cass loamy fine sand is dark grayish-brown or grayish-brown loose, medium, or fine sand 8 or 10 inches deep. It contains considerable well-decomposed organic matter, which imparts the dark color and loamy texture, but which is not present in sufficient quantities to prevent soil drifting during prolonged droughts, if the native vegetation is destroyed. The subsoil is gray, incoherent fine or medium sand, which in most places extends to a depth greater than 36 inches with little change in color or texture but which in a few places contains considerable coarse sand and gravel in the lower part.

The entire soil is typically poorly supplied with lime, although both the surface soil and upper part of the subsoil in places react with dilute hydrochloric acid. The subsoil is very deficient in organic matter and locally contains scattered rust-brown stains resulting from poor drainage.

This soil occupies 384 acres in Adams County. It occurs in two narrow strips along South Channel Platte River in the extreme northwestern part of the county. The parent material consists of sandy alluvium of recent origin, deposited on the present flood plain of the stream, and of wind-blown sand from the river channel. Subsequent weathering and the accumulation of small quantities of organic matter have given the sand a loamy texture.

Areas of this soil are flat, locally modified by low ridges and hummocks composed of almost pure sand. Few areas are subject to overflow, and underdrainage is fair, except in a few places where, in wet years, the underlying water table lies so near the surface as to produce small areas of marshy land. In dry seasons the underdrainage is excessive, and the native vegetation suffers from lack of moisture.

Owing to its small extent, low organic-matter content, and uncertain drainage, all of this soil is used for grazing purposes. The native vegetation consists very largely of sand grass, needle grass, bluestem, marsh grasses, and sedges. This land, chiefly on account of its smaller organic-matter content and lower fertility, has a somewhat lower grazing value than either Cass fine sandy loam or Cass very fine sandy loam.

No definite sale value is available for this soil on account of its small extent, but it is probably worth \$15 or \$20 an acre for grazing purposes.

#### SPARTA SERIES

The soils of the Sparta series have dark grayish-brown surface horizons underlain by gray sandy or gravelly subsoils. They are derived from the partial weathering of stream-deposited sand and gravel and occur on flat or gently undulating terraces. Drainage is thorough and in many places is excessive, owing to the porosity of the soil material. Most of the soils are low in lime. The sand and gravelly sandy loam members of the series are mapped. This county is situated toward the western limit of the belt in which the Sparta soils may occur, and the soils of the series in this county differ from typical in two respects. The surface soils are shallower, and the sand and gravel of the parent material contain a larger percentage of feldspars and other minerals besides quartz.

#### SPARTA SAND

The surface soil of Sparta sand is grayish-brown or dark grayish brown, incoherent sand from 6 to 10 inches deep. Organic matter has slightly darkened the immediate surface, but this material is nowhere present in sufficient quantities to prevent the soil from drifting when cultivated. The subsoil is light grayish-brown, incoherent, medium sand containing small traces of organic matter to a depth of 18 inches. The entire soil is very poorly supplied with lime and does not effervesce when dilute hydrochloric acid is applied.

This soil occurs in three small areas on the Platte River terrace in the extreme northwestern part of the county and in a narrow strip

along Sand Creek in the southwestern part. The total area of the soil in this county is 3.9 square miles.

Sparta sand consists of slightly weathered alluvial sands which were deposited on the flood plains when the streams were flowing at higher levels, and of wind-blown sand from the surrounding soils. The material is of recent origin, and sufficient time has not elapsed to produce a dark-colored surface soil through the growth and decay of vegetation. Sparta sand is very similar to Valentine sand in physical characteristics but differs from it in its more even surface and in its mode of formation.

Areas of this soil are flat or very gently undulating, with some low, rounded sand hummocks and ridges, and lie from 12 to 15 feet above the stream channels. Drainage is good and over much of the soil is excessive. It is all subterranean, the loose porous sands absorbing and carrying off the moisture as fast as it accumulates. However, even the more excessively drained areas are more retentive of moisture than in Sparta gravelly sandy loam and they have a higher grazing value.

Sparta sand is not adapted to farming on account of its low organic-matter content, excessive drainage, and the danger of soil drifting when the native sod is broken. Practically all of it is used for grazing land. Corn is grown on a few of the more protected areas, but the yields are low except in the most favorable seasons. The native vegetation consists chiefly of sand grass, *Stipa* or needle grass, blue-stem, and grama grass. From 2 to 4 acres, depending on the rainfall, will support a cow or steer during the summer grazing season.

No land values are available for this soil, as it seldom occupies more than a small part of the farms on which it occurs. It has about the same grazing value as Valentine sand.

#### SPARTA GRAVELLY SANDY LOAM

Sparta gravelly sandy loam, to a depth greater than 3 feet, consists of an admixture of all grades of sand, together with large quantities of fine and medium gravel. It is grayish brown or dark grayish brown in color, the upper 6-inch layer being slightly darker than the remainder, owing to a small accumulation of organic matter. Organic matter is nowhere present in sufficient quantities to prevent the finer sands from drifting when the native sod is destroyed. In some areas of this soil the subsoil becomes coarser with depth and below a depth of 24 inches consists of the coarser grades of light-brown or gray sand and gravel, together with a comparatively small percentage of fine and very fine sand. Neither the surface soil nor subsoil is noticeably calcareous and the subsoil is practically devoid of organic matter below a depth of 12 inches.

The total area of Sparta gravelly sandy loam in Adams County is 896 acres. The soil occurs in two small, narrow areas on the Platte River terrace in the extreme northwestern part of the county. It was weathered from coarse alluvial material deposited by Platte River when it was flowing at a higher level and from wind-blown sands from the adjoining flood-plain soils and from the near-by Valentine sand and dune sand. This soil differs from the O'Neill soils mapped in adjacent counties chiefly in that it contains less organic matter and has consequently a lighter-colored surface soil.

Areas of this soil are flat, with a gentle slope to the north and east. The surface lies from 5 to 15 feet above the adjoining flood plains. Underdrainage is excessive, as the loose gravelly subsoil absorbs and carries off the moisture as fast as it accumulates, making the soil very droughty. During very dry years even the native grasses suffer from lack of moisture.

This soil is of little agricultural value on account of its droughtiness, and practically all of it is included in pasture land. The gravelly subsoil is locally used for building purposes and for surfacing the near-by highways. The land supports a fair growth of grama grass and sand grass, and cactuses are abundant. The grasses usually wither and dry up during midsummer and can not be depended on for late grazing.

No sale value can be given this land on account of its small extent. It is usually sold in connection with other grazing soils and detracts somewhat from the general value of the farm or ranch on which it occurs.

#### SARPY SERIES

The soils of the Sarpy series have gray or light grayish-brown surface layers underlain by light-colored incoherent sandy subsoils. The lower strata in many places include coarse sand and gravel. The soils are poor in lime. They occur on first bottoms or flood plains along streams. They represent a less mature stage of weathering than the Cass soils and have not accumulated such large quantities of organic matter in their surface layers. They are similar to the Sparta soils in color and in textural characteristics, but they occur on lower positions and are more poorly drained. In Adams County Sarpy sand is mapped.

#### SARPY SAND

Sarpy sand consists of grayish-brown or gray incoherent fine or medium sand which in most places continues to a depth greater than 3 feet with little change in texture. The surface soil, to a depth of 6 or 8 inches, is generally slightly darker than the remainder of the soil, owing to a small accumulation of organic matter. Locally, the material below a depth of 24 inches grades to light-gray coarse sand and fine gravel, and the lower part of the subsoil in many places is mottled with rust-brown stains caused by poor drainage. The material is in few places noticeably calcareous within 3 feet of the surface. Sarpy sand differs from the Cass soils only in the lower organic-matter content and lighter color of its surface horizon.

