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

SOIL SURVEY
OF
KEITH COUNTY, NEBRASKA

BY

M. H. LAYTON, U. S. Department of Agriculture, in Charge
and W. H. BUCKHANNAN, Nebraska Soil Survey

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SOIL SURVEY OF KEITH COUNTY, NEBRASKA

By M. H. LAYTON, United States Department of Agriculture, in Charge, and W. H. BUCKHANNAN, Nebraska Soil Survey[1]

COUNTY SURVEYED

Keith County is in the southwest part of Nebraska, the southwest corner of the county adjoining the northeast corner of Colorado. Ogallala, the county seat, is 332 miles by rail west of Omaha and 228 miles northeast of Denver. The county is rectangular, being 42 miles long from east to west and 27 miles wide from north to south. Its area is 1,085 square miles, or 694,400 acres.

Keith County is in the western part of the Great Plains province and includes about equal parts of the high plains and sand-hill divisions which comprise the uplands and include about 85 per cent of the land in the county. The high plains division occupies the southern part of the county and the sand-hill division the northern part. The broad valley of North Platte River, which extends in a northwest-southeast direction across the county, separates the two divisions. Strips of flood plain and terrace follow North Platte and South Platte Rivers across the county.

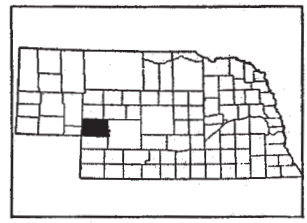

FIGURE 1.—Sketch map showing location of Keith County, Nebraska

The surface features of the high plains division are those of a gently eastward-sloping constructional plain modified in places by shallow stream channels. The southern part is crossed by the broad valley of South Platte River, which separates that part of the high plains division within Keith County into two triangular-shaped table-land areas, of which the northern is slightly larger than the southern.

The table-lands, which are remnants of the original high plains which have escaped extensive erosion, range from almost level to undulating. In places the slope is so slight that were it not for the porosity of the underlying rocks and the low regional rainfall drainage would be deficient. In places shallow basinlike depressions and gravelly and sandy knolls occur on the southern table-land, and low more or less eroded hills are on the eastern end of the northern table-land where outliers of loess have been deposited over the surface. The slopes from the margin of the southern table-land toward the terraces of South Platte River are long and gradual. An exceptionally rough area, where the tributary streams have carved the edge of the table-land and produced narrow strips of extremely dissected land, marks the bluffs of South Platte River.

[1] Report written by F. A. Hayes from field notes of M. H. Layton.

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In the western part of the northern table-land extremely rough land occurs chiefly on escarpments where headward erosion of tributary drainage ways has exposed the bedrock. This rough land averages less than 3 miles in width. In the eastern part of the county, where the rivers are converging, the tributary drainage ways have carved the intervening uplands into an intricate system of deep steep-sided ravines separated by narrow crestlike divides. The numerous exposures of bedrock form rock cliffs and precipitous valley slopes. Toward the western end of the table-land, which is loess covered, the relief is hilly. The surface is broken by shallow, steep-sided drainage ways which in their lower courses tend to break into gullied ravines. Miniature landslides are also prominent features, and in places the slopes present a succession of projections, known as catsteps, which are caused by sliding action.

The second upland division occupies that part of the county north of the North Platte Valley and is a part of the sand-hill region of western Nebraska. Throughout this division wind has been the controlling factor influencing the surface relief, which ranges from flat to hilly. The land is a succession of sandy hills and ridges alternating with narrow valleys and depressions in some of which marshes occur. Throughout most of this division the wind has heaped the loose incoherent sand into a monotonous succession of rounded dunes and ridges ranging in height from 20 to 60 feet. The land lying between the sand hills and the alluvial lands along North Platte River is marked by moderately steep though smooth slopes.

The alluvial lands of Keith County include the terraces and flood plains and occur mainly in broad continuous belts, from 1 to 4½ miles wide, along North Platte and South Platte Rivers. Narrow strips also occur along many of the short tributary branches to these streams.

The terraces or second bottoms are flat or gently undulating except in the more sandy areas where the wind has produced a slightly hummocky relief. They lie from 5 to 30 feet above the normal flow of the streams and about 200 feet below the general level of the uplands. They are well drained. The largest developments of terrace lands are along South Platte River.

The bottom lands or flood plains occupy the lowest positions in the county. They are most fully developed along North Platte River. The surface is prevailingly flat, although it is modified by numerous minor depressions, cut-offs, overflow channels, and slight elevations. The land lies only a few feet above normal stream flow and in places is subject to inundation during periods of high water. Most of the slopes to the higher-lying terrace lands are gradual, although in a few places they are short and steep.

The average altitude of Keith County is about 3,400 feet above sea level. It ranges from approximately 2,980 feet where North Platte River crosses the eastern boundary to about 3,800 feet along the western border of the county, a few miles south of the same stream. The average elevation of the sand hills is about 3,450 feet, of the high plains 3,400 feet, and of the alluvial lands 3,150 feet above sea level. The elevation [2] of Paxton is 3,054 feet, of Roscoe 3,140 feet,

[2] GANNETT, H. A DICTIONARY OF ALTITUDES IN THE UNITED STATES. (Fourth edition.) U. S. Geol. Survey Bul. 274, 1,072 p. 1906.

of Ogallala 3,211 feet, of Brule 3,287 feet, and of Korty 3,105 feet above sea level. The general slope of the county is toward the east.

Drainage is effected through North Platte and South Platte Rivers and their tributaries. The North Platte River bed ranges in width from about 125 to 220 rods and is characterized by broad and gradual meanders, although the general course of the stream is straight.

The South Platte River bed is somewhat narrower than that of North Platte River, and during most of the year water flows in a network of shallow meandering channels. During the dry weather of midsummer the river often becomes dry except for scattered water holes.

Excellent well water is readily obtained in all parts of the county. The upland wells on the south table-land range from 100 to 175 feet in depth and those on the north table-land from 150 to 300 or more feet. In the sand hills the wells are much shallower and an adequate water supply is usually obtained within 80 or 90 feet of the surface. The wells throughout the alluvial lands range in depth from 20 to 100 feet.

Native deciduous trees, consisting chiefly of willow, boxelder, elm, hackberry, ash, and cottonwood, grow in narrow belts along most of the larger drainage ways throughout the county. Sparse growths of scrub cedar occur locally throughout the rougher parts of the escarpment which borders the south side of the North Platte Valley, as along the bluffs at Cedar Point, a few miles west of Keystone. None of the timber is of merchantable size, but it is of value for firewood and fence posts.

Keith County was organized from a part of Lincoln County in 1873. Its present boundaries were established in 1887, when a part of it was taken to form Perkins County. The early settlement was associated with that of the neighboring counties, the greater part of the population coming from Illinois, Iowa, and eastern Nebraska. Most of the inhabitants are native-born Americans. According to the census reports, the population of the county was 194 in 1880, 2,556 in 1890, 1,951 in 1900, and 3,692 in 1910. In 1920 it had increased to 5,294 and is probably somewhat larger at the present time. The 1920 census gives the density of population, all of which is classed as rural, as 5 persons to the square mile. The population is densest throughout the river valleys and table-lands. The sand-hill region is sparsely settled.

Ogallala and Paxton are the only incorporated towns in the county. Ogallala, located in the south-central part, is the county seat and largest town. In 1920 it had 1,062 inhabitants, and Paxton had 430. These places are important distributing centers and afford good markets for the surplus farm products. Small hamlets or sidings along the railroad afford shipping facilities for local communities.

Keith County has good transportation facilities. The main line of the Union Pacific Railroad extends along the north side of South Platte River and a branch of the same system follows the North Platte Valley across the county. These roads make good connections with outside points. In Keith County, however, many farms lie at considerable distances from railroads, so that many farmers are forced to haul their produce from 12 to 17 miles to shipping points.

The public-road system of the county is well developed except in the rougher and more sandy parts where construction and maintenance expenses are excessive. United States Highway No. 30 follows South Platte River across the county. It is gravel surfaced where necessary and is kept well graded. The county roads throughout the more level areas follow section lines. In the severely eroded parts of the high plains and throughout the sand hills, however, the roads are laid out according to the surface relief, winding through the lower-lying areas. Cement or steel bridges and culverts are common on the main roads. Telephone service and rural delivery of mail reach all sections of the county.

Most of the surplus farm products, including grain, hay, cattle, and hogs, are marketed outside the county. Most of the wheat, hay, dairy products, and livestock are shipped to Omaha. The greater part of the grain is handled in elevators where it may be sold at once or stored until prices are satisfactory.

CLIMATE

The climate of Keith County, which is typical of the high plains region, is characterized by rather wide seasonal variations. The winters are somewhat long and cold and the summers are short and warm. The rainfall is moderate, the humidity relatively low, and the rate of evaporation high. The spring is usually cool, with considerable precipitation. The fall is long, with moderate temperature and occasional periods of rainy weather. There is not sufficient variation in surface characteristics to cause any pronounced difference in climatic conditions within the county.

The heaviest rainfall occurs during the growing season, from May to August, inclusive. The greater part of the summer rainfall comes as local thundershowers. In general, however, the rainfall is fairly well distributed in May and June, in July the distribution is less favorable, and during August and September long periods of drought sometimes cause a decided reduction in grain and hay yields. Total crop failures, however, are rare, except in the more sandy sections of the county, as all the hard-land soils are retentive of moisture if properly managed, and small-grain crops are usually harvested before dry weather begins. The average annual snowfall of 40.9 inches occurs mainly during December, January, February, and March.

The average date of the last killing frost at Hillside, Arthur County, is May 18 and that of the first is September 25. This gives an average frost-free season of 130 days, which is barely sufficient for the maturing of corn but is ample for maturing all small-grain crops commonly grown. Killing frosts have been recorded at the Hillside station as late as May 25 and as early as August 26.

During most of the year the prevailing winds are from the northwest, but in May, June, July, and August they are mainly from the southeast. The proportion of clear, sunshiny days is comparatively high.

Tables 1 and 2 are compiled from the records of the Weather Bureau stations at Hillside and Paxton in Arthur and Keith Counties, respectively. The data from Hillside give the normal monthly, seasonal, and annual temperature and precipitation at that place and

may be taken as fairly representative of climatic conditions through Keith County. The records of the Paxton station include only precipitation data.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Hillside, Arthur County*

[Elevation, 3,484 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1916)	Total amount for the wettest year (1915)	Snow, average depth
	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*	*Inches*
December	23.7	65	−24	1.23	0.30	0.38	7.2
January	21.9	66	−35	.35	.12	.29	5.8
February	26.6	78	−28	.39	.26	.77	6.4
Winter	24.1	78	−35	1.97	.68	1.44	19.4
March	36.1	86	−18	.93	.15	1.92	8.9
April	46.7	95	1	2.19	.77	6.31	6.8
May	55.7	96	15	3.24	1.75	4.62	1.4
Spring	46.2	96	−18	6.36	2.67	12.85	17.1
June	67.2	104	29	2.65	2.55	6.81	.0
July	72.3	104	36	3.46	2.51	4.27	.0
August	69.4	104	30	2.76	3.36	5.65	.0
Summer	69.6	104	29	8.87	8.42	16.73	.0
September	61.3	99	17	1.65	1.19	2.34	Trace.
October	48.7	93	0	1.09	.61	1.55	1.6
November	38.6	81	−6	.60	.83	.06	5.8
Fall	49.5	99	−6	3.34	2.63	3.95	7.4
Year	47.4	104	−35	20.54	14.40	34.97	43.9

TABLE 2.—*Normal monthly, seasonal, and annual precipitation at Paxton*

[Elevation, 3,060 feet]

Month	Precipitation				Month	Precipitation			
	Mean	Total amount for the driest year (1924)	Total amount for the wettest year (1915)	Snow, average depth		Mean	Total amount for the driest year (1924)	Total amount for the wettest year (1915)	Snow, average depth
	Inches	*Inches*	*Inches*	*Inches*		*Inches*	*Inches*	*Inches*	*Inches*
December	0.84	2.08	0.59	8.0	June	2.99	1.66	4.01	0.0
January	.49	.02	.48	4.4	July	2.75	1.62	2.52	.0
February	.77	.13	.59	8.1	August	2.98	.54	6.87	.0
Winter	2.10	2.23	1.66	20.5	Summer	8.72	3.82	13.40	.0
March	1.03	.97	1.98	6.6	September	1.24	2.37	1.38	Trace.
April	2.80	.19	9.06	5.3	October	1.09	1.10	1.20	2.3
May	2.69	2.29	9.13	1.9	November	.51	.06	.01	4.3
Spring	6.52	3.45	20.17	13.8	Fall	2.84	3.53	2.59	6.6
					Year	20.18	13.03	37.82	40.9

AGRICULTURE

The early agriculture of Keith County consisted largely of the grazing of cattle on the free open range where a great variety of nutritious grasses afforded good summer and fair winter grazing. Winter losses were heavy at times, but usually the profits on the surviving animals were large. The Union Pacific Railroad was built across the county in 1867 and Ogallala, the county seat, became known as the "End of the Texas Trail" owing to its importance as a shipping point for western and southwestern cattlemen. With the coming of the railroad settlement became more rapid and the cattle industry, although still important, was gradually supplemented by the production of grain crops.

The first farmers located in North Platte and South Platte Valleys, where fuel and water were abundant. By 1880 settlement had spread throughout the uplands, and most of the county was included in homesteads. A large percentage of the tillable land was brought under cultivation, and it is probable that by 1890 the acreage of broken land was as great as it is at the present time. Corn, oats, and potatoes were grown for home use, and wheat soon became the cash crop.

The early settlers experienced hardships, and the agricultural development of the county was slow. A series of droughts, culminating in the extremely dry years of 1893 and 1894, checked agricultural development seriously. The farmers were not familiar with methods of conserving soil moisture, most of the seed used was unsuited to the region, and a system of livestock raising in connection with grain farming was not practiced. In addition to these difficulties, the general financial depression then prevailing over the entire country caused prices of all agricultural products to be low. Many of the farmers became so impoverished that they were forced to leave the county and much of the land fell into the hands of a few men whose holdings were used for grazing under a combined system of stock ranching and grain farming. With the resettlement of the county the large tracts were gradually broken up, but much of the land, including the more sandy and rougher parts, is still used almost exclusively for livestock raising. The resettlement was hastened by the passage of the Kincaid Act in 1905, increasing the size of homesteads available under the public land laws to 640 acres and thus making it profitable to take up land valuable chiefly for pasture.

Table 3, compiled from Federal census data, gives the acreage and production of the principal crops in Keith County and shows the general trend of agriculture during the last 35 years.

TABLE 3.—*Acreage and production of principal crops in Keith County, Nebr., in stated years*

Crop	1889		1899		1909		1919		1924	
	Acres	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*
Corn	14,221	183,242	8,565	127,600	21,679	392,928	38,632	753,311	72,031	834,411
Oats	3,128	43,735	76	1,630	4,188	119,479	3,736	93,671	11,940	295,313
Wheat	5,845	55,810	1,477	8,120	8,320	146,145	37,785	671,513	28,876	475,505
Rye	753	5,006	70	360	388	5,015	3,894	39,897	2,056	19,919
Barley	444	3,664	51	700	286	7,145	1,833	40,888	3,050	64,066
Buckwheat	9	42								
Flaxseed	28	131			77	240				
Potatoes	520	27,705	168	7,028	535	27,750	183	7,272	308	22,215
Other vegetables					231		16		20	
		Tons		*Tons*		*Tons*		*Tons*		*Tons*
Hay, all kinds	13,174	14,164							56,378	45,810
Tame hay			3,159	6,166	6,291	13,532	11,067	18,994	13,333	
Wild hay			27,118	27,664	42,441	37,463	48,420	34,174	43,045	
Coarse forage			267	826	532	1,250	5,813	11,051		
Sugar beets					7	100	764	4,126	549	5,011

According to the Federal census report, the value of all cereals produced in Keith County in 1919 was $2,633,363; of hay and forage crops was $923,673; of dairy products, excluding those used at home, was $108,077; and of poultry and eggs was $123,872. The value of all domestic animals on farms was given as $2,706,583.

At the present time much of the land on the north and south tablelands and throughout North Platte and South Platte Valleys is held in comparatively small farms and is used for the production of grain and livestock. The sand hills are included in large stock ranches, on which sufficient hay is cut for feeding purposes.

According to Nebraska agricultural statistics, corn is the leading crop in the county. It occupied 65,865 acres in 1925 and gave an average yield of 23 bushels to the acre. On farms operated by owners most of the corn is fed to hogs, beef cattle, and work animals, but on tenant farms more of the crop is sold. On many farms corn from 15 or 20 acres is cut each year for silage. The less progressive farmers grow corn on the same land for several consecutive years, but better yields are obtained when it is grown in rotation with small grains and alfalfa. Seed selection is not generally practiced, though recently considerable attention has been given to it. The dent varieties are grown chiefly, but some flint corn is grown. Only the earliest-maturing varieties are planted. Corn is raised on all the soils of the county, except on the poorly drained flood plains, on dune sand areas, and on the sandier soils of the Valentine series. The heavier-textured terraces and uplands give higher yields.

Wheat ranks second among the grain crops. Winter wheat is grown practically to the exclusion of spring wheat, as the yield fluctuates less and there is less loss from drought and rust. The Nebraska agricultural census reports 28,548 acres in winter wheat, with an average yield of 15 bushels to the acre, and 4,476 acres in spring wheat, yielding an average of 11 bushels to the acre, in 1925. Turkey and Kanred are the leading varieties of winter wheat. Most of the wheat is planted on the heavier well-drained soils. The crop is usually harvested with a combine.

In 1925, according to State reports, 8,528 acres were in oats, yielding an average of 28 bushels to the acre. Kherson is the leading variety. Oats are often grown as an intermediate crop between corn and wheat. They are used largely for feed for horses and other livestock. Barley was grown on 2,950 acres in 1925 and produced an average of 25 bushels to the acre. This crop is grown locally on the terraces and flood plains for feed and does exceptionally well on the moist but not wet bottom-land soils.

According to the Nebraska agricultural statistics, rye ranked next to barley in acreage in 1925, when 2,600 acres, with an average yield of 12 bushels to the acre, were grown. The crop is grown chiefly on the lighter and sandier soils, principally for the grain but to some extent for hay and pasture. Rye is more drought resistant than wheat and flourishes on more impoverished soils. Many farmers plant a small patch of rye for pasture early in the fall.

Sugar beets are grown by a few farmers. In 1925, when 464 acres were devoted to this crop, the total production was 5,568 tons, or an average of 12 tons to the acre. This crop is grown entirely on irrigated land and is shipped to the sugar factories at Scotts Bluff and Gering, in western Nebraska.

Potatoes are grown in a small way throughout the uplands and terraces. Most of the crop is used for home consumption, although a few farmers grow potatoes commercially under irrigation. The finer-textured upland and terrace soils are well suited to the crop, and potatoes give promise of becoming an important source of income, especially where conditions are favorable for irrigation. The Nebraska agricultural statistics report 316 acres in potatoes, yielding an average of 90 bushels to the acre, in 1925.

Of the hay crops wild hay occupies the largest acreage, being cut from 43,045 acres in 1925. The average yield was reported to be 0.8 ton to the acre. The yield varies greatly, depending on soil and moisture conditions. In the sand hills and throughout the table-lands it seldom exceeds one-half ton to the acre, whereas on the moist bottom-land soils of the county a ton or more is commonly obtained. Hay cut from the uplands is finer in texture and has a higher feeding value than that obtained on the bottom lands. The hay is stacked in the field and is either baled for the market or hauled to the feed lots as needed for feeding work animals and cattle.

Alfalfa was grown on 10,864 acres, with an average yield of 2.9 tons to the acre, in 1925. The crop does well on the well-drained calcareous terrace and bottom-land soils as well as in the basinlike depressions of the sand hills of the county. It is grown only locally throughout the uplands, as the natural moisture supply in many places is insufficient for best results. The highest yields are obtained where irrigation is practiced. The crop is usually cut twice on the uplands and three or four times on the bottoms or where irrigated. Alfalfa is an excellent crop for building up depleted soils and is often used in rotations. It is not favored for short rotations, however, as most farmers prefer to keep the stand for several years before changing to other crops.

Among the minor crops sorgo (sweet sorghum), millet, Sudan grass, and sweetclover are the most important. They are grown chiefly for feed.

Although a few cherry, peach, apple, and plum trees have been planted on many farms, the demand for fruit is not supplied locally. Among the wild fruits, sand cherries, chokecherries, plums, grapes, and buffaloberries are abundant during favorable seasons.

As throughout most of western Nebraska, the livestock industry holds an important place in the agriculture of Keith County. The raising of cattle is the most important branch of this industry. According to the Federal census, there were 33,180 cattle in the county in 1920, of which 28,443 were beef cattle. In 1925, according to the Nebraska agricultural statistics, the total number had increased to 35,768, of which 3,426 were milk cows. The total value of all cattle in the county was $1,870,660 in 1920 and $1,044,106 in 1925. Most of the herds are of grade stock headed by a purebred bull. The principal breeds of beef cattle are Hereford and Shorthorn, and the quality in general is good. A few dairy cattle, chiefly of the Holstein breed, are kept, but the dairy industry consists largely of the milking of beef cows and the sale of the surplus cream and butter on the local markets.

The Nebraska agricultural statistics report 512,922 acres, or about 72 per cent of the entire county, in range and pasture in 1926. Some ranchers purchase livestock for summar grazing, but most of the range cattle are raised locally. A few farmers located on the finer-textured table-land and terrace soils fatten cattle on corn and alfalfa, but the cattle-feeding industry is of minor importance. Practically no grain is fed in the sand-hill regions of the county. In these localities the animals, if not shipped in the fall, are run on the range throughout the winter and are fed hay in severe weather.

There were 7,742 horses and 793 mules in Keith County in 1925. Practically all the farmers raise their own work animals, and several ranchers in the sand hills have large herds of horses. The animals are of medium or heavy draft types, ranging in weight from 1,300 to 1,500 pounds. The stallions are purebred, but most of the mares are grades.

Sheep raising receives little attention. The Nebraska agricultural statistics report 928 sheep, valued at $10,115, in the county in 1926. A few farmers import a carload or two in the fall, fatten the animals on corn and alfalfa, and ship them to Omaha when the market is favorable. Some sheep are grazed in the rougher areas which border the river valleys.

Hog raising is a moderately important branch of the livestock industry. It is followed chiefly on the table-lands and terraces where corn and alfalfa can be grown. Very few hogs are raised in the sand hills. The Nebraska agricultural statistics report 23,745 hogs, valued at $408,414, in the county in 1926. Duroc-Jersey, Poland China, and Hampshire are the leading breeds. A few farmers have purebred herds, but most of the animals are grades.

Poultry constitutes an important source of farm income. A small flock of chickens is raised on most farms, and many farmers have flocks of 100 or more. As the local demand for poultry products

is increasing annually, the poultry industry is receiving considerable attention. Leghorn, Barred Plymouth Rock, Rhode Island Red, and Orpington are the principal breeds. Ducks, geese, guinea fowls, and turkeys are raised to a small extent. The Federal census shows 47,493 chickens and 2,214 other poultry in the county in 1920. In 1926, according to the Nebraska agricultural statistics, there were 63,975 poultry of all kinds in the county. Poultry was valued at $49,204 in 1920 and $52,460 in 1926.

The adaptation of certain soils to particular crops is observed to some extent by the farmers. It is recognized that the sandy Valentine soils are not suited to alfalfa on account of their low lime content and lack of stability. Alfalfa thrives, however, throughout the terrace lands, and exceptional yields are obtained where irrigation is practiced. Wheat and oats are known to do best on the finer-textured, well-drained upland and terrace soils. Neither crop is grown on irrigated land, but some cornland in North Platte and South Platte Valleys is irrigated. It is recognized that sugar beets thrive in a more moist and more alkaline soil than corn or small grains. As a rule, the heavier and deeper soils are recognized as better suited than sandy land to the general farm crops. Under average prevailing conditions the hard lands are thought to be better suited to the small-grain and forage crops and the sandy soils to such crops as rye, corn, and potatoes. No farming is done on the eroded canyon slopes and the less stable parts of the sand hills, such areas being suitable only for grazing land. The wet bottom lands are used for pasture and for hay production.

Systematic crop rotation is not practiced, although many farmers follow corn with small grain and small grain with alfalfa. When alfalfa sod is broken the land is generally used for both corn and oats before it is planted to wheat. Wheat is often grown on the same land several consecutive years. In general, crop rotation is governed more by the prevailing market demands than by the requirements of the soil.

Wild hay is cut between August 1 and October 30. It is usually stacked in the open and fed to livestock during the winter. Some hay is shipped out of the county each year.

The machinery and equipment on nearly every farm or ranch is adequate for all needs. Four-horse or six-horse gang plows are common, and tractors are used on a few farms.

No commercial fertilizer is used, and manure is seldom applied to the grain lands except throughout the bottom lands and irrigated areas. There is often insufficient moisture in the upland soils to thoroughly decompose the manure, causing the land to become droughty the following year.

Farm labor is scarce, especially during harvest. Most of the laborers are natives, although a few Mexicans work in the sugar-beet fields.

According to the Federal census, the number of farms in the county was 494 in 1890, 303 in 1900, 583 in 1910, and 673 in 1920. The percentage of the county in farms increased from 17.2 per cent in 1890 to 90 per cent in 1920. The average size of farms in 1920 was 913.6 acres. The proportion of improved land in farms was

54.1 per cent in 1890, in 1910 was 38.3 per cent, and in 1920 was 35.6 per cent. The farms range widely in size, but most of them contain between 260 and 500 acres.

The average value of all farm property to the farm was $2,927 in 1890, $8,649 in 1900, $15,636 in 1910, and $38,935 in 1920.

In the 30-year period between 1890 and 1920 the proportion of farms operated by owners decreased greatly. In 1890, 95.14 per cent of the total number of farms were operated by owners. In 1920 this percentage had decreased to 63.2 per cent. Owners occupied 425 farms and tenants 237 in 1920.

The share rental system predominates in Keith County. In 1925, according to the Nebraska agricultural statistics, 120 farms were rented for cash and 425 for a share of the crops. Under the share system the tenant furnishes all equipment, labor, and seed and receives from two-fifths to one-half the crops. On some farms the renter is allowed the use of the pasture lands without charge. Cash rentals range from $2 to $3 an acre for farm land. Grazing land is usually rented for a lump sum, the amount depending on the percentage of land suitable for hay production.

SOILS

Keith County is in that part of the United States where climatic influences, particularly those relating to moisture, have been the controlling factors in determining the character of the soils. The parent materials on which the soils are developed differ widely in color, texture, and composition, but the soil-forming processes, acting through long periods of time, have produced soils having certain common characteristics, the most obvious of which is the dark color of the surface layers. The available moisture of the region has not been sufficient to support a forest vegetation but is very favorable to the growth of short grasses. These grasses, through decomposition, are the source of the organic matter or humus which imparts the dark color to the surface soils.

The second common characteristic is the accumulation of carbonates, chiefly lime carbonate, in the lower part of the subsoil. Downward-percolating waters have largely removed the readily soluble salts from the surface layers, but the rainfall has not been sufficient to leach these salts from the entire soil except in the more sandy areas. The carbonates, therefore, have accumulated at the lower extremity of moisture-penetrated material, forming a layer of higher lime content than occurs either above or below. This layer is commonly known as the lime horizon.

The most mature soils of the county, or those which have been subjected to undisturbed weathering for the longest time, have developed definite horizontal and parallel layers or horizons. The corresponding layers in different soils occupy the same relative positions. Their characteristics are also similar in a general way but differ considerably in detail.

The surface soil, which extends to an average depth of 12 inches, is composed of three rather well-defined layers. The upper layer consists of light grayish-brown loose structureless material, dustlike when dry, and in few places exceeding one-half inch in thickness. It may range in texture from heavy silt loam to fine sandy loam.

The layer is poorly supplied with well-decomposed organic matter, but it contains an abundance of grass remains in various stages of decay. The second layer is 2 or 3 inches thick and is dark grayish brown or chestnut brown in color. It contains an abundance of well-decomposed organic matter and appears to be the layer of maximum humus content. The texture ranges from silt loam to very fine sandy loam. The soil particles are so grouped as to produce a characteristic platy or laminated structure. The material is friable and crushes into a very finely granular mass in which few of the small aggregates exceed one-eighth inch in diameter. The third layer ranges in thickness from 8 to 12 inches, is friable, and is only slightly lighter in color than the layer above, but is characterized by some form of granular structure in contrast to the platy arrangement of the soil particles in the overlying horizon. The granules are irregular and subangular in shape and vary from one-eighth to almost one-half inch in diameter. In most places the smaller granules dominate in the upper part, although they may occur in all parts of this layer, which is of silt loam or fine sandy loam texture.

The subsoil, which lies between depths of 12 and 60 inches, contains two well-defined layers. The upper one is the layer of maximum compaction. It has greater coherence and density than the other layers, owing to an accumulation of considerable fine material which seems to have been carried down by percolating waters from above. The material is grayish-brown heavy silt loam or silty clay loam from 8 to 24 inches thick. The degree of compaction varies greatly, depending on the amount and character of the translocated materials present. The fifth and last layer of the soil is the lime zone. It lies below an average depth of 30 inches, ranges in thickness from 1 to 3 feet, and consists of light-gray loose structureless silt or silty clay. In this horizon lime carbonate is more abundant than in any layer above or below. It may occur as concretions, splotches, fine winding threads, or in disseminated form thoroughly mixed with the silt. The horizon is underlain by unweathered parent material which may range from a loose floury loesslike deposit to indurated sandstone.

The soil profile described is typical of the well-drained but not severely eroded finer-textured upland and terrace soils of Keith County. It represents maturity of soil development as governed by the climatic and vegetative environments of the region. The different soil layers may differ considerably in thickness, color, and texture; one or more may be poorly developed or entirely lacking and they may be separated by sublayers and transitional layers, but their dominant characteristics remain remarkably constant and their position in the soil profile is nowhere reversed.

The soils which have reached maturity on the uplands are shown on the accompanying soil map as members of the Rosebud, Keith, and Dawes series. Those on the terraces are included with the Tripp series. The translocation of clay from the surface or upper part of the soil to the lower referred to in this description is more characteristic of the soils of the Dawes than of the Rosebud or Keith series. In this climatic and vegetative environment the translocation of material would not be expected in soils developing normally from materials containing no deflocculating salts. Marked translocation

in the Dawes soils and faint translocation in the Rosebud and Keith indicates that the parent soil materials contain a very small proportion of deflocculating salts, presumably carbonate of sodium.

In the severely eroded, sandy, and poorly drained sections of the county weathering has been retarded and the effectiveness of the soil-forming processes has been diminished. The surface horizon may be lighter in color than usual, the lime horizon less pronounced, and either or both may be entirely absent. The soils therefore are immature. They may or may not have made some progress in development, but complete maturity has been prevented by one or another or a combination of the following factors: (1) Severity of erosion, (2) instability and resistance of the parent materials, (3) insufficient time, and (4) poor drainage.

Severity of erosion has been the controlling element in preventing maturity of soil development throughout a considerable part of the high plains in Keith County. Excessive surface wash removes the dark-colored surface soil as fast as it is formed and in many places the unweathered parent materials are exposed. In such localities the soils have been grouped in the Colby series and the eroded phases of the Rosebud series.

In the sand-hill division of the county the parent materials are porous incoherent gray sands composed largely of angular quartz grains. They are extremely resistant to weathering, are shifted about more or less by the wind, and in the less stable areas have made scarcely any progress in soil development. In such places the material is not regarded as a soil but is shown on the soil map as dune sand.

In the more protected positions around the margins and within the valley of the sand-hill region the sandy deposits are more stable than elsewhere and have weathered sufficiently to have made some progress in soil development. The surface layers have accumulated more organic matter and are darker colored than dune sand. The sand grains also are less angular and more rounded than in the dune-sand areas. The resistance of the material to weathering, however, has prevented the development of the layered or zonal profile so characteristic of the mature table-land and terrace soils of the county. Those soils of the sand hills which have made some progress toward maturity are included with the Valentine series.

The gravelly sandy loam member of the Cheyenne series may also be placed in that group of immature soils in which maturity of development has been prevented by the unstableness and resistance of the parent materials. The soil consists of a mixture of coarse sand and waterworn gravel. The surface soil, to a depth of a few inches, has been slightly darkened by organic matter.

The soils of the Bridgeport series belong to that group of immature soils in which insufficient time has been the limiting factor in preventing maturity of development. The parent materials include level or gently sloping and well-drained alluvial and colluvial deposits where conditions are especially favorable for soil development. They are calcareous, and this accounts for the high lime content immediately beneath the surface layers. The lime, however, occurs in finely divided form thoroughly mixed with the mineral constituents and there is no evidence of a concentration or segregation

of the carbonates as in soils of the Keith, Rosebud, Dawes, and Tripp series. The surface layers have accumulated some organic matter and are dark grayish brown or chestnut brown in color, but the deposits are of comparatively recent origin and sufficient time has not elapsed for the development of the layered profile characteristic of mature soils. The material remains uniform in texture, structure, and consistence to a depth below 4 or 5 feet.