This soil occurs chiefly in narrow strips along South Channel Platte River in the northwestern part of the county and along Little Blue River in the southern part. The strips border the stream channels and vary in width from a few rods to about one-fourth mile. The parent material consists of sandy alluvium, recently deposited in the stream bottoms during periods of high water. It has not weathered sufficiently to allow the development of the dark-colored surface layer so characteristic of the Cass soils. In many places the material closely resembles riverwash, as it is mapped in other counties of Nebraska, but Sarpy sand is more stable and is not so greatly influenced by each slight rise of the streams.

Areas of this soil range from flat to slightly hummocky, and drainage is variable, depending on the rainfall and the water level in the

main streams. During dry years all the land is thoroughly and in many places excessively drained, owing to the looseness and porosity of the surface soil and subsoil, but in wet years most of the soil is frequently overflowed, although the water seldom remains on the surface longer than a few hours.

Owing to its small extent, low organic-matter content, and incoherent structure, this soil is of little agricultural importance in Adams County and is practically all included in farm pastures. Some corn is grown on the more favorably situated areas, but the amount of cultivated land is almost negligible. The native vegetation is sparse and the land does not have a high value even for pasture. Narrow strips of timber consisting of a fairly dense growth of ash, elm, cottonwood, and willow occur along the stream channels. In a few places the gravelly subsoil is used by the farmers for building purposes and road construction.

No separate sale value can be assigned to this soil, as it occupies only a part of the farms bordering the streams. It has a tendency to lower the general value of the land on which it occurs.

It is doubtful if any of this land should be used for crop production, as it is very unstable when the native sod is destroyed and is droughty during dry years. The planting of tame grasses and clover would tend to increase its value for grazing.

#### NUCKOLLS SERIES

The soils of the Nuckolls series have dark grayish-brown friable surface soils underlain by reddish-brown moderately compact sandy clay subsoils. Lime is abundant below a depth ranging from 18 to 30 inches. These soils occur on valley and ravine slopes and are in most places severely eroded. On these slopes erosion has exposed the parent material of reddish loess which is older than the parent material of the soils on the smooth upland. Nuckolls loam is mapped in Adams County.

#### NUCKOLLS LOAM

The surface soil of Nuckolls loam is very dark grayish brown or brown and is, on the average, about 8 inches deep. It ranges in texture from friable fine sandy loam to heavy silt loam. The subsoil is reddish-brown moderately compact very fine sandy clay which continues to a depth greater than 3 feet. The upper part of the subsoil is slightly darker and more compact than the lower part, due to its larger content of clay and organic matter. The entire subsoil has a rather plastic gritty feel when wet but becomes hard and brittle on drying. The soil is highly calcareous below an average depth of 24 inches, and lime concretions occur abundantly in the lower stratum.

The depth and color of the surface soil vary with the relief. On the more gentle slopes the material is very dark brown or almost black and ranges in thickness from 15 to 24 inches. On the steeper hillsides where erosion is especially severe, the surface soil has been greatly thinned or entirely removed, exposing the reddish-brown upper subsoil layer. Even on the moderate slopes, patches have the decidedly reddish cast which is characteristic of the subsoil of this soil throughout the area of its occurrence. In a few places stream erosion has cut

through the material from which the soil has weathered, exposing a highly calcareous, heavy, compact, bluish or gray clay containing considerable coarse sand and gravel. In the immediate vicinity of these exposures the light-colored material is present in many places within a depth of 3 feet from the surface. Locally the surface soil contains considerable coarse sand and fine gravel.

The total extent of this soil is less than 2 square miles. Areas occur chiefly in the southeastern corner of the county along the edges of the valleys of streams tributary to Little Blue River. Nuckolls loam generally comprises the lower slopes of valleys of which the higher slopes are occupied by the Holdrege, Hastings, or Crete soils. Locally, where erosion has removed the overlying loess, this soil extends over the low ridges and hilltops. Such areas may be seen one-half mile west and about three-fourths mile south of Pauline, along Crooked Creek, and elsewhere throughout the southeastern part of the county. Many such patches, too small to be accurately shown on the soil map, occur as far west as Logan Township and north along Pawnee Creek to the southern edge of Blaine Township.

Nuckolls loam has weathered from a reddish-brown sandy clay formation underlying the loess. The exact derivation of this formation is not clearly understood, but it is thought to represent a loess older than the one which has weathered into the Holdrege, Crete, and Colby soils. The material varies in thickness from a few inches to about 50 feet, depending on the extent to which erosion has advanced. It is known in the old Nebraska surveys as the Loveland phase of the loess.

Areas of Nuckolls loam vary from gently rolling to steeply sloping. The greater part of the soil is very much dissected and is unsuited to farming operations. Drainage is, in general, excessive, and erosion is severe.

About 90 per cent of this soil retains its native covering of grasses, including the same species as occur on the Holdrege and Crete soils, and is used for pasture land. The more gently rolling areas are well adapted to all crops common to the region, and yields are about the same as those obtained on Holdrege silt loam and Holdrege very fine sandy loam.

It is difficult to obtain land values for this soil as it occupies only a small part of the farms on which it occurs and is sold in connection with other soils. The more eroded areas detract somewhat from the general value of the farm.

#### SCOTT SERIES

The surface soils of members of the Scott series vary considerably in color and depth. The average depth is about 10 inches. The upper one-half or two-thirds inch layer is in many places dense black, though it may be almost any shade of gray. The lower part of the surface soil is commonly gray and in many places is almost white. Below the surface soil is heavy, almost impervious bluish-gray or dark-gray clay which continues to a depth of 5 or 6 feet. This material is discolored by rust-brown stains and black concretions. Below it is the grayish-yellow silty material that underlies the entire region. The soils of the Scott series occur in poorly drained depressions on the upland. Scott silt loam has been mapped in this county.

## SCOTT SILT LOAM

Scott silt loam is a soil developed under conditions of excessive moisture. The topsoil is friable and ranges in thickness from a mere film to 12 inches. The color is also variable. The basic black color is more or less sprinkled with white floury silt particles. This white silt is not sufficiently abundant in the upper part of the soil to greatly lighten the dark color, but it increases with depth and in many places forms a thin light grayish-brown or almost white layer in the lower part.

The upper part of the subsoil is a claypan and consists of an extremely compact dark-gray or bluish-gray structureless clay, stained and mottled by numerous rust-brown streaks and spots and hard iron concretions. It is plastic when wet and very hard and tough when dry. This material reaches an average depth of 50 inches. The claypan of this soil differs from that of the Fillmore soils chiefly in its lighter and more mottled color.

Beneath the claypan is dark grayish-brown pulverulent silt loam which merges, at a depth of 60 or 70 inches, with light yellowish-gray, structureless, floury silt. Scott silt loam contains no lime and the underlying silt does not contain lime, at least within a depth of 8 feet from the surface.

Scott silt loam occurs in the deeper parts of numerous local depressions known as "buffalo wallows" or "lagoons" scattered throughout the more level parts of the uplands in all parts of the county. Few areas exceed 1 or 2 acres in extent, though a few in the northeastern part cover about 320 acres.

Owing to the basinlike surface of this soil and to the imperviousness of its subsoil, water often accumulates after rains. It disappears very slowly, and poor drainage exists over the greater part of the soil.

Scott silt loam is not used for crop production but is practically all included in pasture land. Some hay is cut on the larger areas. Where water stands a large part of the year the vegetation consists of sedges, marsh grasses, cat-tails, and other water-loving plants. Smartweed is a characteristic growth, and western wheatgrass flourishes where the ground is not too wet and is kept free from weeds. As the rankness of the grasses and the prevalence of weeds make the hay inferior in quality, the land is best suited to pasture. The native grasses yield from one-half to three-fourths ton of hay to the acre, depending on the rainfall. During protracted droughts vegetation suffers from lack of moisture, as the soil cracks badly on drying and evaporation becomes excessive.