Throughout the bottom lands or flood plains along streams and in the scattered shallow flats and basins of the uplands is a group of soils in which maturity of development has been retarded by poor drainage. Moisture conditions have been favorable for the growth and decay of a luxuriant grassy vegetation, and all the soils have chestnut-brown or black surface layers. The more or less waterlogged condition of the land, however, has prevented thorough aeration and oxidation, and the parent materials beneath the surface soil have been little altered by weathering. The soils of the Cass, Laurel, Lamoure, Gannett, and Scott series belong to this group. They are differentiated in soil mapping on the basis of texture, color, and drainage conditions. The Cass, Laurel, and Lamoure soils occupy flood plains along streams. The first two have porous sandy subsoils, and the subsoil of the third is composed largely of silt and clay. The Cass soils differ from those of the Laurel series chiefly in the darker color of their surface layers. The Gannett and Scott soils have developed in poorly drained depressions throughout the uplands and terraces. The Gannett soils are composed largely of loose incoherent sand and the Scott soils of heavy silt and clay. Owing to the abundance of organic matter, both soils have dark-colored surface layers.

The stage of development reached by the soils of the Scott series is commensurate with the drainage. The subsoils have a much denser and more claypanlike zone of compaction than occurs in any other mature soil.

The principal characteristics previously described have been those imparted to the soils by the various weathering processes, including erosion, leaching, oxidation, and the accumulation of organic matter. In the following pages consideration is given to the characteristics which are due to the composition and process of accumulation of the parent materials from which the soils have developed. On this basis the soils of Keith County may be divided into four groups—residual, loessial, alluvial, and aeolian.

The only exposed bedrock in the county is the Ogallala sandstone of the late Tertiary age. In its unweathered condition this material consists of impure calcareous grit or sand cemented with lime. It is not uniform but contains interbedded deposits of clay, sand, gravel, and lime, occurring in no apparent order. In many places at its base there are beds of conglomerate. Throughout its mass are scattered pebbles of crystalline rocks from the Rocky Mountains, streaks of pebbles and sand, and both thin and thick ledges of sandstone. The harder calcareous beds are of light-gray or cream color, and in many places they outcrop in irregular cliffs around the escarpments leading to the river valleys or give rise to low rounded knobs on the uplands. The thickness of the formation in this general region ranges from 150 to 300 feet and the surface

is comparatively level. In Keith County, however, the surface has been more or less eroded. North Platte and South Platte Rivers have carved deep valleys, and the parent material has been covered in places by extensive deposits of loess, sand, and stream alluvium, so that its exact thickness is unknown. When the rock disintegrates on the surface an accumulation of silt, sand, and scattered pebbles remains. Subsequent weathering and the accumulation of organic matter produce soils of varying character, depending on the conditions under which the materials have weathered. Such soils in Keith County have been classed with the Dawes, Rosebud, and Scott series. They predominate throughout the uplands on the south table-land. The Rosebud soils also occur extensively around the margins of the north table-land which lies between South Platte and North Platte Rivers.

Most of the north table-land in Keith County is capped by a loess deposit which lies uncomformably over the eroded surface of the Ogallala formation. This loessial material represents an outlying remnant of a former smooth plain which at one time extended beyond its present western limits. It is brownish-yellow, yellow, or almost white, highly calcareous loose floury silt containing little material coarser than very fine sand. Locally it is known as yellow clay, though the percentage of clay is comparatively small. The material has a tendency to split into vertical planes producing perpendicular bluffs along watercourses, roads, and other places subject to erosion.

In many places accumulations of particles of white carbonate of lime give the material a splotched appearance, and in a few places there are pockets of sand. Under the influence of the soil-forming processes the loess has given rise to soils differing markedly from one another in different parts of the State. In Keith County these agencies have produced the Keith and Colby soils. The Scott soils also occur on loessial deposits.

Throughout the sand-hill division north of North Platte River and including about 40 per cent of the county the Ogallala formation has been covered by extensive deposits of loose and incoherent fine or medium sand. This vast sand deposit ranges from a few inches to more than 100 feet in thickness. The surface configuration in the sand hills indicates that strong winds have played an important part in assorting and distributing the sand. The work of the wind in disintegrating the tertiary formations and transporting the resultant materials in recent geologic times and even at the present time is very obvious. The aeolian deposits have given rise to areas of dune sand and to soils of the Valentine and Gannett series.

The alluvial material in Keith County, which includes the terraces and flood plains along streams, is of recent age. The tertiary formation has been deeply carved by North Platte and South Platte Rivers and their larger tributaries, and broad valleys have resulted. This erosion has not always advanced at a uniform rate. There were periods in which the valleys were filled with sediment to the level of the highest terraces, but later stream intrenchment below these terrace levels and subsequent deposition of sediments during floods created the lower terraces and the present flood plains.

The alluvial materials of Keith County, because they have been derived from so many different sources and have been assembled and assorted in such a complex manner, have given rise to soils differing widely in character. Those composed largely of fine-textured materials are grouped in the Tripp and Lamoure series. The sandy soils include members of the Cheyenne, Laurel, and Cass series. All these soils occupy bottom-land areas except the Tripp and Cheyenne soils which occur on the well-drained terraces. The soils of the Bridgeport series, which occupy the higher terraces and gentle valley slopes, may also be included in the alluvial group, although the parent materials from which they have weathered have accumulated, in part at least, through colluvial action.

In the system of mapping employed by the Bureau of Chemistry and Soils the soils are grouped in series on the basis of similarity in color, structure, and other characteristics, and of the source, character, and process of accumulation of the material from which they have been developed. The soil series are divided into soil types on the basis of texture, or the proportion of different-sized mineral particles composing the surface soil. Brief descriptions of the soil series mapped in Keith County follow.

The surface soils of members of the Rosebud series are dark grayish brown or chestnut brown. The subsoils are light colored and very calcareous. Angular and waterworn gravel occur locally and in many places are abundant below a depth of 30 inches. A characteristic feature of these soils is the zone of lime accumulation in the lower part of the subsoil. The soils are friable throughout. They occur in upland positions and have weathered from the light-colored highly calcareous and loosely indurated tertiary deposits of the high plains. The parent materials consist largely of limestone, sandstone, and shale rocks. Five members of the Rosebud series, the gravelly sandy loam, loam with a colluvial phase, sandy loam, fine sandy loam, and very fine sandy loam, occur in Keith County.

The soils of the Dawes series are similar to those of the Rosebud series except that their upper subsoil layers are denser and more compact and more of the areas occur in depressions or basinlike positions. The surface soils are dark grayish brown or chestnut brown. The upper part of the subsoil is slightly lighter in color and is decidedly compact. The compact layer, which is characteristic of these soils, resembles a claypan in places. The lower part of the subsoil contains most of the lime washed down from the overlying layers and resembles the corresponding layer in the Rosebud soils. It is loose floury light grayish-brown or almost white silt loam or very fine sandy loam. These soils have weathered from the finer-textured tertiary formations of the region. They occupy the more nearly level and somewhat depressed areas on the tablelands. Dawes loam and Dawes very fine sandy loam are mapped in Keith County.

The Keith soils have dark grayish-brown or chestnut-brown surface soils. The upper part of the subsoil is slightly lighter in color and is more compact. The soil is friable throughout, and no evidence of a claypan layer characteristic of the Dawes soils is seen. The lower part of the subsoil consists of light-gray or white floury and

silty material. This is the layer of maximum carbonate content, having received most of the lime leached from the layers above. The soils of this series are similar to those in the Rosebud group but have weathered from loess and contain no gravel or stone. Keith silt loam and Keith very fine sandy loam, with colluvial phases of both, are mapped.

The soils included with the Colby series have brown or yellowish-brown surface soils which grade abruptly into light-yellowish or whitish subsoils. The surface soils are moderately calcareous, and the subsoils contain an abundance of lime. The carbonates, however, are in finely disseminated form. There is no evidence of the unusual concentration or segregation of lime seen in the lower layers of the Rosebud, Dawes, and Keith soils. The members of the Colby series have weathered from loess and are open and silty. Colby silt loam with a broken phase, and Colby very fine sandy loam with a broken phase are mapped.

The Valentine series includes soils with grayish-brown or dark grayish-brown surface soils. The subsoils are light grayish-brown or gray loose sand. Both surface soil and subsoil are poor in lime. These soils have developed on wind-blown sands which have become stable. Valentine loamy sand and Valentine sandy loam are mapped.

The soils of the Yale series have developed from fine-textured alluvial deposits along the Platte Rivers. The surface soils are grayish brown, becoming lighter with depth in most places. The subsoil is somewhat compact and a little lighter in color than the surface soil. The Yale soils have a slight claypan development. Yale very fine sandy loam is mapped.

The surface soils of members of the Tripp series are dark brown or chestnut brown. The upper part of the soil is a little lighter in color and is slightly more compact than the surface material. The lower part of the subsoil is very light-gray or white floury silt or very fine sandy loam in which most of the lime from the overlying layers has accumulated. These soils are mainly of alluvial origin, but in a few places the material has received some wind-blown deposits or has been modified by colluvial wash. These soils differ from those of the Rosebud series in their topographic position and in the mode of accumulation of the parent materials from which they have weathered. Tripp loam is mapped.

The Bridgeport series includes soils with grayish-brown or chestnut-brown friable surface layers, underlain in places by lighter-colored subsoils though in most places there is no change in color, texture, or structure throughout the soil. The subsoils range from moderately to highly calcareous. The Bridgeport soils differ from soils of the Valentine series in their higher lime content and from the Tripp soils in the absence of the white floury lime-concentration layer in the lower part of the subsoil. Drainage is everywhere good. These soils occupy terraces and colluvial slopes and have weathered from recent alluvial and colluvial material. Bridgeport gravelly sandy loam and Bridgeport fine sandy loam are mapped.

The soils of the Cheyenne series have developed from coarse-textured alluvial deposits which have partly filled the valleys of streams and draws in the western part of the high-plains region. The

surface soils are grayish brown or chestnut brown and are underlain at various depths by subsoils of porous sand and gravel. The subsoil is highly calcareous, and in places the surface soil contains some lime. The carbonates are evenly distributed, and there is no zone or layer of unusually high lime content. Cheyenne gravelly sandy loam is mapped.

The soils of the Scott series have dark-brown or almost black heavy refractory surface soils. The subsoils are dull-brown or black silty clay, grading into stiff heavy compact almost black clay. The material is sticky and plastic when moist but hard and brittle when dry. Below a depth of 5 or 6 feet this layer generally grades into light-yellow or almost white loose floury silt. Both surface soil and subsoil have a bluish-gray cast when thoroughly dry. The Scott soils have weathered from materials washed from the higher-lying soils by sheet water and deposited in temporary ponds which occupy shallow undrained depressions in the uplands and terraces. Scott silt loam is mapped.

The surface layers of the Gannett soils are dark gray or black and contain a large proportion of organic matter which in a few places is almost abundant enough to produce a muck. The subsoils are light-brown or grayish-white sandy loam or sand which in the lower part grades into gray sand similar to that underlying the Valentine soils and dune sand. The Gannett soils have developed in inclosed pockets or swales in the sand-hill region and consist of wind-blown material mixed with fine wash from the hills and modified by the incorporation of organic matter. They are everywhere poorly drained, and many of the lower areas are occupied by marshes or lakes. These soils constitute the valuable hay meadows in the sand hills. Gannett loamy fine sand is mapped.

The surface layers of the Laurel soils are light gray or grayish brown. The subsoils are very light gray, in places almost white, and are highly calcareous. Rust-brown iron stains are common below a depth of 18 or 20 inches. Internal drainage on the heavier areas may be deficient. The Laurel soils have weathered from recent-alluvial deposits and occupy bottom lands or flood plains along the streams. The Laurel series is represented by the very fine sandy loam, fine sandy loam, and sandy loam members.

The Cass soils have dark-brown or almost black surface layers underlain by gray or light-gray sandy and gravelly subsoils. They occupy the first bottoms along streams. These soils differ from those of the Laurel series in the higher organic-matter content and darker color of the surface layers. Cass fine sandy loam occurs in Keith County.

The Lamoure soils have very dark grayish-brown or black surface layers. The subsoils are mottled light and dark silt, clay, or very fine sandy loam. They are highly calcareous and in most places are finer in texture than the surface soils. These soils have weathered from recently deposited stream alluvium. The members of this series differ from the Cass soils in the finer texture and higher lime content of their subsoils and from the Laurel soils in the darker color of their surface layers. Lamoure very fine sandy loam is mapped.

In addition to the soils described, two classes of miscellaneous materials, dune sand and river wash, have been mapped in Keith County.

In the following pages of this report the various soils of Keith County are described in detail and their relation to agriculture is discussed. The accompanying soil map shows their distribution in the county. Table 4 gives the names, acreage, and proportionate extent of the soils mapped.

TABLE 4.—*Acreage and proportionate extent of the soils mapped in Keith County, Nebr.*

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Dawes loam	33,984	4.9	Laurel sandy loam	13,888	2.0
Dawes very fine sandy loam	17,536	2.5	Valentine sandy loam	14,464	2.1
Keith very fine sandy loam	34,240	5.0	Valentine loamy sand	40,640	5.8
Colluvial phase	896		Lamoure very fine sandy loam	5,376	.8
Keith silt loam	24,896	3.9	Cass fine sandy loam	3,136	.5
Colluvial phase	2,048		Gannett loamy fine sand	1,216	.2
Rosebud loam	39,808	5.9	Colby silt loam	8,896	2.8
Colluvial phase	1,536		Broken phase	10,432	
Rosebud very fine sandy loam	18,368	2.6	Colby very fine sandy loam	4,608	1.7
Rosebud sandy loam	14,912	2.1	Broken phase	6,784	
Rosebud fine sandy loam	1,920	.3	Yale very fine sandy loam	4,544	.7
Rosebud gravelly sandy loam	64,320	9.3	Cheyenne gravelly sandy loam	6,400	.9
Tripp loam	10,688	1.5	Scott silt loam	2,304	.3
Bridgeport fine sandy loam	37,952	5.5	Dune sand	227,008	32.7
Bridgeport gravelly sandy loam	12,672	1.8	River wash	1,536	.2
Laurel fine sandy loam	20,032	2.9			
Laurel very fine sandy loam	7,360	1.1	Total	694,400	

DAWES LOAM

The one-half or 1 inch surface layer of Dawes loam consists of a grayish-brown structureless dustlike mulch composed largely of silt particles but containing considerable very fine sand, small quantities of coarser sand, and scattered rounded pebbles from one-sixteenth to one-eighth inch in diameter. It does not have the smooth velvety feel so characteristic of a silt loam soil. The second layer consists of laminated or platy material resembling in structure the corresponding layer in the Keith soils. This layer has an average thickness of about 3 inches and is similar in texture to the surface layer but is dark grayish brown in color, owing to its high organic-matter content. There is little or no color change when the material is pulverized, which probably indicates that the organic constituents thoroughly permeate the soil aggregates. When pressed between the fingers the laminations break into a very finely granular mass, the small lumps averaging less than one-fourth inch in diameter. Considerable loose structureless material is also present.

The third layer, which lies between depths of 3 and 15 inches, is the lower layer of the surface soil. It is similar to or slightly darker in color than the second layer, contains less sand of any grade and practically no gravel, and is slightly more compact. Its characteristic feature, however, is the finely granular structure or arrangement of the soil particles. There is no evidence of lamination as in the overlying layer, but the material breaks naturally into small subangular granules from one-eighth to one-fourth inch in diameter.

These granules are slightly compact but are readily crushed between the fingers and when pulverized assume a slightly lighter shade than occurs on a broken face. The dark-colored organic matter has evidently not permeated the soil aggregates so deeply as in the layer above but occurs chiefly as a thin film over the surface of the granules. The three layers described are loose and mellow. The third is slightly more compact than the others but remains friable even when dry and there is no suggestion of a claypan.

The fourth, or upper subsoil layer, is the zone of maximum compaction. It lies between depths of 15 and 20 inches and consists of very dark grayish-brown compact loam or clay loam. The material contains a much higher percentage of silt, clay, and organic matter than do the layers above. It breaks naturally into coarse angular and irregular-shaped granules from one-fourth to one-half inch in diameter. The basic or dominant shade is almost black, but the color is not uniform. It is modified by numerous indefinite specks and splotches of lighter-colored material which cause the general very dark grayish-brown color. Scattered small, rounded, water-worn pebbles also modify the basic shade. In some places this layer contains scattered insect borings within which the material remains extremely dark and compact. The soil when crushed has a slightly lighter color than a broken face.

The three layers of the surface soil and the zone of maximum compaction have been so thoroughly leached of soluble carbonates that no visible effervescence occurs when hydrochloric acid is added. The fifth, or lower subsoil layer, however, has received much of the lime carried down from the overlying layers. It lies between depths of 20 and 36 inches and is light-gray or almost white structureless silt loam with a smooth floury feel. It contains very little organic matter. The upper 6 or 8 inches of this material is only faintly calcareous, but the lower part has a high lime content and effervesces freely when acid is applied. The lime occurs chiefly as soft white fillings in old rootlet channels but is also thoroughly disseminated throughout the soil.

Beneath the lime zone the material changes abruptly to loose incoherent gravelly sand which contains barely sufficient fine material to make it somewhat loamy. This horizon probably represents a gravelly layer of the parent Tertiary sandstone from which the soil has weathered. It continues below a depth of 5 feet and rests on light-gray bedrock similar to that underlying the Rosebud soils. The lime present occurs only in finely divided form and as a thin coating on the surfaces of the gravel and sand units. There is no evidence of lime concentration as in the layer above.

Dawes loam is uniform throughout the area of its occurrence in this county. The several layers may differ slightly in thickness, color, and texture from place to place, but they remain remarkably uniform in structure and consistence and in no place is their position in the profile reversed. The coarse sandy and gravelly upper layer of the parent material may be absent and the lime zone may rest directly on the partly disintegrated limy sandstone of the parent bedrock, but these differences are either unimportant or of such local occurrence that they are not shown on the soil map.

This soil is extensive throughout the table-land in the southern part of the county. It is the dominant upland soil south of Ogallala and occurs in large and small areas in all precincts south of South Platte River. The larger areas, which comprise the greater part of entire precincts, contain numerous patches of other soils within their borders.

The land is prevailingly flat. With Dawes very fine sandy loam it occupies almost level and slightly depressed areas where drainage ways are either absent or in an initial stage of development. Surface run-off is naturally slow, but the moderate rainfall prevailing in the region is either absorbed or drains into the basin-like depressions occupied by the Scott soils. However, the land does not become too moist for farming operations.

Dawes loam is an important agricultural soil in Keith County. Its large extent and favorable topographic features render it well suited to all crops common to the region. The native vegetation includes a luxuriant growth of grama and buffalo grasses, with considerable western wheat grass and herbaceous plants. Beef cattle are pastured on the areas not devoted to grain crops or hay land.

Wheat and corn are the leading crops, and oats, rye, and barley are grown on many farms. The forage crops include sorgo, Sudan grass, and kafir. Potatoes thrive but are grown only for home use. Good yields of all crops are obtained in seasons of normal rainfall. Winter wheat yields from 10 to 40 bushels, with an average of about 15 bushels to the acre, and corn from 20 to 30 bushels. Corn, especially where planted on recently broken sod, is sometimes attacked by cutworms and the yields are greatly reduced. Oats yield about the same as corn. The oat crop is occasionally injured by warm winds at critical periods. The average acre yield of rye is about 18 bushels and of barley 20 bushels.

Crop rotation is not practiced. The soil fertility is in no immediate danger of becoming exhausted. Considerable organic matter is added annually from the higher-lying soils. Commercial fertilizers are not used, but some barnyard manure is applied. Care is necessary in the use of coarse organic manures which may accentuate drought conditions.

Dawes loam is naturally very strong and productive, and when sufficient moisture is available slightly larger yields are obtained on it than on the Keith and finer-textured Rosebud soils. In dry years, however, partial crop failures are more frequent on account of the lower water-retaining power of this soil. The heavy claypanlike layer impedes absorption. The greater part of the available moisture lies above the compact layer or within a depth of 15 or 20 inches from the surface. Crop roots utilize this moisture, making good growth in the spring. The soil is exceptionally well suited to winter wheat and rye, as these crops usually mature before the moisture supply becomes exhausted. Corn, however, requires moisture throughout the summer, and in seasons of low precipitation the available supply is not sufficient for continued growth.

Thin seeding, so that adequate moisture may be available for each plant, is beneficial. The land is best suited to early-maturing crops and dwarf strains which require a minimum of moisture. Such

forage crops as sorghum and Sudan grass, which grow slowly in the early part of the season and thereby conserve soil moisture, are able to continue growth until they mature.

Summer tillage sometimes precedes fall seeding and apparently slightly increases the yields. Under all conditions thorough destruction of weeds is essential, and the surface soil should be kept well pulverized.

DAWES VERY FINE SANDY LOAM

Dawes very fine sandy loam is similar to the loam member of the same series in all profile characteristics except the texture of the two upper layers. The structureless surface mulch and the laminated layer contain more of the finer grades of sand, less silt, and less coarse material than occur in the same layers of Dawes loam.

Dawes very fine sandy loam occurs only in the southern table-land division of Keith County in close association with Dawes loam. The areas range in size from a few acres to about 8 square miles. The largest area is in the extreme southeastern corner of the county. An irregular-shaped body, comprising about 4 square miles, is 5 miles south of Korty, in Logan Precinct. Smaller though typically developed areas are in Paxton, Logan, East Ogallala, and West Ogallala Precincts.

This soil has weathered in the same manner and from the same materials as the loam member of the Dawes series. The larger very fine and content of the surface layers is probably owing to wind-blown additions from sandier soils.

Areas are almost level and surface drainage is slow. The surface soil and subsoil, however, usually absorb the moderate rainfall of the region, and the slope is sufficient to divert the excess surface waters into one or another of the lower-lying basinlike depressions.

The native vegetation, crops, yields, and methods of soil management on this soil are similar to those on Dawes loam, and the land has about the same sale value.

In Table 5 are given the results of mechanical analyses of samples of the surface soil, subsurface soil, and several layers of the subsoil of Dawes very fine sandy loam.

TABLE 5.—*Mechanical analyses of Dawes very fine sandy loam*[1]

Number	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
376310	Surface soil, 0 to 1 inch	0.3	7.7	7.6	11.3	20.6	38.9	13.7
376311	Subsurface soil, 1 to 4 inches	1.0	9.0	13.5	20.2	22.8	20.4	13.0
376312	Subsoil, 4 to 12 inches	.8	7.5	7.3	10.0	17.9	34.7	21.8
376313	Subsoil, 12 to 20 inches	.4	5.1	5.5	8.2	19.1	33.1	28.5
376314	Subsoil, 20 to 28 inches	.4	2.8	3.3	6.8	21.1	38.2	27.4
376315	Subsoil, 28 to 36 inches	.8	7.7	8.2	12.4	26.4	26.6	17.9
376316	Subsoil, 36 to 56 inches	1.9	17.1	22.0	27.1	19.0	4.8	8.1

[1] After treatment with hydrogen peroxide.

KEITH VERY FINE SANDY LOAM

The surface layer of Keith very fine sandy loam consists of light grayish-brown loose structureless very fine sandy loam, from one-fourth to one-half inch thick. It is underlain by a layer of dark

grayish-brown material, from 2 to 4 inches thick, which is of similar texture but of platy structure and which breaks horizontally. The plates range in thickness from one thirty-second to about one-sixteenth inch. They are very indefinite and so fragile that it is almost impossible to determine their form and size. The material breaks down into a very finely granular mass, the small granules averaging between one-sixteenth and one-eighth inch in diameter. Most of the granules are more or less flat, with two parallel faces, indicating that the material has broken along its structural planes. The dark color of this layer indicates a very high humus content. The organic matter seems to be most abundant between the laminations, although it is more or less thoroughly disseminated throughout the soil aggregates. When pulverized, the material of this layer assumes a somewhat lighter shade, approaching the color of the immediate surface layer.

The third layer of the surface soil lies between depths of 3 and 8 inches. It is grayish-brown silt loam containing very little sand. Its dominating characteristic, however, is the faintly granular structure or arrangement of the soil aggregates. The material breaks naturally into soft subangular lumps having an average diameter of about one-fourth inch. These, when crushed or cut through, have a slightly lighter color than their coatings would indicate. This is probably owing to the more concentrated organic matter coating on the surface of the granules.

The next layer, which is the upper layer of the subsoil, is similar in texture to the material above but is slightly lighter in color and decidedly more granular. It lies between depths of 8 and 16 inches. The soil particles are grouped in rather definite irregular-shaped aggregates, many of which have rounded corners. The particles are rather uniform in size, ranging from one-fourth to three-eighths inch in diameter. When crushed they assume a slightly lighter shade than the surface of the unbroken granules. The lower layer of the subsoil is slightly more compact and somewhat darker in color than the layers above. It ranges in thickness from 15 to 20 inches and lies between depths of 16 and 28 inches. It is moderately heavy silt loam, the basic color of which is dark grayish brown but in which faint mottles of black from one-sixteenth to one-eighth inch in diameter occur. The mottles are evenly distributed and give this layer a slightly darker general appearance than the color of the soil material would indicate. When crushed the material has a considerably lighter shade than when observed on a broken face. The structure is similar to that of the layer above. This is the layer of maximum compaction and, although slightly heavier than the other layers, it remains friable throughout and crushes easily between the fingers.

The layers previously described have been leached of their carbonates to such an extent that no visible reaction is obtained when hydrochloric acid is applied. In the next layer, however, the carbonates have accumulated through the action of downward-percolating waters, and the layer is commonly known as the lime zone. It ranges in thickness from 12 to 40 inches and commonly occurs between the 28 and 48 inch depths. The upper part and usually about half of this layer is mottled dark grayish-brown and almost black friable silt

loam in which the dark grayish-brown color predominates. The darker mottles are uniformly distributed and occur as elongated twisted rodlike forms about one-fourth inch in diameter and from one-half to more than 2 inches in length. These darker intrusions were probably caused by the accumulation of organic matter in parts of old worm or insect holes. Most of them are uniformly very dark grayish brown throughout, but a few are slightly lighter in color beneath the periphery. The general structure of the layer is coarsely granular, although the aggregates are poorly developed. The aggregates are similar in size and shape to those in the zone of maximum compaction, but they are considerably more friable. The carbonates in this upper layer of the lime zone occur chiefly as white fine winding threads having a more or less inverted dendritic arrangement. In many places they closely resemble fungi mycelium in form. The carbonates seem to be coextensive with the basic shade of the layer, and the black intrusions are very low in lime.

The lower part of the lime zone is the layer of maximum carbonate accumulation. Its basic color is grayish yellow, but the layer is mottled with dark intrusions similar in size, shape, and color, although more numerous than those in the layer above. The material is loose structureless silt loam which breaks into soft angular clods of various sizes. The lime in this layer occurs in the same form as in the overlying layer and also as numerous soft specks, splotches, and white filmlike coverings along joints and cracks in the soil. The dark intrusions contain no visible lime but effervesce when acid is applied.

Beneath the lime zone is the parent loess, a grayish-yellow loose massive or structureless calcareous silt. It has a characteristic columnar form or breakage, the columns averaging about 5 inches in diameter. At irregular intervals these are broken by numerous horizontal seams and cracks. The lime occurs in finely divided form thoroughly mixed with the silt, and there are no spots of unusual concentration or segregation of the carbonates. The loess extends with little variation to a depth below 10 or 12 feet. Scattered rust-brown iron stains are present in many places below a depth of 60 or 70 inches.

A few variations in this soil deserve mention. The organic-matter content of the surface layers differs somewhat with the topographic features. Organic matter is most abundant and the soils are darkest on the level areas and gradual slopes where conditions have favored the growth and decay of plant life and soil weathering has progressed undisturbed by erosion. On the steeper slopes, however, the dark-colored organic matter has been removed almost as fast at it has formed and the soil is prevailingly light in color. In such places the Colby soils are gradually encroaching on this soil. In many localities the surface layers of Keith very fine sandy loam contain so much silt as to approach a silt loam in texture, but small scattered bodies of such character are included with Keith very fine sandy loam in mapping.

In cultivated fields the original structural characteristics of the surface layers have been greatly altered by tillage operations. The surface soil to a depth of 4 or 5 inches consists of very dark grayish-brown very fine sandy loam which breaks into granules similar to those of the original laminated layer except for the absence of any well-developed faces or flat parallel surfaces.

Keith very fine sandy loam occurs on the divide between North Platte and South Platte Valleys and south of South Platte River in the southeastern part of the county. The areas between the two rivers are rather uniform, although they include numerous basinlike depressions which are occupied by soils of the Scott series. The area in the southeastern part of the county includes areas of other soils within its borders.

This soil has weathered from loessial deposits, outlying remnants of which locally overlie the tertiary bedrock of the region. The sandiness of the surface soil is owing largely to the presence of wind-blown materials from the more sandy soils of the county.

Areas range from nearly level to rolling, but by far the greater part of the soil is almost flat or gently undulating. In general the more nearly level areas occupy the higher positions where the original smooth loess mantle has escaped destructive erosion. The rougher areas occupy the steeper and more eroded slopes.

Drainage is everywhere good. The slope is usually sufficient, even on the flatter areas, to carry off the surplus moisture, and the silty subsoil affords ample underdrainage. This soil is very retentive of moisture, and crops do not suffer from drought except during prolonged periods of dry windy weather.

Keith very fine sandy loam is one of the best upland soils of the county. The native vegetation includes a dense growth of grama and buffalo grasses intermixed with considerable June grass and western wheat grass. About 60 per cent of the land has been broken and is used for crop production. Corn, wheat, and oats are the leading crops, although most farmers grow small patches of rye, barley, sweetclover, millet, or Sudan grass for feed. Crop yields are good. Cattle raising is practiced in the areas not under cultivation, but the cattle-raising industry is of less importance on this soil than on soils unsuited to grain production. Many farmers, however, fatten beef cattle. Hogs are raised on most farms and a few farmers have large herds.

A rotation system which seems to be favored is corn two or three years; oats one year; wheat two or three years; and forage crops, including sweetclover, millet, or Sudan grass, from one to three years. On most of the farms the market demand is the controlling factor in crop rotation, and some farmers grow the same crop for several consecutive years.

Keith very fine sandy loam, colluvial phase.—The colluvial phase of Keith very fine sandy loam has slightly deeper and darker surface layers than the typical soil. The surface material, however, is of more recent origin and has not weathered sufficiently to have developed such definite zones or layers as are characteristic throughout the very fine sandy loam member. The immediate surface layer is loose structureless dark grayish-brown very fine sandy loam from 4 to 6 inches thick. The laminated layer is very poorly developed, in many places entirely lacking, and the surface layer usually rests directly on finely granular silt loam similar to or slightly darker in color than the surface soil material. This layer, which is the lower layer of the surface soil, extends to an average depth of 12 inches. The subsoil is the same as that in the typical soil.

Soil of this phase occurs in a few small areas in the south-central part of Chase Precinct. Its total area does not exceed 2 square miles.

This soil is the result of colluvial action. The unusual depth and dark color of the surface layers are owing largely to the addition and mixing of material washed from the topsoils of the higher-lying Keith very fine sandy loam. The soil occupies small valleys and gentle slopes where conditions have favored continual surface accumulations from higher levels. It is in reality an old soil with a comparatively new surface soil. In a few places a faintly laminated layer, probably representing a structural remnant of a former surface soil developed in the same manner as the typical soil, occurs below a depth of 8 or 10 inches. In most places, however, the laminated structure has been destroyed by the addition of transported materials and the reassortment of the surface deposits through colluvial action. Drainage is thorough but not excessive, and soil of the colluvial phase is not subject to destructive erosion.

This soil is slightly stronger and more productive than the typical soil, owing largely to its more favorable moisture supply and the larger organic-matter content of the surface soil. The differences in crop yields, however, are not sufficient to cause any increase in land values, and the land sells for about the same price as Keith very fine sandy loam.

KEITH SILT LOAM

Keith silt loam differs from Keith very fine sandy loam only in the texture of the two surface layers. Both the structureless surface mulchlike covering and the laminated or platy layer contain less sand and more silt than do the corresponding layers of the very fine sandy loam member. The remaining layers of the two soils and the parent materials from which they have weathered are very similar in all characteristics.

This soil occurs in the west-central part of the county on the broad divide between the Platte Rivers. It extends westward beyond the Keith County line into Garden and Deuel Counties.

Areas are flat or gently undulating and lie slightly above areas of Keith very fine sandy loam. Some of the highest places in the county are occupied by this soil, which occurs on the higher remnants of the old loess plain which have escaped any noticeable erosion. Drainage is thorough, as the slope of the land is sufficient in most places to carry off the surplus moisture, and the mellow subsoil affords ample underdrainage.

The crops, methods of management, and sale values are about the same as for Keith very fine sandy loam, and the farmers recognize no difference in crop yields between the two soil types.

Keith silt loam, colluvial phase.—The surface soil layers of this soil differ from the corresponding layers of Keith very fine sandy loam, colluvial phase, only in texture. They contain a smaller percentage of all grades of sand and a larger amount of silt. The color, structure, consistence, and arrangement of the layers, however, remain practically the same. The subsoil layers are similar to those underlying the very fine sandy loam and silt loam members of the Keith series.

This soil occupies positions similar to those occupied by Keith very fine sandy loam, colluvial phase. It occurs on valley slopes and floors in the west-central part of the county. The largest area, covering about 2 square miles, is along Chase Canyon.

The crops, yields, and methods of management are about the same as for Keith very fine sandy loam and Keith silt loam, and the soil has about the same sale value.