It is difficult to give land values for this soil as it generally occupies but a small percentage of the farms on which it occurs. Where it occupies a considerable acreage, the selling price of the farm is greatly reduced.

Scott silt loam probably should not be used for crop production. Some farmers haul manure and straw on this land in an effort to increase its porosity and prevent the accumulation of surface water, but it is doubtful if this method will give the desired result, since the poor drainage is caused by the heavy, impervious subsoil. If land values were higher in this county it might be profitable to reclaim the land by means of a system of deep drainage ditches.

## DUNE SAND

Dune sand consists of gray or grayish-brown, smooth, incoherent, fine, or medium sand which continues to a depth of more than 3 feet with little change in texture. The soil contains some organic matter but not enough to prevent drifting when the covering of grasses is removed. It is fairly retentive of moisture, considering its loose structure. Neither the surface soil nor the subsoil is noticeably calcareous.

There is little variation in dune sand throughout the area of its occurrence, although locally the material contains more silt, clay, and organic matter than typical, owing probably to more favorable conditions for weathering and the growth and decay of plant life. The loamier areas have a thicker grass covering than most of the soil and therefore a greater grazing value.

Dune sand occurs only in close association with Valentine sand in the northwestern and southwestern parts of the county. Its total area does not exceed 4 square miles. It has been formed in the same manner and from the same material as Valentine sand and differs from this soil chiefly in its more uneven surface. The sand is piled into dunes varying in height from 20 to 50 feet, with blow-outs in many places. Dune sand contains less organic matter, is less stable, and has a lower grazing value than Valentine sand. A negligible part of the land is subject to active wind erosion. There are very few continuous waterways through dune-sand areas, as the rainfall is absorbed almost at once.

Dune sand is of little value for farming, as the destruction of the native sod is followed by damaging wind erosion. Nevertheless, a few patches here and there are in cultivation. Corn is the chief crop grown, but the yield is poor, especially after the first year. Practically all of the land is used for pasture, though some hay is cut from the smoother areas. The native vegetation includes a great number of grasses, of which long-leaved reed grass, redfieldia, and Stipa are the most common. The soil is capable of maintaining from 75 to 100 head of livestock to the square mile during the summer grazing season.

The current price of dune sand ranges from \$20 to \$30 an acre, depending on improvements.

The use of this land depends on the preservation of the native grasses. The surface is generally well sodded, and the grass has materially improved during recent years, owing to the control of prairie fires which formerly swept over much of the land during late fall and early spring. Dune sand is incoherent, and as it loses in stability under cultivation, no attempt should be made to utilize it for crops.

## AGRICULTURE

The first white men to realize in part the agricultural possibilities of the area now included in Adams County were emigrants en route to the gold fields of California between 1855 and 1865. At that time, however, the land was thought to be valuable only for grazing purposes. The first settlers were cattlemen who, a few years later, established themselves along the Oregon Trail, which crossed the county from the northwest to the southeast. About 1870 the settlers

began to grow sod corn for sale to the emigrants. The yields were good, and the farming possibilities became recognized. In 1872, when the Chicago, Burlington & Quincy Railroad was completed across the county, settlers arrived in large numbers, and all the desirable farming land was rapidly taken up under the preemption and homestead laws. Sod corn was commonly the first crop planted and, together with game and beef, was the principal food. As living conditions became more stable spring wheat, oats, barley, rye, and garden vegetables were grown. A flour mill was established in Hastings in the early part of the decade between 1870 and 1880.

The early agricultural development was slow, as the early settlers were not familiar with local climatic conditions and soil requirements. The prevalence of insect pests, the frequency of droughts, and the lack of capital also impeded progress. Little attention was given to seed selection or to the preparation of the seed bed, and consequently the yields were usually low. In 1874 grasshoppers destroyed most of the crops, and in the early part of the decade between 1890 and 1900 droughts were so severe that many farmers became so impoverished that they were forced to leave the county. At present there is a tendency to improve crops by careful seed selection and to increase the productiveness of the soil by crop rotation, manuring, and growing leguminous crops such as clover and alfalfa. Diversified farming, including the production of grain and hay, now predominates. The raising of livestock is of secondary importance because only small areas are more suitable for pasture than for crop production.

The following tables, compiled from the reports of the Federal census, show the trend of agriculture in Adams County during the last 45 years:

*Number of animals on the farms in 1880, 1890, 1900, 1910, 1920, and 1925*

Domestic animals	1880	1890	1900	1910	1920	1925 <sup>1</sup>
Dairy cows.....	2,343	8,193	7,230	7,639	12,595	7,196
Other cattle.....	2,718	18,905	16,403	10,905	6,773	13,033
Horses.....	3,846	8,701	11,054	12,901	10,703	9,884
Mules.....	758	877	833	1,349	1,788	1,761
Swine.....	12,749	4,482	57,640	35,259	25,415	29,437
Sheep.....	456	2,187	773	4,105	6,969	5,180
Poultry (all kinds).....	35,968	124,925	107,090	252,254	160,753	191,566

*Number, extent, and value of the farms and number operated by owners, tenants, and managers in the years 1880, 1890, 1900, 1910, 1920, and 1925*

Farms	1880	1890	1900	1910	1920	1925 <sup>1</sup>
Number of farms.....	1,505	1,764	1,949	1,831	1,688	1,670
Land in farms..... acres.....	247,194	304,012	343,131	346,168	346,616	335,153
Improved land in farms..... do.....	169,684	281,307	305,465	307,154	305,633	-----
Average size of farms..... do.....	164.2	172	176.1	189.1	205.3	200.7
Value per farm..... dollars.....	2,170	3,368	5,765	18,916	26,300	20,122
Value land per acre..... do.....	-----	-----	22.47	81.05	101.41	154.92
Number operated by owners.....	1,297	1,142	1,124	1,035	840	797
Number operated by tenants.....	208	622	806	790	840	863
Number operated by managers.....	-----	-----	19	6	8	10

<sup>1</sup>United States census of agriculture, 1925, Bureau of the Census.

*Acres and production of principal crops in 1879, 1889, 1899, 1909, 1919,  
and 1924*

Crop	1879		1889		1899	
	Acres	Bushels	Acres	Bushels	Acres	Bushels
Corn	29,397	900,866	95,584	4,102,814	110,325	2,368,310
Oats	5,023	137,771	43,748	1,266,327	36,478	943,160
Wheat	64,074	685,684	27,118	335,495	82,398	1,263,370
Rye	352	4,383	950	13,589	475	5,670
Barley	3,778	75,132	9,653	222,404	533	10,050
Flaxseed		1,025	575	5,288		
Potatoes		31,608	1,942	182,830	1,501	161,321
		<i>Tons</i>		<i>Tons</i>		<i>Tons</i>
Hay	2,738	3,572	23,043	25,272		
Tame					4,959	9,419
Wild					10,214	9,149
Alfalfa <sup>2</sup>					2,071	4,634
Coarse forage					1,467	3,739
		<i>Gallons</i>		<i>Gallons</i>		<i>Gallons</i>
Sorgo		1,419	103	6,686	61	3,319
		<i>Trees</i>		<i>Bushels</i>		<i>Bushels</i>
Apples			16,799	5,392	59,045	4,602
Peaches			8,624	340	4,067	59

Crop	1909		1919		1924 <sup>1</sup>	
	Acres	Bushels	Acres	Bushels	Acres	Bushels
Corn	90,042	1,327,464	67,452	1,900,049	93,280	27,512,774
Oats	22,338	534,630	18,245	561,151	24,498	601,192
Wheat	113,129	2,250,868	139,583	1,167,991	95,917	2,092,617
Rye	103	1,314	1,275	12,797		
Barley	246	4,324	6,198	141,149	5,771	112,922
Potatoes	1,406	94,307	1,110	51,039		
		<i>Tons</i>		<i>Tons</i>		<i>Tons</i>
Hay					24,352	36,095
Tame	20,091	33,861	15,330	27,147		
Wild	8,305	7,342	8,296	7,820		
Alfalfa <sup>2</sup>	16,641	29,232	13,328	23,626		
Coarse forage	1,110	2,309	9,965	24,974		
		<i>Gallons</i>		<i>Gallons</i>		
Sorgo	156	275				
		<i>Trees</i>		<i>Bushels</i>		
Apples	36,366	26,605	8,696	6,451		
Peaches	35,628	957	1,313	298		

<sup>1</sup> United States census of agriculture 1925, Bureau of the Census.

<sup>2</sup> Alfalfa is also included in the item "Tame hay."

In 1919 the acreage of wheat exceeded that of all other crops combined on account of the strong demand and prevailing high price of the grain, but during the last few years the acreage has been greatly reduced until now it is about equal to that of corn.

In 1922 wheat ranked second to corn in acreage. Winter wheat is grown practically to the exclusion of spring wheat. Winter wheat can be planted in the fall after the busy season is over. It matures earlier in the summer than spring wheat, so that it is not so apt to be affected by droughts and hot winds. The yields fluctuate less than those of spring wheat, and there is less danger from smut and rust. The average yield of winter wheat in 1922 was 10 bushels to the acre and of spring wheat was 8 bushels. Turkey continues to be the leading variety of winter wheat, although an increasing acreage is planted to Kanred each year. The strains have been kept pure by the more progressive farmers, but on the tenant farms they have become mixed. Wheat is planted throughout the loessial uplands

and terraces. It is a "hard-land" crop and is seldom grown on the more sandy soils. A binder usually is used in harvesting, but in exceptionally dry seasons when the stems are too short for binding the grain is headed. The crop is shocked or stacked in the field for threshing. Most of the grain is sold direct from the machine, but a few farmers store it for a higher market. Some of the wheat is sold to the flour mill at Hastings.

The Nebraska Department of Agriculture reports 93,206 acres in corn in 1922. The yield was 1,398,090 bushels, an average of 15 bushels to the acre. This yield is considerably below the general average for the county during a period of years. In exceptionally favorable seasons 30 or 40 bushels to the acre are obtained. Corn is either listed in or is planted in checkrows, depending usually on the press of work at seeding time. Listing prevails, and a 1-row lister is commonly used. Corn planted in checkrows can be cultivated in several directions and is more easily kept free from weeds than listed corn. On the more sandy lands, however, listing is favored by all farmers, as the furrows tend to collect moisture and the ridges to check soil drifting. Corn is usually cultivated from three to five times. When corn follows a crop of corn that was not cut for fodder or silage the stalks are broken down with a stalk cutter and the field is disked before plowing. On farms operated by owners, most of the corn is fed to hogs, beef cattle, and work animals. On tenant farms more of it is sold. There were 72 silos in the county in 1922, and on farms where these are located from 10 to 20 acres of corn are cut each year for silage. The common practice is to husk the corn from the standing stalks in the fall and to pasture the cattle and horses in the fields during the winter. Many farmers fence off a few acres of unhusked corn for hog range and some husk only enough to supply their work animals, allowing the cattle for market to graze in the fields until fattened. A small acreage is annually cut for forage. Many tenant farmers grow corn on the same land several consecutive years, but this practice is conducive to lower yields than where corn is grown in rotation with small grains and alfalfa. In recent years some attention has been given to the improvement of the seed corn by selecting the larger and better-formed ears when gathering the crop, but as a rule, seed selection is not practiced. Practically all the corn is of the dent varieties, but little attention is given to keeping the strains pure. Reid Yellow Dent, Iowa Silvermine, Nebraska White Prize, and mixtures of these strains are most commonly grown. Corn is raised in all parts of the county except on the more poorly drained flood plains, the steeper valley slopes, and the most sandy areas. The well but not excessively drained terrace soils and the less eroded parts of the uplands are preferred for corn on account of the higher yields they produce.

In point of acreage oats was third in the list of grains in 1919, when it yielded an average of 20 bushels to the acre. Oats are planted in the same manner as wheat, except that they are usually drilled in as early in the spring as the frost is out of the ground. Kherson is the leading variety, but considerable Swedish Select is grown. Very little effort is made to control smut, although the disease sometimes lowers crop yields during wet seasons. Oats are usually cut with a binder and either shocked or stacked for threshing. The grain is used largely as feed for horses and other livestock, but some is sold. Although a

little of the straw is baled, most of it is left in the the field and made accessible to livestock. Some farmers procure seed from other sections of the country, but many simply clean a sufficient quantity of the previous crop for seed. Oats are grown on all but the sandier, rougher, and more poorly drained soils of the county, but the crop does best on the more nearly level uplands and the heavier-textured soils of the terraces.

Among the grain crops, barley ranks next to oats in acreage. In 1919 it gave an average yield of 17 bushels to the acre. The crop is grown in all parts of the county except on the more sandy areas and steeper hillside slopes. It will stand considerable moisture and yields best on the first bottoms or flood-plain lands. Barley is grown chiefly for feed, though some of it is sold. The crop is cut with a binder and later threshed. The straw is commonly left in the field and livestock is allowed to feed on the stacks.

Rye follows barley in acreage. The acreage devoted to this crop varies considerably, depending on the market. The average yield of rye was 11 bushels to the acre in 1922. Rye is grown chiefly on the heavier upland and terrace soils. It is usually grown for the grain but is used to some extent for hay and pasture. It is more drought resistant than either wheat or barley and flourishes on more impoverished soils. The crop is harvested either with a binder or header, depending on the length of the stems. The grain is threshed from shocks or from stacks, the latter method prevailing when the crop has been headed. Most of the rye is fed to livestock on the farms, though some is sold. Many farmers plant a small patch of rye for early fall pasturage.

Potatoes, chiefly for home consumption, are grown throughout the county. Potatoes are commonly planted by hand, the cuttings being dropped in every third plow furrow. The potato-growing industry could undoubtedly be profitably extended, as the climatic and soil conditions are favorable and the county is well located with respect to markets.

Among the hay and forage crops, alfalfa occupies the leading acreage. In 1922 the average yield was 1.7 tons to the acre. Alfalfa requires a smooth, mellow seed bed and is usually planted after wheat. The land is plowed, disked, and harrowed, and the seed is commonly broadcast and covered with a harrow. This crop does best if it is sowed immediately after the first good rain in early August. From 12 to 15 pounds of seed to the acre are considered sufficient. Alfalfa does well on all the soils of the county except dune sand, the sandy Valentine soils in which the lime content is insufficient for best results, and the poorly drained soils of the flood plains. It is especially adapted to the lighter-colored loessial soils which are rich in lime. Three and sometimes four cuttings are obtained during the season. The hay is generally stacked in the field, hauled to the feed lots as needed, and used as feed for cattle and hogs. Hogs are often allowed to run in the fields during the summer, but cattle are seldom grazed on green alfalfa on account of the danger of bloat. The crop is an excellent one for preventing erosion and for building up depleted soils. It is not favored for short rotations, however, as most farmers prefer to keep the stand for several years before changing to other crops.

Wild hay is cut chiefly on the poorly drained bottom-land soils and on the sandy soils of the Valentine series. The average yield is

about 0.7 ton to the acre. The higher yields are obtained from the bottom lands, but the upland hay is of much better quality, as it grows less rank, is finer in texture, and has a higher feeding value. The hay is used as feed for work animals and cattle, the portion fed to cattle being stacked in the fields and hauled to the feed lots as needed, and the portion to be fed to work animals usually being stored in the barns.

Among the minor crops grown chiefly for feed, sorghum, millet, Sudan grass, and sweet clover are the most important. Sudan grass, especially, has increased in acreage during the last few years. It yields an average of 2.1 tons of hay to the acre.