ROSEBUD LOAM

The surface soil of Rosebud loam, which ranges in thickness from 8 to 12 inches, is composed of three fairly well-defined layers. The upper one is light grayish-brown loose structureless loam from 1 to 3 inches thick. It is composed largely of silt particles, although it contains considerable very fine sand and fine sand, together with a few scattered gravel. The gravel consists of small more or less rounded pebbles, few of which exceed one-fourth inch in diameter. The second layer, which ranges in thickness from 2 to 4 inches, is darker than the surface layer and has a faintly laminated or platy structure. It is dark grayish-brown friable silt loam or loam, in most places containing about the same amount of fine gravel but more silt and less sand than the layer above. The laminated or platy structure is seldom so well developed as in soils of the Keith series, and in many places it is scarcely noticeable. The layer breaks down into an imperfectly finely granular mass which contains considerable loose structureless material. This is apparently the layer of highest organic-matter content, as indicated by its dark color. There is little or no change in color when the material is pulverized or cut through.

The third layer is grayish-brown, faintly granular, very friable silt loam ranging in thickness from 4 to 6 inches. There is no evidence of the imperfectly laminated or platy structure which occurs in many places in the overlying layer, and the material is slightly lighter in color. When pulverized it assumes an even lighter shade than occurs on a natural broken face, probably indicating that the organic matter is not so thoroughly disseminated as in the overlying layer but occurs more as a surface film or coating on the granules.

The fourth layer, or the upper part of the subsoil, differs from the layer above chiefly in its slightly greater denseness. It ranges in thickness from 8 to 12 inches and lies between depths of 10 and 22 inches. It is the layer of maximum compaction, although the material remains rather friable and crushes easily between the fingers. The layer consists of grayish-brown heavy silt loam similar in structure to the layer above but containing very little sand and only an occasional pebble. The fifth, or lower subsoil layer, differs from the layer of maximum compaction in its lighter color and greater friability and in its lime-carbonate content, which is sufficient to give a faint reaction when acid is applied. It is the upper part of the zone of carbonate accumulation and lies between depths of 22 and 28 inches. The material is light grayish-brown faintly granular silt loam for the most part, but in many places it contains so much sand as to approach very fine sandy loam in texture. When pulverized it assumes a lighter shade. This layer has

a faintly columnar form or breakage, the columns being of irregular sizes and shapes and averaging about 4 inches in diameter. They are broken by numerous horizontal seams and cracks at irregular intervals. The lime is not disseminated throughout the soil but occurs in small, scattered soft concretions and specks and as thin coatings on the peripheries of a few root and worm holes.

The sixth layer is the one of maximum lime accumulation. It lies at about the average depth of moisture penetration in this region, which is from 22 to 30 inches beneath the surface, and ranges in thickness from 8 to 10 inches. The material is very light grayish-brown or pale yellowish-brown loose floury silt loam or very fine sandy loam which differs little in color when pulverized or when observed on a smooth cut face. Lime carbonate, occurring as soft concretions, specks, splotches, fine winding threads, and in finely divided form thoroughly mixed with the soil, is abundant.

Beneath the lime zone the material becomes gradually more sandy, gravelly, and stony until at a depth of about 6 feet the unweathered parent tertiary bedrock is reached. This consists of light-gray loosely indurated and limy sandstone containing an abundance of coarse angular and waterworn gravel of a great variety of crystalline rocks. In many places the material greatly resembles lime mortar in appearance and for this reason is known as "mortar-bed" material by the State geologists.

The foregoing description is typical for the greater part of Rosebud loam. Numerous local variations, however, deserve mention. The principal variation in the surface soil is toward silt loam and very fine sandy loam and small areas having soil of one or another of these textures are included with the typical soil in mapping. Locally the laminated or platy layer of the surface soil is so poorly developed as to be obscure and the structureless surface mulch rests directly on the faintly granular layer of the lower part of the surface soil. In several places the soil is underlain at a depth ranging from 2 to 3 feet by either coarse gravel or the unweathered parent formation. In such places the subsoil layers are very poorly developed or entirely absent, the material consisting of 1 or 2 inches of light grayish-brown structureless loam underlain by dark grayish-brown friable and faintly granular silt loam or very fine sandy loam. The very fine sandy loam continues to the underlying rock or gravel. Locally the lime zone is reached within 2 feet of the surface. Where this condition prevails, the zone of maximum compaction, which normally overlies the lime zone, is usually absent and the material beneath the zone of carbonate accumulation consists of loose floury silt loam or very fine sandy loam which becomes gradually coarser with depth until the bedrock is reached. The variations described, although numerous, seldom occupy more than a few acres in a single area and are of such local importance that they are not shown separately on the soil map.

Rosebud loam has weathered in place from the tertiary bedrock of the region. It differs from soils of the Keith series in the larger sand-and-gravel content of its subsoil. The Keith soils, having weathered from loess, contain no gravel and only transported sands are present in the surface layers.

Areas range from nearly level to hilly but in the main are undulating or gently rolling. The rougher areas occur on the slopes between the uplands and South Platte Valley where drainage ways have created a steeply sloping and in places decidedly hilly relief.

Rosebud loam occurs extensively throughout the southern upland division in Keith County. The largest areas are in Logan Precinct, and large and small areas occur in all precincts south of South Platte River. This soil occurs only locally on the north side of the river.

Drainage is everywhere good, and in the rougher areas surface run-off is excessive and erosion severe. The slope is usually sufficient, even on the flatter areas, to carry the surplus surface moisture into the lower-lying Dawes and Scott soils or into some invading drainage channel. The loose porous subsoil affords ample underdrainage.

Rosebud loam is one of the best upland soils of Keith County. The areas topographically suited to farming are well suited to all crops common to the region. This soil is considered equal to Keith very fine sandy loam and Keith silt loam in productiveness and resistance to the injurious effects of poor management. The native vegetation consists of a luxuriant growth of buffalo and grama grasses, together with considerable western wheat grass and June grass.

About half this soil has been broken for crop production. The cultivated areas are used for corn, wheat, oats, rye, and barley, ranking in acreage in the order named. The virgin land is used for cattle grazing and hay production. A few farmers fatten cattle during the winter for market. Hogs are raised on most farms, and and many farmers have herds of 100 or more.

The yields of all crops depend largely on the rainfall. In seasons of ample precipitation yields, especially of corn, are sometimes twice those of normal years. During average seasons the corn crop averages about 20 bushels to the acre. Winter wheat averages about 15 bushels to the acre. Very little spring wheat is grown, as the yields are much lower and the crop must be planted at a time when other farm work is pressing. The average yield of oats is about 25 bushels, of rye 18 bushels, and of barley 20 bushels. The native grasses on this soil will support from 150 to 200 cattle to the square mile during the grazing season, from June 1 to about October 30.

Crop rotation is not generally practiced and on most farms the current price and demand for grain determines the crops grown. Many farmers grow wheat or corn on the same ground for several consecutive years. The more progressive farmers endeavor to change their crops every second or third year and to grow some sweetclover each season.

Rosebud loam is easily handled, except in the rougher areas where erosion is rather severe, and it can be cultivated without injury shortly after heavy rains. As with nearly all the well-drained soils of the county, however, precipitation is the controlling factor in determining crop yields, and since the rainfall ranges from moderate to light, means must be taken to utilize the available soil moisture to the best advantage. Plowing under green crops is also beneficial. If manure is to be applied to the land it should be given sufficient time to decompose thoroughly before the succeeding crop is planted. In the rougher areas erosion is a serious problem, and corn especially

should be planted in furrows running at right angles to the prevailing slope. In general, early-maturing crops give the highest yields, as they can be harvested before being injured by the dry weather of middle and late summer.

Rosebud loam, colluvial phase.—This soil is very similar to typical Rosebud loam except in the character of its surface materials. The structureless surface layer and the faintly granular layer are usually slightly thicker than in the typical soil. The intermediate faintly laminated or platy layer is seldom present. The subsoil is very similar to the typical subsoil.

This soil has weathered from the same materials which gave rise to typical Rosebud loam. However, as it occupies long gradual slopes its surface layers have been thickened and darkened by the addition of colluvial materials from the higher lands.

Soil of the colluvial phase occurs in narrow strips on the valley slopes south of South Platte River in the western part of the county. Its total area does not exceed 3 square miles.

This soil is equal or superior to Rosebud loam in productiveness, and most farmers prefer it for cultivated crops on account of its lower position and more favorable moisture supply. The crops that are grown on the typical soil thrive on this soil and in addition some alfalfa is grown.

ROSEBUD VERY FINE SANDY LOAM

Rosebud very fine sandy loam differs from Rosebud loam only in the texture of the surface soil to a depth of 3 or 4 inches. The surface layer contains more very fine sand, less coarse material, and less silt than is commonly present in the corresponding layer of Rosebud loam. The other layers of the two soils and the parent materials from which they have weathered are very similar. The variations which occur in the very fine sandy loam member are likewise similar to those in the loam member, and in a few small areas even the surface textures differed so little that separations on the soil map are based on the character of the main area in which they lie. The large area of Rosebud very find sandy loam occupying parts of East Ogallala and West Ogallala Precincts, however, contains an unusually large amount of fine sand in the immediate surface soil and in a few places it approaches a fine sandy loam in texture, but the textural variations are of such patchy nature that they are included with the predominant soil.

This soil has weathered from the same bedrock formation on which the loam was developed. The larger very fine sand content of the surface soil may be owing to slight differences in the character of the parent rock or to the addition of wind-blown materials from the adjacent more sandy soils.

The largest area of Rosebud very fine sandy loam, comprising about 12 square miles, occupies the tablelike divide between the Platte Rivers in East Ogallala and Paxton Precincts. A smaller, though typical area, borders the western county line in Brule Precinct. Two small patches may be seen southeast of Sarben in the east-central part of the county. The soil occurs only locally north of North Platte River or south of South Platte River.

The relief varies from almost level to gently undulating. The soil as a whole averages more nearly level than the other members of the Rosebud series, as it does not occur on steeply sloping land in this county. The slope is sufficient to carry off the surface water, and the subsoil affords good underdrainage. Very little of the land is subject to destructive erosion.

This soil ranks with members of the Keith series and with Rosebud loam in productiveness, and the farmers show no preference among these soils, as they are all adapted to the same crops, yield equally well, and are managed in the same manner.

Land values of Rosebud very fine sandy loam are about the same as of Rosebud loam.

ROSEBUD SANDY LOAM

The surface soil of Rosebud sandy loam, to an average depth of 12 inches, is a light grayish-brown structureless mixture of all grades of sand, together with small amounts of silt, clay, and organic matter. The fine sands and medium sands predominate, however, and the finer constituents are nowhere sufficiently abundant to prevent some drifting in cultivated fields during prolonged periods of dry windy weather.

The subsoil, which extends below a depth of 6 feet, is very light grayish-brown fine sand or medium sand with barely sufficient silt and clay to give it a slightly loamy texture. The material is incoherent and resembles the sands underlying the Valentine soils and dune sand. Below a depth of about 5 feet the subsoil contains sufficient lime to effervesce freely when hydrochloric acid is applied. The same parent rock from which the other Rosebud soils have weathered underlies the soil material at a depth ranging from 8 to 10 feet beneath the surface.

Rosebud sandy loam occurs in large and small areas on the valley slopes and throughout the uplands on both sides of North Platte River. One of the largest areas, comprising about 6 square miles, is along Whitetail Creek in the north-central part of the county. A smaller though typical area is in West Ogallala Precinct about 2½ miles northwest of the county seat. Small areas lie along Clear Creek, Gold Fish Creek, O'Bryan Canyon, south of Keystone, and southwest of Sarben.

The surface of this soil is strongly undulating or rolling. Much of the land has a rather hummocky relief such as is caused by wind in areas of loose sand.

Surface drainage is poorly established in most places. The underdrainage, however, is excessive, owing to the porosity and sandiness of the subsoil. Consequently the land is somewhat droughty.

Most of the Rosebud sandy loam is used for cattle grazing and hay production. Only about 15 per cent is in cultivation. Corn is practically the only cultivated crop grown and the average yield is about 15 bushels to the acre, although 25 to 30 bushels are obtained during seasons of abnormally high precipitation. This soil is not suited to small grains, as it is rather unstable and drifts more or less with consequent injury to crops having shallow root systems. The native grasses include fairly dense growths of sand grass and Stipa or needle grass, together with small amounts of bluestem.

These grasses will support from 90 to 120 cattle to the square mile during the summer grazing season, or when cut for hay will yield about a ton from each 4 acres.

The chief need of this soil is the conservation of moisture and the addition of material to increase its stability. The land seldom needs plowing after the sod is broken as the soil in its natural condition is sufficiently mellow for corn. This crop should be cultivated only enough to keep down the weeds, as constant stirring of the land promotes soil drifting.

ROSEBUD FINE SANDY LOAM

Rosebud fine sandy loam differs from Rosebud loam mainly in texture. The two upper soil layers lack the laminated and platy structure occurring in the loam, and granules are not well formed. The subsoil averages a little deeper and is lighter in color than the Rosebud loam subsoil. The finer material has leached down to a more uniform depth, and granulation is only noticed in the upper part of the subsoil. The lower part of the subsoil is a zone of maximum lime accumulation and the lime zone lies a little deeper than in the loam soil. The organic matter is practically absent in the lime zone, but the underlying parent material is the same as in Rosebud loam.

The soil material differs somewhat in different localities. In a few places the tertiary bedrock is reached within a depth of 3 feet and locally, on the steeper slopes, erosion has removed both surface soil and subsoil, exposing the underlying sandstone. The principal surface variations are toward a sandy loam, and small areas are known to contain so much sand as to approach a loamy sand in texture. These variations, however, are of such small extent and local importance that separation on the soil map was not warranted.

Rosebud fine sandy loam has weathered from the same general material as the very fine sandy loam and loam members of the Rosebud series. Its higher sand content may be owing partly to variations in the parent bedrock and partly to the addition of wind-blown materials from more sandy soils.

Areas range from nearly level to gently rolling, many being characterized by low rounded ridges with intervening shallow depressions. Surface drainage is everywhere thorough. Owing to the looseness of both surface soil and subsoil, underdrainage is excessive in a few places.

This soil is used chiefly for grazing. Corn and rye are the chief cultivated crops. The native vegetation consists of sand grass, Stipa, bluestem, and a little grama grass. These grasses will support about 125 cattle to the square mile during the summer grazing season.

Rosebud fine sandy loam occurs in three small areas along Clear Creek in the northwestern part of the county and in a small area about 7 miles south of Korty in the southeastern part. The total area of this soil is 1,920 acres.

ROSEBUD GRAVELLY SANDY LOAM

The surface soil of Rosebud gravelly sandy loam in most places consists of 8 or 10 inches of light grayish-brown sandy loam which

contains much fine and coarse gravel. Below this layer the color becomes gradually lighter and the coarse material more abundant. Angular fragments of the light-gray bedrock are present at a depth ranging from 20 to 30 inches, and the tertiary sandstone underlies the soil at a depth of about 3 feet. The gravel of which the soil is so largely composed consists of both angular and waterworn fragments of the great variety of crystalline rocks contained in the underlying Ogallala formation. The fragments range from one-half inch to more than 2 inches in diameter. In many places the surface soil contains sufficient lime to react with hydrochloric acid, and the subsoil is highly calcareous.

In many places throughout areas of this soil the soil material consists of a heterogeneous mass of coarse sand, gravel, and waterworn pebbles below a depth ranging from 4 to 6 feet. Elsewhere the surface soil, to a depth of 6 or 8 inches, may contain considerable fine material intermixed with the gravel. Outcrops of the tertiary bedrock are common, in many places cropping out as cliffs and bluffs along drainage ways. In such localities, or wherever the bedrock lies unusually near the surface, the gravel contains numerous angular fragments of the parent limy sandstone.

Areas of Rosebud gravelly sandy loam occur chiefly around the edges of the northern table-land where it occupies rather continuous strips and areas of various sizes on the eroded valley slopes. This soil occurs only locally south of South Platte River and on the north side of North Platte River.

Areas range from steeply sloping to extremely rough and broken, and rounded and steep-sided gravel hills are a characteristic feature. In those areas where the bedrock outcrops, however, the relief is much more pronounced, and the land is extremely rough and broken.

Drainage is excessive, and erosion is severe. Surface wash on the steeper slopes removes the finer-textured materials and organic matter almost as fast as they are produced by the weathering forces. Consequently, the soil remains extremely porous.

This soil, although extensive, is of little agricultural importance in Keith County. It is all included in grazing land, as it is too stony for crop production. Owing to the porosity and droughtiness of the soil the native grasses are sparse, and the land does not have a high value even for pasture. From 8 to 12 acres are required for each head of livestock during a grazing season.

TRIPP LOAM

Tripp loam is very similar to Keith very fine sandy loam except in the texture of the surface soil. A larger proportion of silt and more of the coarser grades of sand are in the upper layers of the Tripp soil. The subsoils of the two soils, however, are very similar in all characteristics.