There are several farm orchards throughout the county, but the demand for fruit is not supplied, and it would seem that fruit production, especially on the heavier terrace soils, could be profitably extended. Trees usually do not do so well on the uplands on account of the lack of moisture, which is largely offset on the terraces by seepage from the higher slopes and by the nearness of the water table to the surface. Apples, peaches, plums, pears, and cherries are the most important cultivated tree fruits. Of the wild fruits, plums and grapes are abundant along Little Blue River during favorable seasons.

The sale of livestock and livestock products is an important source of revenue in Adams County. The total value of all cattle in 1920 was given as \$858,288. Only a few farmers in the immediate vicinity of Hastings devote their entire time to the dairy industry, but nearly every farmer milks a few cows, chiefly of mixed dairy and beef breeds, and sells the surplus dairy products in the local markets.

The beef-cattle industry is of minor importance in Adams County because so little pasture is available. Some steers are shipped in from outside points and fattened on corn and alfalfa. After from 30 to 90 days they are sold, usually on the Omaha market. Most of the beef cattle are of Hereford or Shorthorn breeds.

Hog raising is an important branch of the livestock industry. Every farmer has a few hogs, and large herds are raised on many farms. In 1920 the total value of hogs was \$478,268. Duroc-Jersey, Poland China, and Hampshire are the leading breeds. A few farmers have purebred herds, though most of the animals are grade stock. The common practice is to fatten the hogs on corn, either in feeding yards or by turning them into the fields and allowing them to "hog down" the corn in the fall. On a few farms the hogs are fed on the corn wasted by fattening cattle. Alfalfa is usually added to the corn ration and during the summer the pigs are often allowed to run in the alfalfa fields until the third crop is ready to cut. During past years many herds have been greatly reduced or entirely destroyed by hog cholera, but much attention is now given to vaccination and sanitation in combating this disease, and its disastrous effects have been largely eliminated.

Sheep raising receives little attention and there are only a few flocks of sheep in the county. Some farmers buy a carload or more of sheep in the fall, fatten them on corn and pasturage, and sell them when prices are favorable. The favorable climatic conditions and the abundance of nutritious feeds would seem to warrant an extension of sheep raising, as large numbers could be fattened in the corn-fields in the fall, at a minimum cost.

Many farmers raise their own work animals and sell a team occasionally. Most of the horses are of heavy draft types, the Percheron being the favorite breed. Much improvement has been made in horses since the introduction of purebred stallions. Some mules are raised, but the local demand for these animals is greater than the supply.

Poultry constitutes an important source of farm income, and a small flock of chickens is raised on every farm. The local demand for poultry products is usually good, and the poultry industry is receiving increased attention. The Leghorn, Plymouth Rock, Rhode Island Red, and Orpington are the principal breeds. Ducks, geese, turkeys, and guinea fowls are raised to a small extent.

The adaptation of certain crops to particular soils is observed to some extent by the farmers. It is recognized that the sandy Valentine soils, on account of their low lime content and instability, are not suited to alfalfa and that this crop does exceptionally well on the highly calcareous soils of the Colby series and on the well-drained loessial terraces. Corn thrives better than small grain on the sandy soils, though the highest yields are obtained on the Waukesha and Holdrege soils. Experience has shown that, under average conditions, the hard lands are better suited to all grain and forage crops than the sandy lands. The wet bottom lands are used for pastures and for hay production. Although the above crop adaptations are generally recognized, there is not sufficient variation in yields to cause specialized farming in any part of the county except in the areas of loose sand which are used only for grazing.

Systematic crop rotation is not practiced, although rather indefinite systems are used by many farmers. When alfalfa sod is broken many farmers plant corn for two years, oats for one year, wheat for one or two years, then return the field to corn. Corn, on account of its deeper rooting system, is probably better adapted than small grains to recently broken alfalfa ground, but even corn may be damaged by drought during dry seasons, as the alfalfa plant requires considerable moisture and leaves the ground in a rather dry condition. Corn is often planted on the same land for as long as four years, is followed by oats for one year, then by wheat for one or two years. A rotation which seems to have merit consists of corn two years, oats, rye, or barley one year, wheat two years, and alfalfa from four to six years. Under the prevailing farming practices, the rotation is governed more by the relative demand and price of grain products than by the requirements of the soil.

Only moderate attention is given to proper cultivation and fertilization of crops. Wheatland is commonly plowed in the fall just before seeding, the seed bed is packed with a harrow and disk, and the grain is planted with a press drill. Little time is allowed for the proper aeration and settling of the soil between plowing and seeding. Some wheat is drilled between the corn rows in the fall.

The farms, as a rule, are well improved. Most of the houses and barns are painted and kept in good repair and there is a general appearance of prosperity. The farms are fenced and cross fenced, mostly with barbed wire, though many of the alfalfa fields and cornfields are inclosed with hog-tight woven-wire fencing. Four-horse teams are commonly used in performing most of the farm work. A few tractors are used during the plowing season and modern labor-saving

implements are in general use. Most farms are equipped with manure spreaders, grain drills, mowers, rakes, binders, riding cultivators, and disk harrows, and a few with corn binders and hay balers. In 1922, according to the Nebraska Department of Agriculture, there were 448 gasoline engines, 125 gasoline tractors, 21 trucks, and 1,237 automobiles on the farms of Adams County. Only the more expensive farm machinery is sheltered.

Practically no commercial fertilizer is used in Adams County. Considerable barnyard manure is applied to the land, but the supply is seldom sufficient to greatly increase the total crop yields. Little care is taken to preserve the manure, most of it being piled in the open and exposed to the weather until it is hauled to the fields. Under this practice much of its fertilizing value is lost by leaching. The more progressive farmers haul the manure direct from the barns or feed lots to the field, applying it mainly to the cornland and wheatland, but on tenant farms the land in the immediate vicinity of the barnyard, regardless of its needs, usually receives the larger part of the manure.

Farm laborers are not easily obtained, especially during the busy season. Wages range from \$40 to \$45 a month with board and room. Day laborers receive from \$2.50 to \$3 a day, and \$4 a day was paid during the harvest season of 1923. Corn shuckers received 6 or 8 cents a bushel. Seven cents a bushel were paid for threshing wheat and 4½ cents for oats.

According to the Federal census, the percentage of the county in farms increased from 68.4 per cent in 1880 to 95.9 per cent in 1920. The average size of the farms during the latter year is reported to be 205.3 acres. The area of improved land in the average farm increased from 112.7 acres in 1880 to 181.1 acres in 1920. The farms vary greatly in size, but most of them range from 160 to 320 acres. In the last 40 years, the proportion of the farms operated by the owners has greatly decreased and the proportion operated by tenants has increased. In 1880, 86.2 per cent of the total number and in 1925 only 47.7 per cent were operated by the owners.

The share-rental system predominates in Adams County. According to the Nebraska Department of Agriculture, 78.5 per cent of the land rented is operated on the share basis. Under this system the tenant furnishes all equipment, labor, and seed, and receives from three-fifths to two-thirds of the crops. On farms rented for cash, the tenant usually pays \$4 or \$5 an acre for strictly farming land and \$3 an acre for pasture land. On a few farms the renter is given the use of the pasture land without charge.

Selling prices of the land range from about \$15 to \$200 an acre, depending on the surface features, drainage, character of the soil, improvements, and location with respect to markets. The average price for the county is probably about \$100 an acre. The highest-priced land is that including the Holdrege, Crete, and Waukesha soils, and the lowest priced is areas of dune sand, Valentine sand, and the more poorly drained parts of the flood plains.

#### THE SOILS AND THEIR INTERPRETATION

Three principal factors, the parent material, the soil-forming processes that have acted on this material, and the length of time these processes have acted, determine the development and distribution of

soils in any given region. The parent material from which the upland soils of Adams County have developed was silty material called loess, which was presumably fairly uniform in its chemical and physical properties. The regional soil-forming agencies, such as climate, are also nearly uniform. The influences of climate are strongly impressed on the soils and slight differences in the supply of soil moisture produce marked variations in some of the important soil characteristics. The gradual decrease in the mean annual precipitation from east to west across the county, however, is not sufficient to account for the differences in the soils, nor does the distribution of these differences indicate that they are due entirely to broad climatic changes. The differences that exist in the soils must, therefore, be due largely to local influences that control the amounts of moisture acting on the soils and to differences in the periods of time during which these soils have been subjected to these varying conditions of moisture.

The explanation for differences in soils is found in the surface relief that controls the quantity of water entering the soil or standing over the surface. Fine-textured soils on flat or depressed areas which receive and retain the largest quantities of water show certain well-marked characteristics, among which are advanced stages of leaching and concentrations of clay in the subsoils. On the more rolling areas, excessive leaching and the formation of claypan have not reached an advanced stage as less water has entered the soil. As a result, the soil climate is similar, with respect to moisture, to that which produced the soils of regions farther west where a drier atmospheric climate prevails. Over a considerable part of the rolling upland areas the original nearly level surface has been altered by erosion and the former weathered soil has been removed. The increased rapidity of the surface run-off has prevented the formation of a newer fully developed soil even if such a soil could ever again form under the influence of the changed topographic and soil moisture conditions.

In the more nearly level uplands of the county the soils have been undisturbed by erosion, and the soil-forming processes have acted for longer periods of time than in the more rolling sections. The soils, therefore, have attained a more advanced stage of development. Their character is controlled largely by the moisture conditions under which they have weathered and the length of time they have been subjected to such conditions. Varying quantities of moisture acting for longer or shorter periods has resulted in the development on the smoother upland of several distinct soils. These have been arranged in this report in five soil series, namely, the Holdrege, Hastings, Crete, Fillmore, and Scott. These, in the order named, have weathered under an increasingly larger and more continuous moisture supply.

A common characteristic of the surface soils in these series is their dark color. This color is imparted by finely divided organic matter derived from the decay of grass roots and intimately mingled or combined with the mineral components of the soil. The surface soils range from dark grayish brown to almost black and are from 6 to 20 inches thick, both color and thickness depending on the local drainage conditions that determine the moisture supply and control the accumulation and retention of organic matter. The most striking variation in these soils is in the character of the subsoil or illuviated horizon. This layer in different stages of development varies greatly in density and compaction, depending on the quantity of clay that has accumulated.

The soils of the Holdrege series, by reason of climate or surface characteristics, have not had sufficient moisture to form the claypan so common in the more nearly level upland soils of the county which developed under the influence of a more humid soil climate. The Hastings soils have made noticeable progress toward the development of a claypan but still remain rather friable throughout. In the Crete soils, the claypan is very well developed and in the Fillmore it attains its maximum compaction. The Scott soils, which have been subjected to water in larger quantities and for longer periods of time than any soil previously mentioned, have claypans which are only slightly less compact than those in the Fillmore soils but which are lighter and more mottled in color.

In addition to differences in the claypan layer, the subsoils of the more nearly level upland soils differ in several other features, due to variations in the moisture conditions under which they have developed. These features were mentioned in the more detailed descriptions of the soils.

The dark-colored upper horizon of the Holdrege soils has a total thickness of about 20 inches and consists of three persistent layers. The upper, ranging in thickness from one-fourth inch to 3 inches, is a loose mulch, dustlike when dry. It is commonly matted with grass roots and contains sufficient organic matter to give it a dark grayish-brown color. The second layer, ranging in thickness from 2 to 6 inches, may be called the laminated layer. When closely examined, the material is seen to be arranged in thin, fragile, platelike forms which overlie one another, producing a laminated or platy structure. When disturbed, the laminated material falls apart into a loose friable mass. The layer is well supplied with organic matter and is very dark grayish brown or almost black. The third layer, which averages about 15 inches in thickness, is either faintly granular or structureless. Most of the soil material is arranged in small more or less rounded particles. These particles are soft and vague in outline, and with the usual amount of loose material the layer appears almost structureless. A broken surface is as dark as the layer above, but if the material is sliced or powdered the browner color produced shows that the organic matter which colors the material is a film or coating on the surface of the structure particles.

The subsoils of the Holdrege soils also have three layers. The upper layer, immediately below the dark surface soil, reaches an average depth of about 30 inches. It consists of grayish-brown, fine-textured material which breaks into more or less cubical clods from one-half inch to 2 inches in diameter. The material has no well-defined structure but is slightly more coherent than the material above and below. It is, however, friable throughout. The second subsoil layer is light grayish-brown, loose, fine-textured material which reaches a depth of about 4 feet below the surface. The next lower layer is similar in structure to the one above but is light grayish brown or almost white in color. This material contains an abundance of lime, both in a finely divided form and as concretions. The zone of maximum lime accumulation in the upper part of this layer seldom exceeds 2 feet in thickness. Below a depth of 6 feet the lime content gradually decreases.

Beneath the layer of lime accumulation is the parent loess, a loose, floury, almost white silt which remains uniform to a depth of many

feet. It contains less lime than the layer above, and most of the lime is finely divided and disseminated throughout the soil material of the layer.

The soils of the Hastings, Crete, and Fillmore series may be taken as representative of soils developed under conditions of more abundant moisture than the Holdrege soils but not subjected, during development, to long-continued saturation, as were the soils of the Scott series.

The Hastings, Crete, and Fillmore soils, in the virgin state, have five horizons or layers. The first, or surface layer, consists of a structureless mulch, dustlike when dry and ranging in thickness from a mere film to 2 inches. The color varies from grayish brown to dark grayish brown. The second layer is the laminated or platy layer. These two layers are similar, in essential characteristics, to the corresponding layers of the Holdrege soils. The third persistent layer, which is from 10 to 24 inches thick, has a distinctly granular structure. The soil material is arranged in small aggregates or structure particles, from one-eighth to one-fourth inch in diameter with well-rounded edges and corners. These granules fall apart readily into a loose friable mass. The granular structure in this layer is best developed in the Crete soils but is also very pronounced in the Hastings soils. It is poorly developed in the soils of the Fillmore series. When pulverized or sliced, the granular material has a lighter color than the broken face, indicating that the organic matter occurs as a film or coating over the granules. The decidedly granular structure of this third layer of the Hastings and Crete soils is one of the features which distinguishes these soils from those of the Holdrege and Fillmore series.

The three dark-colored friable layers described make up what is usually designated as the A horizon. The two layers immediately below these make up the subsoil or B horizon. The upper subsoil layer, or the fourth from the surface, is the zone of maximum compaction. This heavy layer persists in the Hastings, Crete, and Fillmore soils which, in the order named, have increasingly denser upper subsoil layers and are differentiated on the comparative density of this horizon. The color of the zone of maximum compaction ranges from grayish brown or dark grayish brown in the Hastings soils to very dark brown or black in the Fillmore. In the grayish-brown layers, the color is not uniform but is a mixture of grayish brown and very dark grayish brown. Intrusions of the darker color are more numerous in the upper part of the layer where they follow seams and cracks, worm and insect burrows, and root holes. In the subsoil of the Fillmore soils, the black color is rather solid in the upper part and changes downward to dark grayish brown. The fifth layer in the Crete and Fillmore soils is a sharply defined zone of lime accumulation. It begins, in most places, at a depth ranging from 36 to 48 inches and is from 10 to 18 inches thick. Lime is abundant, occurring chiefly as small, hard and soft concretions and as fillings or coatings in seams and root, insect, or worm holes. In the Hastings soils the lime zone is usually deeper than in the Crete and Fillmore soils and is separated from the zone of maximum compaction by a 10-inch to 20-inch transitional layer of gray silt. Moreover, the lime zone in the Hastings soils contains greater quantities of finely divided lime than occur in the corresponding layers of the Crete and Fillmore soils and is seldom so

sharply defined, especially near its base. Loess, the geologic formation from which the Hastings, Crete, and Fillmore soils developed, is beneath the lime zone.