In a few places the surface layers of the soil mapped as Tripp loam contain so much very fine sand and so little coarse material that the texture is in reality very fine sandy loam. Locally the subsoil rests on sandy or gravelly materials below a depth of 5 or 6 feet. This condition is unusual in the Keith soils and is of such local

occurrence and minor agricultural importance in Tripp loam that such areas are included in mapping.

The soil has weathered from stream sediments deposited when the rivers were flowing at higher levels. Later stream intrenchment has left the deposits as terrace or bench forms considerably above the present flood plains. The sediments came from the near-by loessial and residual uplands and from soil provinces to the west.

Tripp loam occurs in both large and small areas on the higher terraces within the Platte Valleys. The largest areas are on the south side of South Platte River in the western part of the county. This is the dominant soil on the terraces throughout Vail Precinct. It also occurs extensively in the southern part of West Ogallala Precinct and locally along North Platte River.

The relief is flat or very gently undulating with a gentle slope toward the streams and down the valleys. There are very few pronounced surface irregularities. Drainage is good, though nowhere excessive. The slope is sufficient to remove the surplus surface water, and the friable subsoil affords good underdrainage.

Tripp loam is one of the most productive soils in Keith County. It is naturally strong and fertile and is preferred to the Keith and Rosebud soils for general farming on account of its lower position and more favorable moisture supply. It annually receives more or less organic matter through surface wash from the higher lands and will withstand severe cropping under poor management for several years. Practically all the land is under cultivation. The relief is favorable for irrigation, and the greater part of the soil is included in irrigated farms.

All crops common to the region do well. Corn, wheat, oats, and alfalfa are the principal crops. A few farmers grow potatoes commercially, but this industry is of minor importance. Cattle raising is not practiced, as the land is too valuable to be used for grazing purposes. Many farmers, however, feed cattle for market. Most of the animals are native Herefords purchased from ranchers in the sand hills or rougher hard-land areas. Hogs are raised on most farms, and many farmers have large herds. A general appearance of prosperity prevails.

Corn yields average about 25 bushels, wheat 20 bushels, and oats 25 bushels to the acre. These crops are seldom irrigated during the growing season, although the soil is sometimes thoroughly soaked a few weeks prior to the preparation of the seed bed. Most of the alfalfa is irrigated and yields 3 or 3½ tons of hay to the acre from three cuttings. Where irrigation is not practiced 2 tons of alfalfa hay is considered a high yield. Irrigated potatoes yield from 150 to 250 bushels to the acre.

BRIDGEPORT FINE SANDY LOAM

The surface soil in virgin areas of Bridgeport fine sandy loam consists of grayish-brown fine sandy loam or loamy fine sand from 10 to 15 inches thick. It contains considerable organic matter and some silt and clay, but not in sufficient quantities to bind the sand grains together. Consequently, the soil is loose and incoherent and in many cultivated areas drifts more or less during periods of dry,

windy weather. The subsoil differs little from the surface soil in texture or structure, but, owing to a lower organic-matter content, it averages slightly lighter in color. It continues uniform below a depth of 4 or 5 feet where it merges almost imperceptibly into the parent material of loose, incoherent light-gray sand. Below a depth ranging from 12 to 18 inches the soil contains sufficient lime to react with hydrochloric acid. The lime occurs in finely divided form thoroughly mixed with the soil, and no spots of unusual concentration occur. The organic matter decreases rapidly below a depth of 20 inches and only faint traces occur in the lower part of the subsoil. The determining characteristics of this soil are the uniformity in texture and structure throughout and the presence of lime carbonate in the subsoil.

Bridgeport fine sandy loam has no important variations. In different localities the material may vary slightly in texture and structure, but in most places the surface soil and subsoil bear the same relation to one another and the soil profile remains uniform throughout. In a few places scattered pebbles occur in both surface soil and subsoil, and the material below a depth of 5 feet consists of light-gray gravelly sandy loam.

Bridgeport fine sandy loam occurs extensively in the Platte River Valleys throughout their distance across the county. The largest areas are on the south side of South Platte River where the soil occurs in fairly continuous strips, ranging from one-fourth mile to about 2 miles in width. Most of the areas within the North Platte Valley are smaller than those along South Platte River.

The relief ranges from almost level to gently rolling. The soil occurs both on the nearly level terraces and near the base of the longer and more gradual slopes leading to the uplands. Many of the more level areas are modified by low swells and falls such as are produced in loose sand by wind.

Drainage is everywhere thorough and, owing to the porosity of the subsoil, is excessive in many places. The soil has a low water-retaining power and is considered rather droughty. It is not subject to destructive erosion.

On account of its large extent and favorable relief, Bridgeport fine sandy loam is a fairly important agricultural soil in Keith County. It is less drought resistant than Tripp loam, but on account of its lower position the moisture supply is almost as favorable as in the Keith and Rosebud soils. However, this soil is neither so strong nor so fertile as the better upland soils. About 40 per cent of it is under cultivation, and the remainder is used for hay and pasture. The native vegetation includes sand reed grass, Stipa or needle grass, bluestem, and small quantities of grama grass. Corn is the leading cultivated crop. Wheat and oats are grown in the lower and more protected areas, but on account of its looseness and sandiness the soil as a whole is not well suited to small grain. A small part of this soil in the western part of the county is irrigated and used largely in the production of alfalfa and potatoes.

Crop yields, except in the irrigated sections, range widely, depending on the rainfall. In seasons of high precipitation they compare favorably with those obtained on the Keith and Rosebud soils, but in dry years they are low. In seasons of normal precipitation corn

averages about 20 bushels, wheat 12 bushels, and oats 18 bushels to the acre. On the irrigated areas of this soil alfalfa yields 2½ or 3 tons of hay and potatoes from 125 to 150 bushels to the acre. The native grasses on this soil will support from 90 to 150 head of cattle to each square mile or when cut for hay will yield from one-fourth to three-fourths ton to the acre, depending on the rainfall.

BRIDGEPORT GRAVELLY SANDY LOAM

Bridgeport gravelly sandy loam differs from Bridgeport fine sandy loam in texture, gravel content, and depth to lime. The surface soil contains considerable organic matter but not enough to prevent some drifting when the native sod is destroyed. Drainage is excessive, and the land is more droughty than Bridegport fine sandy loam. It occupies colluvial slopes and alluvial fans representing outwash from the uplands.

This soil is of little agricultural importance but is locally farmed with other soils. Where irrigated it produces fair crops, but crop yields are not so high as on Bridgeport fine sandy loam.

LAUREL FINE SANDY LOAM

The surface soil of Laurel fine sandy loam is grayish-brown mellow sandy loam about 10 inches thick. To a depth of 2 inches the material is usually structureless, but the remainder of this horizon contains more silt and clay and has a moderately well-developed granular structure, the granules being irregular in shape and angular. The upper part of the subsoil, which continues to a depth of about 20 inches, is light grayish-brown sandy clay loam, slightly more compact than the overlying layer but rather friable. This layer is underlain by structureless very light grayish-brown fine sand containing small quantities of silt and clay. Below the subsoil an incoherent mass of sand and gravel is present in most places. The surface layer contains considerable organic matter but the quantity decreases rapidly with depth, and only faint traces occur below a depth of 20 inches. Both surface soil and subsoil have a high lime content, and the subsoil contains numerous rust-brown iron stains.

Considerable variation from typical occurs in different localities. The chief surface soil variation is toward very fine sandy loam. In many places the surface soil rests on loose incoherent fine sand which gradually becomes coarser with depth and overlies a heterogeneous mixture of sand and gravel at a depth ranging from 2 to 3 feet.

Laurel fine sandy loam has weathered from recently deposited sediments in the river flood plains. Areas are flat, modified in places by stream channels, cut-offs, and slight elevations. The land lies only a few feet above the river beds but is not subject to overflow from the main channels. Most of the soil is sufficiently drained for crop production. The underlying water table, however, is everywhere near the surface, and during seasons of high precipitation it rises sufficiently to render small areas too moist for cultivation.

This soil occupies numerous strips and areas of various sizes within the flood plains of the Platte Rivers. One of the largest areas

forms a continuous strip along the south side of South Platte River through Paxton and Logan Precincts. Another large area is between Belmar and Lemoyne.

Laurel fine sandy loam is an important agricultural soil in Keith County. Its high moisture content and favorable relief make it especially suitable for the production of corn, alfalfa, and sugar beets, and about 50 per cent of the land is used for one or another of these crops. The remainder, including the more poorly drained areas, is devoted to hay production. The native grasses include rank growths of salt grass, wire grass, and other moisture-requiring grasses.

Corn is the leading crop, and during average years yields range from 25 to 35 bushels to the acre. Small grain is seldom grown on this soil, although barley does well. Alfalfa yields 2 or 2½ tons of hay to the acre and sugar beets from 12 to 15 tons. In average years from one-half to 1 ton of native hay is obtained from each acre.

The net returns from the more poorly drained areas could be greatly increased by sowing timothy and clover seed among the native grasses. It is seldom advisable to use such land for cultivated crops unless artificial drainage is established.

LAUREL VERY FINE SANDY LOAM

Laurel very fine sandy loam differs little from Laurel fine sandy loam except in the texture of its surface layer, which consists of grayish-brown friable very fine sandy loam 10 or 12 inches thick. This layer is underlain by a layer, 8 or 10 inches thick, of light grayish-brown material of similar or slightly heavier texture. This layer, in turn, rests on very light grayish-brown loose fine sand which continues below a depth of 4 feet. Both surface soil and subsoil are highly calcareous. The surface soil is well supplied with organic matter, but the subsoil, below a depth of 20 inches, is almost devoid of this material. Scattered rust-brown iron stains are present in the subsoil.

The foregoing description is typical of the greater part of this soil, but the material varies considerably in different localities. The surface soil may contain more or less sand and the sand may be coarser than in typical areas; a layer of coarse sand and gravel may be present below a depth of 24 inches and may continue for several feet; or the material may remain uniform in texture and structure below a depth of 5 feet. The subsoil, however, is invariably lighter in color than the surface soil. These variations, although numerous, occupy small patchy areas and are not separated from the typical soil.

Laurel very fine sandy loam occurs chiefly in the North Platte Valley but occupies a few small areas along South Platte River. The largest area, comprising several square miles, is in the vicinity of Keystone in Whitetail Precinct. Smaller though typical areas lie northwest of Lemoyne and southeast of Martin.

On account of its small extent, this is not an important agricultural soil in Keith County. However, owing to the favorable moisture supply, it is productive and where adequately drained is well suited to the production of corn, alfalfa, and sugar beets. The

poorly-drained areas are used for hay land. The native vegetation includes rank growths of the same grasses as those on Laurel fine sandy loam. Farmers recognize no difference in average crop yields on the two soils.

LAUREL SANDY LOAM

Laurel sandy loam differs from Laurel fine sandy loam mainly in texture, the surface soil being sandy loam instead of fine sandy loam. The sandy loam soil is also somewhat lighter in color and the horizons are not so well developed. The sand content throughout is much higher and in places this soil approaches a loamy sand. The soluble salts are leached to a greater depth and the brown iron stains are somewhat darker than those in Laurel fine sandy loam. This soil is better drained but on account of its sandy texture is slightly less productive than Laurel fine sandy loam.

VALENTINE SANDY LOAM

The surface soil of Valentine sandy loam is grayish-brown or dark grayish-brown friable loam which contains an abundance of fine sand and medium sand. It is fairly well supplied with organic matter and is somewhat more stable than the loamy sand member of the same series. The subsoil, beginning at an average depth of 12 inches, is light-brown or light grayish-brown loamy sand containing sufficient silt and clay to give it a slightly sticky feel when moist. When dry, however, it is rather loose and incoherent and resembles the subsoil of Valentine loamy sand in all visible characteristics. Below a depth of 30 inches is loose incoherent gray sand similar to that underlying dune sand areas. This soil has a very low lime content.

The soil material varies somewhat, depending largely on the relief of the areas. In swales and basins, where conditions have been especially favorable for the growth and decay of plant life and the accumulation of fine materials washed in from the higher lands, the surface soil in many places is 18 or more inches deep and very dark grayish brown in color. In such localities the subsoil contains a much higher percentage of fine material than usual, is coherent, and in many places approaches a fine sandy loam in texture. On the low ridges and knolls the fine material and organic matter have been largely removed by the wind, and the surface soil is light-gray loose incoherent sand seldom exceeding 6 inches in depth. The subsoil apparently contains no binding material but consists of very light-gray incoherent fine sand or medium sand to a depth below 6 feet. In a few areas of this soil scattered fine gravel occur on the surface and throughout the subsoil. The material as a whole, however, is remarkably free from gravel. The parent materials on which the soil has developed have been reworked, reassorted, and subsequently weathered to such an extent that it is not possible to make any definite statement in regard to their origin.

This soil occurs chiefly throughout the uplands in the south-central and southeastern parts of the county in scattered areas of various sizes. It also occurs locally on the slopes on the south side of North Platte River. The largest areas are within the southern table-land division, in Paxton Precinct.

Areas range from very gently undulating to hummocky. Most of the land lies slightly above the associated loessial and residual soils and averages considerably less uneven than areas of Valentine loamy sand. The greater part of the soil is characterized by scattered low rounded knolls and ridges rising from a generally level surface. Surface drainage is not established, but the surplus moisture is rapidly absorbed by the porous sands.

Valentine sandy loam is only moderately important in the agriculture of Keith County. It occupies a fairly large total area but in many places is surrounded by the more productive soils of the Keith, Dawes, and Rosebud series, and for this reason is used chiefly for cattle grazing and hay production. Some corn is grown in the lower and more protected areas where moisture conditions are most favorable. On account of the looseness and sandiness of the seed bed small grain is seldom grown.

The native vegetation includes a luxuriant growth of sand reed grass, Stipa, and bunch grasses, together with considerable grama grass. These grasses will support from 90 to 100 cattle to each square mile during the summer grazing season or when cut for hay will yield from one-fourth to one-half ton to the acre. Corn yields from 15 to 30 bushels to the acre, depending on the rainfall.

Valentine sandy loam is fairly stable and retentive of moisture, considering its large sand content, and when carefully managed will produce corn profitably. In seasons of abnormally high precipitation wheat, oats, and rye yield well, but the uncertain and usually low rainfall prevailing in this region prevents the growth of much small grain on this soil.

VALENTINE LOAMY SAND

The surface soil of Valentine loamy sand is grayish-brown or dark grayish-brown incoherent fine sand or medium sand containing sufficient organic matter to give it a loamy texture but not enough to prevent soil drifting when the native sod is destroyed. The material changes rather abruptly, at an average depth of 10 inches, to the parent material of loose incoherent fine sand or medium gray sand, which continues uniform below a depth of 6 or 8 feet. This gray sand closely resembles the sand underlying dune sand. This soil is very low in lime.

This is the dominant soil in the numerous dry valleys throughout the sand-hill section of the county. It also occurs locally on the terraces and flood plains along the Platte Rivers, and a few small areas occur throughout the uplands in the southeastern part of the county.

Areas range from flat to rolling. Many of the more nearly level areas are modified by numerous low ridges and knolls with intervening shallow depressions which give the land a rather hummocky or choppy appearance.

Valentine loamy sand, although rather extensive throughout the sand hills, does not have a high agricultural value on account of its unstableness and low water-retaining power. In general, it contains less organic matter and is less productive than Valentine sandy loam. It is, however, more coherent and drought resistant than dune sand. This land is used chiefly for pasture and hay land.

Some corn is grown in the more protected situations, but the yields are commonly low even on recently broken ground. The soil drifts badly when the native sod is destroyed, and the cornfields are usually abandoned after the second or third year.

The native grasses include fairly luxuriant growths of sand reed grass and Stipa or needle grass, together with small amounts of grama grass. These grasses yield from one-fourth to one-half ton of hay to the acre, depending on the rainfall.

LAMOURE VERY FINE SANDY LOAM

The surface soil of Lamoure very fine sandy loam, to a depth ranging from 8 to 12 inches, is very dark grayish-brown friable very fine sandy loam which appears black when wet. It contains large quantities of both silt and fine sand but little coarser-textured material. Thoroughly decomposed organic matter is abundant. The upper subsoil layer, which extends to a depth of about 2 feet, is similar to the surface soil in texture, but owing to its lower organic-matter and clay content is slightly lighter in color and is denser. The material has no definite structure but breaks into irregular-shaped angular lumps of various sizes and shapes, the vertical axes of which are usually longer than the horizontal axes. The soil is sticky and plastic when wet but becomes hard and brittle on drying. Below a depth of 2 feet the subsoil gives way rather abruptly to grayish-brown sandy clay loam containing numerous white splotches, seams, and spots of lime which give the material an irregularly mottled grayish-brown or white appearance. An incoherent mass of coarse sand and gravel is present at a depth ranging from 40 to 50 inches and continues to a depth below 5 or 6 feet.