The soils of the Scott series occur in depressed areas throughout the flat upland. They have no natural drainage, and water stands over the surface for a large part of the year. The surface soils of the members of this series range in thickness from 2 to more than 12 inches. The structure is variable, but in most places it is more or less laminated and is rarely granular. The color of the upper part of this layer is nearly black. The lower part may or may not be dark colored. In many places it is light colored and may be of any shade of gray or almost white. The subsoil is heavy, olive-drab or bluish, structureless, impervious clay. Below an average depth of 6 feet, this material grades abruptly to the loose grayish-yellow loess from which the soil has weathered.

The soils classed with the Colby and Nuckolls series may be considered as immature, as their characteristics are due to more or less constant erosion which has prevented the accumulation of organic matter in the surface soil and the development of definite layers in the subsoil.

In the Colby soils the rapid removal of the surplus water from the steeper slopes in the southwestern part of the county has not allowed the leaching of carbonates as fast as new material has been exposed at the surface. Therefore, lime is abundant from the surface downward. In the western and northwestern parts of the county, the Colby soils occur on comparatively flat areas. This unusual development of light-colored soils in this region is thought to result from the newness of the parent materials and perhaps also in part from the composition of the raw material which has been slow in accumulating organic matter. The soils of the Colby series are grayish brown and are very shallow. They are underlain by grayish-yellow floury silt similar to that beneath all the loessial soils of the county.

In the Nuckolls soils conditions have been very similar to those prevailing in the more eroded parts of the Colby, but the Nuckolls soils have weathered from parent material known in the Nebraska surveys as the Loveland phase of the loess. This material is pale-red friable silt containing some sand, chiefly of the finer grades. It underlies the gray, practically sand-free loess of the uplands and is exposed only in the deeper valleys or more severely eroded parts of the county. Most of the exposures are on steep valley slopes, hill shoulders, and narrow crestlike divides. The Loveland material is thought to be an older and more oxidized loess than the overlying one. The rapid surface run-off in most places has prevented the accumulation of much organic matter, and the surface soils of the Nuckolls soils seldom exceed 4 or 5 inches in thickness. They are composed largely of friable, grayish-brown or dark grayish-brown granular material. This is underlain, to a depth of about 15 inches, by pale reddish-brown, slightly more compact but still granular silt or very fine sandy loam which rests on the unweathered parent formation. On the steeper slopes, erosion has removed the entire surface soil, exposing the reddish-colored underlying material. The soils have not developed definite zones or layers except in the more protected or nearly level situations. In such localities they resemble the soils of the Hastings series, except for the reddish color in their subsoils.

Dune sand and the soils of the Valentine series are also immature. They are composed largely of wind-worked sands which are thoroughly leached of lime. They have not weathered sufficiently to have developed zones or layers in their profiles and their surface soils are prevailingly light in color owing to very slight accumulations of organic matter. Dune sand is not a soil. It is simply a geologic formation consisting of incoherent, more or less shifting sand which has been piled into dunes, from 20 to 50 feet high, by wind action. The surface soil of dune sand is only a trifle darker than the lower layers.

The Valentine soils are a little more stable than dune sand. They occupy nearly level or hummocky surfaces in the lower-lying areas. Sufficient organic matter has accumulated to noticeably darken their surface soils to a depth varying from 4 to 6 inches. The organic-matter content, however, is never sufficient to prevent soil drifting when the native sod is destroyed. The soils are composed chiefly of fine or medium sands and contain no gravel of any grade.

A group of soils with profiles somewhat different from any previously described occur on well-drained terraces in Adams County and include the Hall, Waukesha, and Sparta soils. They have weathered from alluvial sediments deposited by the streams when they flowed at higher levels.

The surface soils of the Hall and Waukesha soils are similar to those of the upland soils which developed under a moderate moisture supply. They especially resemble the surface soils of the Crete and Hastings soils. The subsoils are lighter in color than the surface soils and are fine textured, being composed largely of silt. In the Hall soils the subsoils have not been leached of their carbonates, and lime is abundant in the lower part. The subsoils of the Waukesha soils, however, contain no lime accumulations. The low lime content is probably due partly to a deficiency of lime in the parent materials and partly to thorough underdrainage, which has removed the carbonates.

The Sparta soils are composed largely of sand and gravel which has greatly resisted soil development. The surface soils are light in color, due to a low organic-matter content, and the coarse-textured subsoils are leached of their carbonates.

The soils on the first bottoms or flood plains in Adams County have been classed in the Cass and Sarpy series. The materials from which these soils have developed are composed largely of sandy sediments washed in from the adjoining uplands or regions to the west and deposited on the flood plains of the streams during periods of high water. The coarse-textured sediments are of comparatively recent origin and have not weathered sufficiently to have developed soils with definite zones or layers such as occur on the loessial uplands and finer-textured terrace deposits. The subsoils of both the Cass and Sarpy soils consist of fine or medium gray sands in the upper part. The material in most places becomes coarser with depth and is a loose, heterogeneous mixture of sand and gravel below a depth of 3 or 4 feet. Considerable organic matter has accumulated in the surface soils of the Cass soils, which are very dark grayish brown or almost black to a depth varying from 4 to 6 inches. The surface soils of the Sarpy series are very low in humus, are grayish brown or gray in color, and are comparatively thin.

## SUMMARY

Adams County is in south-central Nebraska. It contains 565 square miles or 361,600 acres. The physiography of the county is that of a broad, southeastward-sloping plain, the surface of which has been slightly modified by stream erosion and wind action. The relief ranges from almost flat to steeply sloping and in places is choppy or hummocky. The greater part of the county is flat or gently undulating.

The county has an average elevation of about 1,950 feet above sea level. The drainage is effected through Little Blue River and its tributaries and through tributaries of Big Blue and Platte Rivers. As a whole, the county is well drained.

Adams County was established in 1867. The early settlers came chiefly from the Central States. According to the 1920 census, the population was 22,621, of which 51.5 per cent is classed as urban. Hastings, the county seat and only city, has a population of 11,647.

The transportation facilities of the county are good, no point being more than 9 miles from a railroad station. There is an excellent public-road system. Omaha is the chief market for grain and livestock, and most of the dairy and poultry products are shipped to Lincoln.

The climate of the county is well suited to grain growing and stock raising.

Crete silt loam is the most extensive soil in Adams County. It is adapted to all crops common to the region.

Holdrege silt loam ranks second in acreage and is one of the strongest corn soils of the uplands. The surface relief is typically slightly more uneven than that of Crete silt loam.—Holdrege very fine sandy loam is less important than Holdrege silt loam.

Hastings silt loam, like the Crete and Holdrege soils, occurs on the smooth uplands and has an agricultural value intermediate between that of the first two soils mentioned.

Colby silt loam is not well supplied with organic matter but has a high lime content. It is especially well adapted to alfalfa and produces fair yields of all crops common to the region. The very fine sandy loam, fine sandy loam, and loamy sand members of this series are also mapped.

The Fillmore soils occur in depressions and vary in agricultural value according to drainage conditions.

Hall silt loam occurs chiefly in the eastern part of the county in narrow strips along intermittent drainage ways leading into Little Blue River. It has weathered from alluvial and colluvial silts recently washed down from the adjoining uplands and deposited along narrow stream valleys.

Valentine sand is not well adapted to general farming on account of its looseness and sandiness and the danger of soil drifting when the protective vegetation is destroyed. Most of this soil is used for pasture and hay land.