This soil is highly calcareous. The surface soil does not everywhere contain sufficient lime to react visibly with acid, but no evidence of a deficiency of lime occurs. The subsoil has a high lime content. The organic matter, so abundant in the surface layer, decreases rapidly with depth and is practically absent below a depth of 30 inches.

This soil differs from soils of the Laurel series in the higher organic-matter content and consequently darker color of its surface layer and the larger clay content of its subsoil. The last-mentioned feature, together with a greater lime content, differentiates it from members of the Cass series.

The soil has weathered from fine-textured sediments deposited by the river during comparatively recent times. Areas are flat, and drainage is variable. The surface soil in most places is fairly well drained, but the water table lies at a slight depth and during wet seasons rises sufficiently to produce small areas of marshy land. The high moisture supply has favored the rapid growth and decay of plant life and the surface of the deposits has been greatly darkened by organic matter.

Included with mapped areas of this soil in the vicinity of Sarben in the eastern part of the county is an area of Lamoure silt loam comprising about 320 acres. This area differs from Lamoure very fine sandy loam only in the slightly finer texture of its surface and upper subsoil layers.

Lamoure very fine sandy loam occurs in only a few small areas within the bottom lands of North Platte River. The largest area extends along the Union Pacific Railroad in a narrow strip 4 miles west of Sarben. Smaller areas are east of Lemoyne and north of Keystone.

On account of its small extent, Lamoure very fine sandy loam is of little agricultural importance in Keith County. It is a naturally strong and fertile soil, however, and about 60 per cent of it, including the better-drained areas, is used in the production of corn, alfalfa, and sugar beets. The remainder is used for hay land. Wire and salt grasses comprise most of the native vegetation and seem to thrive, even on areas which have become slightly alkaline.

On account of the larger organic-matter content of this soil, crop yields are slightly higher than on Laurel fine sandy loam. The two soils have about the same sale value.

CASS FINE SANDY LOAM

The surface soil of Cass fine sandy loam is very dark grayish-brown loose fine sandy loam from 8 to 12 inches thick. The sand, of which it is so largely composed, includes all of the textural grades, but fine sand dominates. The dark color indicates a high organic-matter content. Below the surface soil the change in color and texture is abrupt, and the subsoil consists of very light grayish-brown incoherent fine sand or medium sand which contains very little organic matter. In most places this material continues without change to a depth below 5 or 6 feet, but locally it is mixed with considerable coarse sand and gravel below a depth of 36 to 40 inches. Rust-brown iron stains are numerous throughout the upper part of the subsoil but are rare in the lower part.

This soil has weathered from recent river deposits of sandy nature. Areas are flat except where locally modified by slight rounded elevations and shallow depressions. Drainage is poor, considerable areas remaining marshy during the greater part of the year.

Cass fine sandy loam occurs in a few small areas in the North Platte bottom lands and locally along South Platte River northwest of Dorty Lake. The largest area, comprising about 2 square miles, is on the north side of North Platte River in the extreme eastern part of the county.

Practically all of this soil is included in hay land. It supports a rank growth of slough grass and other water-loving grasses. Wire and salt grasses, however, are not abundant. The native grasses will yield from three-fourths to 1 ton of hay to the acre, depending on the available moisture supply.

Under artificial drainage this soil could be made to yield much higher returns than at present. Its high native-hay production, however, limits its use for grain and tame-hay crops.

GANNETT LOAMY FINE SAND

Gannett loamy fine sand consists of a loose incoherent mixture of fine sand and medium sand to a depth below 6 feet. The surface layer, to a depth of 6 or 8 inches, contains an unusually large amount of organic matter and is very dark grayish brown or black in color.

In most places the organic remains are well decomposed, but locally much fibrous material in various stages of decay is included, and the surface soil has a rather porous and spongelike structure. The organic-matter content decreases rapidly with depth, and the material below a depth of 12 or 14 inches is similar to the incoherent gray sand that underlies the dune-sand areas. The soil is calcareous above an average depth of 2 feet, but does not contain sufficient lime to react with acid in the lower part.

Areas of this soil are rather uniform in Keith County. The material may vary slightly in texture, color, and organic-matter content, and locally a 2 or 3 inch layer of bluish-gray sandy clay may be present below a depth of 3 feet.

The soil is derived from the same material as dune sand, but it has been modified by the growth and decay of vegetation. It occurs in the deeper valleys wherever the surface of dune sand has been lowered to approximately the level of the water table which underlies the sand hills. An abundance of moisture, which causes a rank growth of meadow grasses, is characteristic of it. Areas are flat or very gently undulating, and drainage is inadequate. Many of the lower areas are occupied by shallow lakes or marshes.

Gannett loamy fine sand occurs only in a few small areas in the sand-hill section of the county. Few of the individual areas exceed 160 acres in size. They are most numerous in Lonergan and Whitetail Precincts. A narrow strip of this soil borders West Birdwood Creek in the northeastern part of the county.

This is the leading hay soil of the sand-hill region, and in counties where it occurs more extensively it supplies the greater part of the hay so necessary in carrying livestock through the winter.

The native grasses consist of big bluestem, switch grass, Indian grass, wild timothy, and needle grass. These grasses yield from three-fourths to 1 ton of hay to the acre. Heavy growth of rushes and sedges displace the hay grasses in the lakes and marshes.

This soil is well suited to the production of clover and alfalfa, and the high hay yields obtained have a tendency to increase the general value of the land.

COLBY SILT LOAM

Colby silt loam is composed chiefly of very light grayish-brown loose floury silt which extends to a great depth without change. The surface soil, to a depth of 8 or 10 inches, contains some organic matter and is grayish brown or dark grayish brown in color, the shade depending largely on the configuration of the land. Areas having the darker surface soil occupy more nearly level land where erosion is not severe and conditions have been most favorable for vegetative growth. This soil is highly calcareous. The surface material does not everywhere contain sufficient lime to react with acid, but the remainder of the soil contains an abundance of lime carbonate both in finely divided form and as scattered soft concretions, specks, splotches, or fine winding threads. The last-mentioned form usually occurs along old rootlet or worm holes, either entirely filling the cavities or occurring as a film on their surfaces. Scattered rust-brown stains and soft concretions of iron oxides are present below a depth ranging from 40 to 50 inches.

This description is typical of the greater part of this soil which is, in reality, simply an eroded phase of Keith silt loam. The soil profile depends largely on the extent of erosion to which the Keith soil has been subjected. In the more nearly level areas or those most recently exposed to excessive surface wash erosion has modified or removed only the dark-colored surface layers and the remainder of the soil is the same as Keith silt loam. Colby silt loam, therefore, may contain all the layers common to Keith silt loam except the dark-colored surface layer, or it may be so severely eroded as to have lost all resemblance to the Keith soil. Where erosion is especially severe the underlying parent loess is exposed in many places. Locally the surface material has become mixed with wind-blown sands and approaches a very fine sandy loam in texture. In a few places the silt loam and very fine sandy loam members of the Colby series merge so gradually that the lines of separation on the map are purely arbitrary.

This soil has weathered from silty loessial remnants which locally cap the tertiary bedrock of the region. Surface wash has removed the dark upper layers from the Keith soils, exposing their lighter-colored subsoils. Slight weathering of the exposed material and the incorporation of small quantities of organic matter in the surface soil have resulted in the formation of the present soil.

Colby silt loam occurs only in a few long narrow strips and small irregular-shaped areas throughout Chase and Brule Precincts in the west-central part of the county. The largest area is along Brule Canyon. Tracts range from steeply rolling to hilly and are intermediate between the nearly level or undulating areas of Keith silt loam and the extremely eroded gullied and dissected areas of Colby silt loam, broken phase. The soil occurs on fairly steep slopes and moderately sharp divides between or around the heads of drainage channels.

Drainage is everywhere thorough, and on many of the steeper slopes surface wash is excessive and erosion severe. The soil material is very retentive of moisture when surface run-off is artificially controlled.

Owing to its small extent and rather unfavorable relief, Colby silt loam is not an important agricultural soil in Keith County. About 70 per cent of it remains with its native covering of grasses and is used for grazing purposes. The remainder, including the more gradual slopes, is in corn and small-grain crops. The native vegetation is composed largely of grama, buffalo, and June grasses which grow luxuriantly and afford good pasture in the spring and early summer. During the dry weather of late summer and early fall, however, the grasses often wither and can not be depended on for late grazing.

Land of this kind is handled in much the same manner as the Keith and finer-textured Rosebud soils, although greater care is taken to prevent erosion. All available barnyard manure is applied.

Accurate sale values for soil of this kind are difficult to obtain, as the land seldom occupies entire farms. The soil, however, has a tendency to decrease the general value of the farm on which it occurs, especially where the remainder of the farm is composed of the more productive Keith and Rosebud soils.

The chief needs of this soil are protection from erosion and an increased organic-matter content in the surface layers. Deep plowing and heavy applications of manure, coarse straw, or other vegetable matter are beneficial. Terracing the steeper slopes in order to check the flow of the surface waters would also decrease erosion. Incipient gullies should be filled or dammed with rubbish, straw, or other waste material in order to catch the sediment from the higher lands.

Colby silt loam, broken phase.—The broken phase of Colby silt loam includes the rougher and more severely eroded areas of Colby silt loam. The land is so badly washed and gullied as to be suited only for grazing land, whereas the typical soil includes considerable land suitable for cultivated crops where care is taken to check erosion. The surface features of the two soils, however, are not everywhere sharply defined. Small areas of the typical soil are included with areas of the broken phase in mapping.

The general relief of this soil is extremely rough and broken. It is characterized by steep gullied slopes separated by intervening narrow and crestlike divides. Soil slipping is common and many of the steeper slopes present a succession of vertical exposures locally known as catsteps. All the areas are dissected by intermittent streams that have cut deep and, in places, almost perpendicular-walled valleys. Drainage is everywhere excessive.

This soil has been formed over loessial deposits under conditions extremely unfavorable for soil development. In many places it consists of raw loess, the surface of which is only slightly stained with organic matter.

This broken land occurs only on the north table-land division in Chase and West Ogallala Precincts, chiefly on the steep escarpments bordering the northern and southern edges of the divide where the land slopes abruptly to the Platte River Valleys. The largest area extends as a narrow irregular strip from Eagle Gulch to Kelly Canyon across the heads of all drainage ways leading into North Platte River. A somewhat smaller though typical area is west of Ogallala Gulch around the heads of drainage ways leading to South Platte River. A strip comprising 3 or 4 square miles lies west of Eagle Gulch. The remaining areas are few and small.

Practically none of the soil is under cultivation. The surface in most places is too rough for cutting hay and the land is used almost exclusively for grazing purposes. It supports a good growth of grama, buffalo, and June grasses which afford pasturage for about 100 head of cattle to each section during the summer grazing season.

The preservation of the native grasses is the controlling element in the utilization of this soil. Overgrazing should be carefully avoided, as the destruction of the vegetation promotes erosion and the carrying capacity of the range may thus be reduced for many years.

COLBY VERY FINE SANDY LOAM

Colby very fine sandy loam is similar to Colby silt loam in all its profile characteristics except the texture of the surface soil layers. To a depth of 6 or 8 inches Colby very fine sandy loam contains more of the finer grades of sand and less silt than the silt loam to a corresponding depth. Southeast of Paxton on the south side of South

Platte River are two small areas in which most of the surface soil contains sufficient sand to be classed as fine sandy loam, but owing to the patchy nature of the surface textures and the small total area the soil was included with Colby very fine sandy loam in mapping.

This soil has weathered from the same loessial deposit and in the same manner as Colby silt loam. The larger sand content of its surface layer is owing chiefly to the addition and mixture of material blown from the coarser-textured soils of the county.

Areas range from steeply rolling to hilly but are not quite so rough as tracts of Colby silt loam. The divides are somewhat broader and more rounded, and in most places the slopes are more gradual than those of Colby silt loam.

Colby very fine sandy loam occurs chiefly in small scattered areas on the high divide between the Platte Rivers. The largest area is in Brule Precinct a few miles north of Brule. A smaller though typical area lies northwest of Ogallala.

On account of its small extent and unfavorable relief, Colby very fine sandy loam is of little agricultural importance in Keith County. About 50 per cent of the land is under cultivation and the rest is used for hay and pasture. The soil is suitable for all crops commonly grown on Keith silt loam and Keith very fine sandy loam. Crop yields, however, on account of the less favorable moisture supply and the lower organic-matter content of the surface layers of this soil, average from one-fourth to one-third lower than on the Keith soils.

The land is handled in about the same manner as Colby silt loam, and the methods of improvement recommended for that soil apply to this.

Colby very fine sandy loam, broken phase.—Colby very fine sandy loam, broken phase, includes those areas of Colby very fine sandy loam which are so rough and broken as to be unsuitable for anything but pasture. Erosion has removed the organic matter almost as fast as it has formed, so that the soil consists largely of light-gray or pale yellowish-gray floury calcareous loess, darkened by organic matter to a depth of only 2 or 3 inches. In many places the organic constituents have been entirely removed and the loessial deposit is exposed.

The relief is everywhere rough and broken, though not quite so rugged as in areas of Colby silt loam, broken phase. The slopes are a little more gradual, the divides, although narrow, are more rounded, and the general appearance is smoother. Stream erosion has carved the surface into an intricate system of narrow canyons and sharp ridges. Soil slipping and the development of catsteps, although present in this soil, are less pronounced than in Colby silt loam. Drainage is excessive.

The native vegetation includes the grasses which grow on the broken phase of Colby silt loam and in addition some sand grass and Stipa or needle grass.

This soil occurs only on the northern table-land, chiefly in the central and eastern parts of the division, in scattered broken strips and small areas where even the loessial material is severely eroded. The corresponding phase of Colby silt loam occurs only in the western part. The largest area is between and around the heads of O'Bryan Canyon and Ogallala Gulch in West Ogallala Precinct.

Smaller areas occur as narrow broken strips on the table-land escarpments which border the Platte Valleys and on the crest of the divide between the streams.

The selling price of this land is about the same as for Colby silt loam, broken phase. This soil, however, is usually preferred, as it generally supports a slightly heavier vegetation and has a somewhat less rugged relief. The small sand content of the surface soil seems to assist in conserving the soil moisture, and vegetation usually withstands drought a little better than on the broken phase of the silt loam. Overgrazing is equally injurious to both soils.

YALE VERY FINE SANDY LOAM

The surface soil of Yale very fine sandy loam to a depth of 3 or 4 inches is very dark grayish-brown mellow silt loam having a faintly developed finely granular structure. The second layer, which continues to a depth of 9 inches, is somewhat lighter in color and the granules are more distinct and are heavily sprinkled with gray. The surface layer is rich in organic matter, which accounts for its dark color. The third layer is slightly lighter in color and a little more compact than the overlying layers. It lies between depths of 9 and 14 inches and consists of dark grayish-brown heavy silt loam containing small amounts of clay but little sand of any grade. This horizon has no pronounced structure, and the material breaks into irregular-shaped lumps of all sizes intermixed with much finely divided material. When pulverized the soil becomes slightly lighter in color than is indicated on a natural broken face.

The chief characteristic of the fourth layer is its heaviness and compactness. It is the layer of maximum compaction and consists of grayish-brown heavy silt loam or silty clay loam from 4 to 6 inches thick. Most of it is faintly granular, the small lumps averaging about one-fourth inch in diameter. In many places, however, the material has no apparent lines of weakness but breaks into irregular angular clods of all sizes and shapes. When moist these are only moderately compact, but they become extremely hard and brittle on drying. This layer effervesces freely with acid. The carbonates occur in finely divided form uniformly mixed with the silt.

The fifth layer is decidedly lighter in color than any of the overlying layers. It is composed largely of a light grayish-brown mixture of very fine sand and silt, together with considerable clay. It is less dense and compact than the overlying layer but not so loose and friable as the three layers of the surface soil. Disseminated lime is abundant, although there is no evidence of any concentration or segregation of the carbonates. A finely granular structure is well developed in this layer, and the material breaks naturally into small subangular lumps from one-eighth to one-fourth inch in diameter. The lumps are only slightly compact and crush readily between the fingers even when the soil is dry. This layer ranges from 4 to 6 inches in thickness and lies between depths of 18 and 24 inches.

Below a depth of 24 inches the material becomes gradually lighter in color, more friable, and usually coarser in texture to a depth below 6 feet. Light-gray or very light grayish-brown loamy fine sand underlies most of the soil below a depth of 4 feet. All of the lower layers are highly calcareous, the lime being uniformly distributed

throughout the mineral constituents. The organic matter decreases with depth and only faint traces occur below the zone of maximum compaction.

Yale very fine sandy loam differs somewhat in different localities. The principal surface variation is toward silt loam and small patches having a silt loam texture are included. In a few places the zone of compaction contains considerable very fine sand and is much more friable than usual. Locally a fine or medium incoherent gray sand is present at a depth of 30 inches and continues below 5 or 6 feet. These variations, although numerous, do not occupy a large total area and are all included with the typical soil.