Waukesha silt loam occurs in a few narrow, elongated strips and medium-sized areas on the terraces of the larger streams. It is well drained, very productive, withstands drought well, and is adapted to all crops common to the region.

The Cass soils occur in bottom-land positions along Little Blue River in the southern part of the county and along South Channel Platte River in the northwestern part. Drainage is variable. The soils are used for general farming, hay production, and pasture.

Sparta sand and Sparta gravelly sandy loam occupy terrace positions in the Platte River Valley in the northwestern part of the county. They are lacking in organic matter and are used chiefly for grazing purposes.

Sarpy sand occurs chiefly in narrow strips bordering the channels of Little Blue and Platte Rivers. It differs from the Cass soils in the lighter color and lower organic-matter content of its surface layer. Most of it is used for pasture land.

Nuckolls loam covers a very small total area in Adams County. It occupies valley slopes, and many areas are topographically unsuited to farming.

Dune sand is mapped locally in the northwestern and southwestern parts of the county. It is composed of wind-blown materials derived either from loessial or stream-transported sand and is valuable only for grazing.

Scott silt loam is of small extent and occurs in numerous depressions known as "buffalo wallows" scattered throughout the more level parts of the uplands. It is poorly drained and unsuited to crop production.

The type of agriculture generally practiced consists of diversified farming, which includes the production of grain and hay and the raising of livestock. The chief crops are corn, wheat, oats, rye, barley, alfalfa, and wild hay. Cattle and hogs are raised on most farms and constitute an important source of farm income.

The soils of Adams County have been developed under prairie conditions. With the exception of the more recent sands, they all show the influence of grass vegetation and of weathering under the prevailing climatic conditions. Most of the soils have dark-colored surface layers, this color being imparted by finely divided carbonaceous material derived from the decay of grass roots. Variations in the degree and manner of weathering, which in this county is governed largely by relief and drainage conditions, have produced differences in the resultant soils. Those soils which have lain in their present positions undisturbed by erosion for a considerable time have accumulated large quantities of organic matter in their surface layers and clay in their subsoils. They have lost most of their carbonates through leaching and, in general, represent an advanced stage of soil development. The remaining soils of the county have reached various stages of maturity depending on the relative amount of weathering to which they have been subjected.



[PUBLIC RESOLUTION NO. 9.]

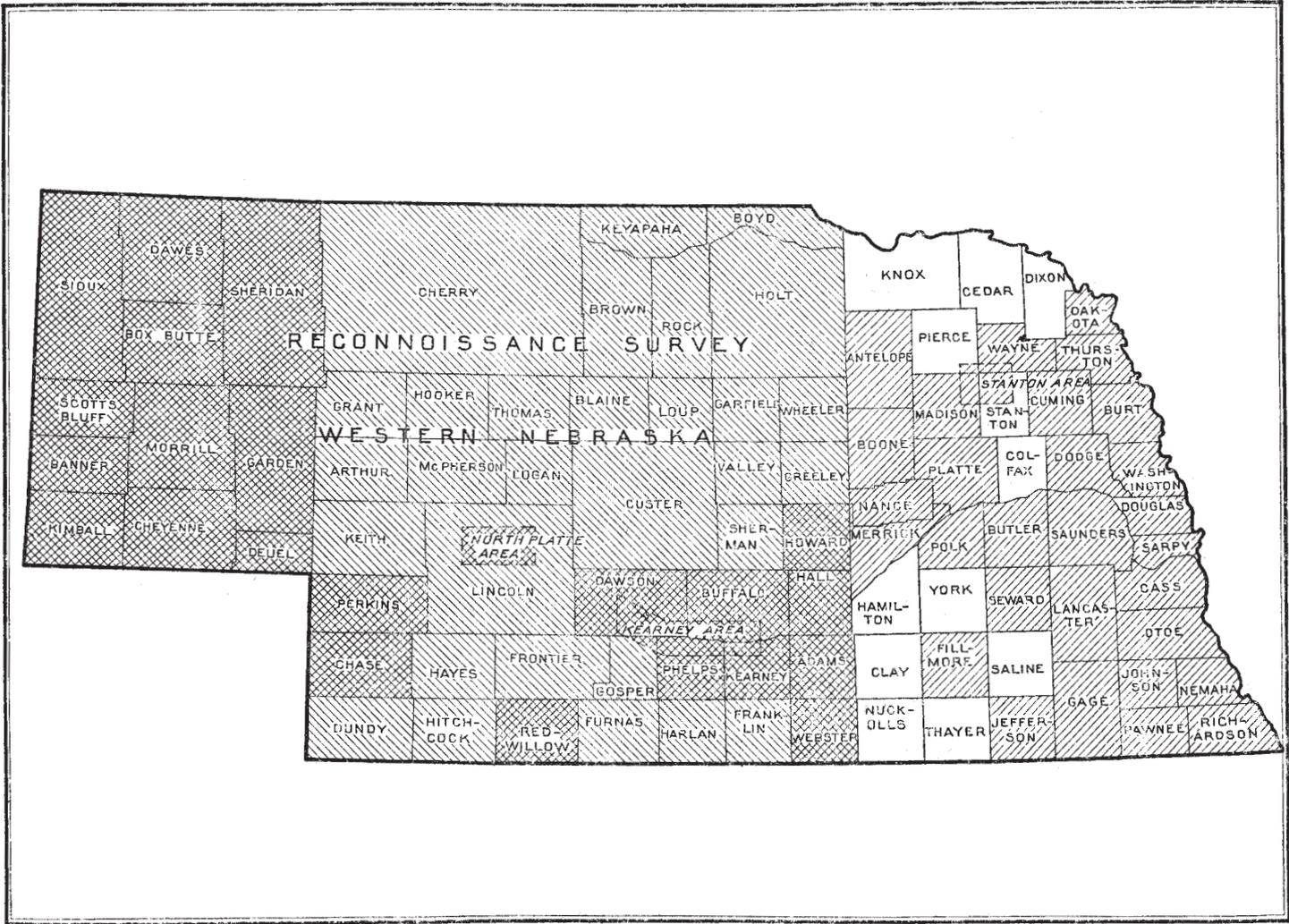
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

*Resolved by the Senate and House of Representatives of the United States of America in Congress assembled,* That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided,* That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils, and on July 1, 1927, the Bureau of Soils became a unit of the Bureau of Chemistry and Soils.]



SIDUX    DAWES    SHERIDAN    CHERRY    KEYAPAHA    BOYD    KNOX    CEDAR    DIXON  
 BOX BUTTE    BROWN    ROCK    HOLT    ANTELOPE    PIERCE    WAYNE    THURSTON    OAK    OTA  
 SCOTTS BLUFF    GRANT    HOOKER    THOMAS    BLAINE    LOUP    GARFIELD    WHEELER    MADISON    STANTON AREA    STANTON    CUMING    BURT  
 BANNER    MORRILL    GARDEN    ARTHUR    MCPHERSON    LOGAN    CUSTER    VALLEY    GREELEY    BOONE    PLATTE    COLFAX    DODGE    WASH-  
 RIMBALL    CHEYENNE    DEUEL    KEITH    LINCOLN    DAWSON    SHERMAN    HOWARD    MERRICK    POLK    BUTLER    SAUNDERS    DOUGLAS    SARPY  
 PERKINS    LINCOLN    DAWSON    BUFFALO    HALL    HAMILTON    YORK    SEWARD    LANCASTER    CASS  
 CHASE    HAYES    FRONTIER    GOSPER    PHELPS    KEARNEY    ADAMS    CLAY    FILLMORE    SALINE    JOHN-  
 DUNDY    HITCHCOCK    RED WILLOW    FURNAS    HARLAN    FRANKLIN    WEBSTER    HUCKLELLS    THAYER    JEFFERSON    GAGE    PANNEE    NEMAH  
 RICHARDSON

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