This soil has weathered from sediments deposited by the streams when they were flowing at slightly higher levels. Later intrenchment left the deposits as terraces or bench lands and subsequent weathering has resulted in the present soil.

The surface is flat or very gently undulating and is modified in places by slight elevations and shallow depressions. The land lies from 8 to 12 feet above the normal flow of the streams and is not subject to inundation from the main channels. Drainage is variable. The slope is usually sufficient to slowly remove the surplus surface moisture except in the lower areas where the water collects immediately after rains and disappears slowly through absorption and evaporation. Some such areas are more or less alkaline, a white efflorescence appearing on the surface of the ground during periods of dry weather. Underdrainage is poor, as the imperviousness of the compact layer greatly retards moisture penetration.

Yale very fine sandy loam occupies a few scattered and usually small areas on the lower terraces of the Platte Rivers. It is most extensive south of South Platte River. One of the largest areas, comprising about 2 square miles, occurs as a narrow strip a few miles southeast of Ogallala. A smaller though typical area is in the vicinity of Dorty Lake in the southwestern part of the county. The areas along North Platte River are few and small.

Owing to its small extent and poor underdrainage, Yale very fine sandy loam is of little agricultural importance in Keith County. Practically none of it is used for crop production, nearly all being included in pasture and hay land. The native vegetation includes rank growths of wire grass, wild rye, salt grass, joint grass, and other moisture-requiring grasses, together with a little buffalo and grama grass. These grasses will support from 70 to 80 cattle to each quarter section during the summer grazing season, or when cut for hay will yield from one-half to three-fourths ton to the acre, depending on the season. The hay obtained from land of this kind is usually coarser and has a lower feeding value than that cut from the higher terraces or uplands, but the greater yield tends, in large manner, to offset the inferior quality.

Yale very fine sandy loam is a strong and fertile soil and should be used more extensively for crop production. Although natural drainage conditions are rather unfavorable to crops, most of the land can be artificially drained where necessary. Its producing power would be greatly increased by a system of tile drainage or open ditches.

CHEYENNE GRAVELLY SANDY LOAM

Cheyenne gravelly sandy loam consists of a heterogeneous mass of light grayish-brown sand and gravel to a depth below 3 or 4 feet where it rests on the light-gray tertiary bedrock of the region. The surface soil, to a depth of 8 or 10 inches, usually contains a little more sand and less gravel and has a slightly darker color than the remainder of the soil. The entire soil, however, is everywhere low in organic matter and fairly uniform in texture. The sands are of all textural grades and the gravel consists of a great variety of waterworn crystalline rocks, together with numerous angular fragments of calcareous sandstone.

The soil material is composed of alluvial sediments that have been transported, chiefly during torrential rains, from the coarser layers of the local formations and deposited along the stream channels.

Areas are flat, but on account of the loose and open consistence of the material drainage is in most places excessive.

Cheyenne gravelly sandy loam occurs in narrow strips in the beds of intermittent drainage ways throughout the residual uplands and also as small outwash areas along the edge of the alluvial lands within the Platte Valleys. Typical areas are in several of the small gulches south of the Alfalfa Irrigation Canal, along Brule, Ash Camp, and O'Bryan Canyons, and within Eagle and Coyote Gulches. The total area of this land is small.

All the Cheyenne gravelly sandy loam is included in pasture land. The native vegetation is sparse, and the soil is not considered very valuable even as grazing land. It has a tendency to reduce the selling price of the farm on which it occurs.

SCOTT SILT LOAM

The surface soil of Scott silt loam to a depth of 4 or 5 inches is dark grayish-brown heavy silt loam, which contains considerable organic matter, some clay, and some very fine sand. The clay is evenly distributed and the surface layer is seldom dense. It does not seem to have any definite structure but cracks irregularly. Between a depth of 5 and 18 inches the material averages slightly more compact. The clay seems to be somewhat segregated and the structure particles contain a heavy gray coating which is noticeable when they are dry.

The third layer is the one of maximum compaction. It lies between depths of 18 and 34 inches and consists of steel-gray silty clay or clay. It is extremely compact and resembles a claypan in all physical characteristics. It may be either massive and structureless or may break naturally into large irregular prismatic clods, the units of which retain the prismatic form and seldom exceed one-half inch in diameter. Most of these clods have a sprinkling of gray material on their surfaces, but practically no color change occurs in the material of this layer when it is pulverized, which probably indicates that the dark organic matter is thoroughly mixed with the mineral constituents of the soil.

Below a depth ranging from 34 to 40 inches the organic matter decreases rapidly and the subsoil becomes lighter and more friable.

Rust-brown specks of iron occur in this layer, but it is generally leached of its carbonates. It ranges from 6 to 18 inches in thickness and is underlain in most places by the parent material which may be either loess or tertiary sandstone.

Scott silt loam occupies numerous shallow basinlike depressions, locally known as " buffalo wallows " or " lagoons," scattered throughout the finer-textured upland and terrace soils of Keith County. Most of the areas are small, comprising only a few square rods. Few of them exceed 40 acres in size. Drainage is poor and in the spring after heavy rains water often stands on the surface of the depressions for several weeks.

On account of its poor drainage conditions, Scott silt loam is not used for crop production. The native vegetation includes sedges, rushes, and other water-loving plants, with prairie grasses around the margins of the areas. The land has some value for hay and grazing purposes. Most of the areas within cultivated fields are regarded as waste land.

A few areas of this soil are favorably situated for artificial drainage, but the expense involved in drainage is seldom warranted by increased crop returns.

DUNE SAND

Dune sand is gray or grayish-yellow incoherent fine sand or medium sand which extends to a great depth with little or no change in texture. The surface soil, to a depth of 4 or 5 inches, contains some organic matter but not enough to prevent soil drifting when the sod is broken. The material is fairly retentive of moisture, considering its porous consistence and sand texture. It is very low in lime.

Dune sand is rather uniformly developed throughout the area of its occurrence in Keith County. Locally the material contains more silt, clay, and organic matter than typical, owing probably to more favorable conditions for weathering or vegetative growth and decay. The loamier areas have a thicker grass covering than most of the dune sand and therefore a greater grazing value.

Areas range from sharply rolling to hilly. The loose sand is piled into dunes from 20 to 60 feet high. Blow-outs are common, most of them occurring on the northwest side of the dunes. The material contains less organic matter, is less stable, and has a lower grazing value than the Valentine soils. At present, however, a negligible part of it is subject to active wind erosion. No continuous waterways run through dune sand areas, but the rainfall is rapidly absorbed and there is seldom any run-off even on the steeper slopes.

Dune sand occupies about one-third of Keith County. It is the dominant material north of North Platte Valley and represents a part of the vast sand-hill region of western Nebraska. Small scattered outliers occur south of North Platte River and on the tablelands in the extreme southeastern part of the county.

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, mainly to corn. The yields are poor, especially after the first year, and the field is soon abandoned. Practically all the land is used for pasture land, though

some hay is cut on the smoother areas. The native vegetation includes a great variety of grasses, of which long-leafed reed grass, redfieldia, and Stipa are the most common. These grasses will maintain from 60 to 90 head of livestock on each square mile during the summer grazing season.

The preservation of the native grasses is the foundation of the only industry to which dune sand is suited. The surface is generally well sodded. Owing to the control of prairie fires and the care taken to prevent overgrazing, the grass has materially improved in most parts of the sand-hill region during recent years. As dune sand loses its stability under cultivation, no attempt should be made to use this land for crop production.

RIVER WASH

River wash occurs as numerous sand flats, islands, and bars within and bordering the channels of the Platte Rivers. The areas, although numerous, are small, few of them exceeding 10 acres in size, and the total area of this material slightly exceeds 2 square miles. The surface lies but a few feet above the normal flow of the rivers and is subject to frequent inundation.

River wash is not permanent; the material undergoes change with each overflow, and even during normal flow the sandy deposits are shifted about, added to, or removed by the varying current. They are also modified to some extent by the wind. River wash supports a scant vegetation of grass and willows and is all included in pasture land. As it is undergoing changes from weathering, the more stable areas will ultimately develop into soils similar to other bottom-land soils.

SUMMARY

Keith County is in southwest Nebraska adjoining the northeast corner of Colorado. It is rectangular in shape, the longer dimension extending east and west. It includes 1,085 square miles, or 694,400 acres. The county represents a part of a former smooth plain sloping gently eastward from the Rocky Mountains. Stream and wind erosion have greatly modified the surface of the old constructional plain in Keith County, however, resulting in three major upland divisions separated by the broad valleys of North Platte and South Platte Rivers. The two southern divisions, with their flat or gently rolling surfaces, are tablelike remnants of the former plains which lay on both sides of South Platte River. The land on the escarpments leading into the river valleys is thoroughly dissected. The northern upland division is north of North Platte River and includes about 40 per cent of the county. It is a part of the vast sand-hill region of western Nebraska. The surface ranges from nearly level to hilly and dunelike. The alluvial lands, including the terraces and flood plains, occupy broad continuous strips from 1 to 4½ miles wide along the Platte Rivers. They have flat or gently undulating surfaces and lie about 200 feet below the general level of the uplands.

Keith County has an average elevation of about 3,400 feet above sea level. The general slope is toward the east. Drainage is effected through North Platte and South Platte Rivers and their tributaries.

Keith County was organized in 1873. Ogallala, the county seat and largest town, had 1,062 inhabitants in 1920.

The climate is suited to the production of grain and hay crops without rigid adherence to dry-farming methods. It is also well adapted to livestock raising. The rainfall is usually very favorably distributed. The average length of the frost-free season is 130 days.

The present agriculture consists of diversified farming, including the production of grain, hay, and livestock, except in the sandier or rougher areas. The chief crops are corn, wheat, oats, barley, wild hay, and alfalfa. The livestock includes cattle, hogs, horses, and poultry.

Keith County is in that part of the United States where climatic influences, particularly those relating to the moisture supply, have been the controlling factors in determining the character of the soils. The most obvious characteristic of the soils here is the dark but not black color of the surface soils. A second characteristic is the accumulation of lime in the lower part of the subsoil. The moderate rainfall has not leached the carbonates from the entire soil section except in the more sandy areas, and they have accumulated at the lower extremity of moisture penetration. These two common characteristics, being persistent in all the soils which have been subjected to undisturbed weathering for long periods of time, may be regarded as indicative of soil maturity for this region. The loose drifting sand of the dune sand areas, the stationary Valentine soils, and the severely eroded upland soils have not developed these characteristics and are immature.

Differences in the character and mode of accumulation of the parent materials have also exerted a strong though less important influence than that of climate, surface relief, and drainage in determining the character of the soils. The loessial materials, which are fine-textured silts, have weathered into the Keith and Colby soils. The sandy tertiary bedrock of the region has given rise to soils of the Rosebud, Dawes, Valentine, and Gannett series as well as to extensive areas of dune sand. The alluvial materials, composed of sediments deposited as valley terraces and flood plains by the streams, have weathered into the Yale, Tripp, Bridgeport, Cheyenne, Laurel, Lamoure, and Cass soils.

Rosebud loam and Rosebud very fine sandy loam are similar to soils of the Keith series except in the higher gravel content, slightly less even topography, and the rocklike character of the parent formation from which they have weathered. They are very strong and fertile and adapted to all crops common to the upland soils of the region.

The Dawes soils have a heavy compact layer in the upper part of the subsoil differing in this respect from members of the Keith and Rosebud series. They occupy the flatter and, in many places, slightly depressed parts of the table-lands where conditions have favored an excessive accumulation of fine material in the subsoil.

Members of the Colby series occupy the more severely eroded areas of loessial materials which locally cap the table-lands. They are very low in organic-matter content and prevailingly light in color. These features differentiate them from the darker-colored soils of the Keith series.

The Valentine soils are composed largely of sand which has become stable and accumulated some organic matter in its surface layers. They are suited chiefly for grazing purposes.

Scott silt loam occupies small basinlike depressions or buffalo wallows throughout areas of finer-textured upland soils. It has developed an extremely dense, claypanlike layer in the subsoil and is poorly adapted to cultivated crops.

Gannett loamy fine sand occurs only in the wet valleys in the sand hills. The excessive moisture content has caused a rapid vegetative growth and decay, so that the surface layers are very dark in color. The subsoils are composed of the same loose incoherent sands which underlie dune sand.

The Tripp soils occupy well-drained terraces along the Platte Rivers. They are fine textured throughout, very fertile, and have a high moisture-retaining power. Part of these soils are under irrigation.

The soils of the Bridgeport series occupy gentle colluvial slopes and gently sloping terraces. They are of comparatively recent origin and have not weathered sufficiently to have developed a layered or zonal profile such as is present in members of the Tripp, Rosebud, Keith, and Dawes series. The coarser-textured soils of the Bridgeport series have low water-retaining powers and are considered rather droughty.

Cheyenne gravelly sandy loam is composed of a light-gray heterogeneous mass of coarse sand and gravel. It occupies narrow strips in the channels of intermittent drainage ways. The land supports a scant vegetative covering and is of little value even for grazing.

The Laurel, Lamoure, and Cass soils occupy bottom-land areas. They are not subject to overflow from the rivers, but the underlying water table lies near the surface, and in wet years rises sufficiently to produce small areas of marshy land. The subsoils of the Laurel and Cass soils are sandy or gravelly, whereas those of the Lamoure soils are fine textured and retentive of moisture.

River wash and dune sand are not classed in any soil series. River wash occupies small sand bars and islands along the Platte Rivers, and dune sand is the dominant material in the sand-hill region.

[PUBLIC RESOLUTION—No. 9]

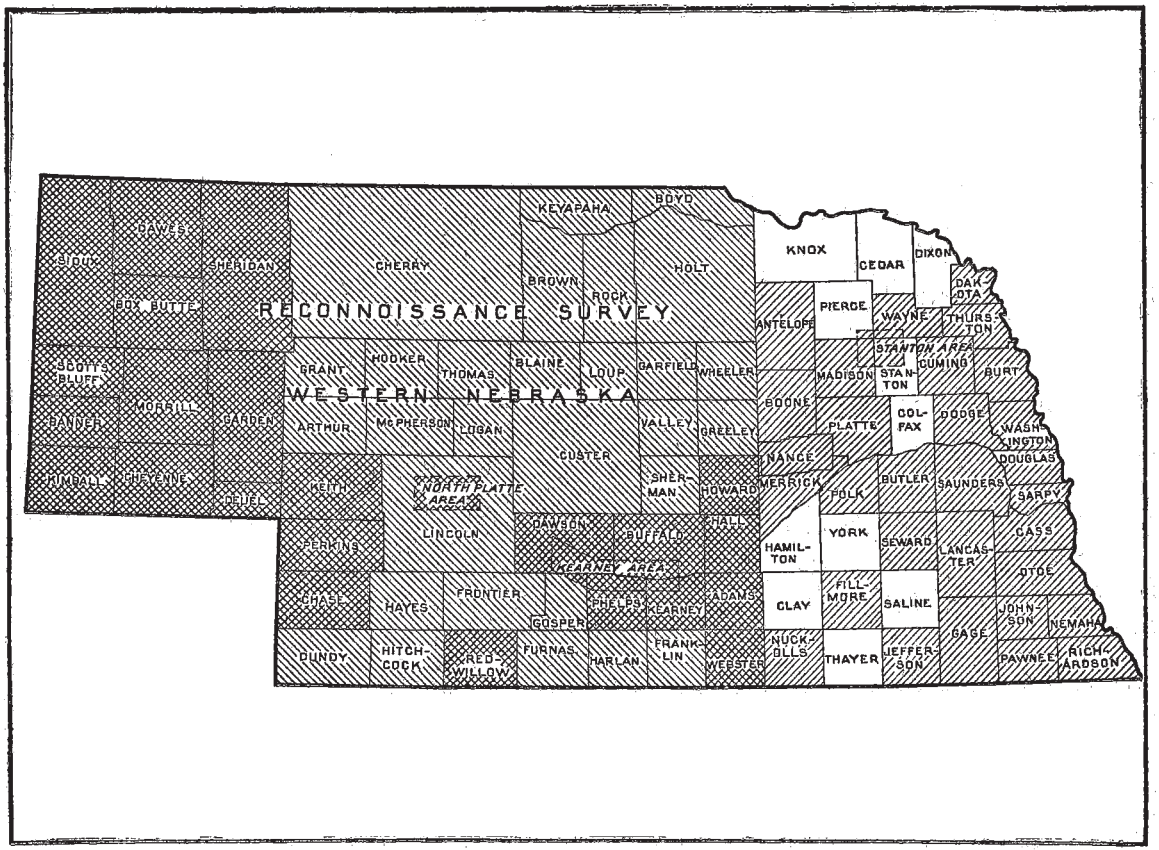
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

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.]



Areas surveyed in Nebraska, shown by shading

U. S. GOVERNMENT PRINTING OFFICE: 1930

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