SOIL SURVEY OF SIOUX COUNTY, NEBRASKA.

By W. A. ROCKIE, In Charge, and C. E. DEARDORFF, of the U. S. Department of Agriculture, and L. H. BRITTON and L. S. PAINE, of the Nebraska Soil Survey.—Area Inspected by THOMAS D. RICE.

DESCRIPTION OF THE AREA.

Sioux County lies in the extreme northwestern corner of Nebraska, with Wyoming bordering it on the west and South Dakota on the north. On the east are Dawes and Box Butte Counties, and on the south Scotts Bluff County. The included area is 2,055 square miles, or 1,314,200 acres.

The county lies in the High Plains division of the Great Plains region. Approximately half of its area is a more or less eroded table-land which stands at an elevation approaching that of the original constructional plain. The table occupies the southern three-fifths of the county, with the exception of the southwest corner, which has been cut off by the North Platte Valley. The topography of the table varies from sharply rolling to gently undulating, depending upon the extent to which erosion has cut back into the plain. There are no flat areas, such as occur in the counties to the east, where the original surface has entirely escaped erosion. The northern edge of the table is a deeply dissected northward-facing escarpment known as Pine Ridge. From the foot of Pine Ridge, a broad lowland area of low relief stretches northward into South Dakota and northeastward into Dawes County. All this lowland area below and north of Pine Ridge except the southeastern part, which is a part of White River Basin, is known as Hat Creek Basin.

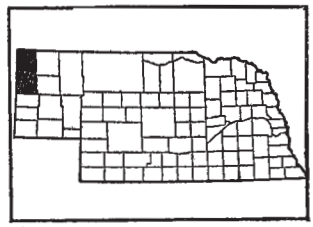

FIG. 40.—Sketch map showing location of the Sioux County area, Nebraska.

The valley of the Niobrara River, which extends from west to east across the county, is deeply intrenched below the general upland level and divides the table-land into two distinct divisions. The north and south tables are known as the Dawes and Box Butte Tables, respectively. In the southwestern part of the county the table-land breaks less abruptly to the terrace lands of the North Platte Valley. From these rough valley sides the gently sloping terrace lands drop in successive levels, together with the constant slope of the terrace sur-

face, toward the North Platte River in Scotts Bluff County. Occasional residual hills stand above the general terrace level.

The topography of Hat Creek Basin, which occupies the northern part of the county, varies greatly in different parts of its area. Along the foot of Pine Ridge is a long, uniform north slope, with a gradient generally less than 10 per cent. Permanent and intermittent northward flowing creeks, in ravines from 20 to 100 feet deep, break the continuity of this slope land at short intervals. These slopes are generally deeply covered with soil, except where cut by a canyon or draw draining northward from Pine Ridge. Along these steep-sided, severely eroded draws bedrock outcrops—the Arikaree formation at the higher elevations and the Brule at lower levels. Narrow alluvial bottoms and some wide terraces occur along the largest of these creeks. The areas of Brule outcrop are frequently eroded into Badlands topography.

With increasing distance from Pine Ridge, these slopes are less uniformly northward, but are more thoroughly dissected by drainage channels transverse to the course of these larger creeks. Occasional residual buttes and knobs of Arikaree or Brule material rise 25 to 100 feet above the general level of the adjoining basin lands, their tops possibly uneroded and having cultivable areas, their sides being either Rough broken land or Badlands, or a near approach to these types.

About 4 to 6 miles from the base of Pine Ridge, the hills just described give way to gravel points, ridges, and knobs. These gravels and sands are the remnants of a thin bed of sand, gravel, and clay which underlies the Brule formation, and is known as the Chadron formation. Low knobs of this gravelly deposit are scattered northward to and beyond the South Dakota boundary. The Pierre clay land, with its characteristic topography, covers practically the entire area lying more than 6 to 8 miles north of Pine Ridge, except for these gravelly and sandy knobs.

The uneroded surface of the Brule formation is characterized by long, smooth slopes and flats; these are interspersed with Badland areas. North of this Brule area a very marked topographic change occurs. Here begins a monotonous succession of rolling or waving hills, usually with a relief between ridge and draw of 25 to 75 feet. Short, steep slopes are occasionally encountered, but generally the continuous gentle slopes prevail.

The creeks from Pine Ridge have joined to form larger, but fewer, valleys, along some of which terraces a mile or more in width occur. The creek channel is usually intrenched from 10 to 20 feet below these terraces, generally with little or no alluvial bottom. Hat Creek is the only permanent stream in the lower part of the basin. Many flowing creeks enter the basin from Pine Ridge, but soon become dry.

Only a few small, irregular drainage channels of the White River Basin extend into Sioux County. Conditions here are practically the same as in the Hat Creek Basin, except that these several creek watersheds do not all have the conditions described in the basin to the northwestward.

Pine Ridge—the northern escarpment of the table-land that covers the central part of the county—is a very distinct topographic feature. It enters the county from the west about 10 miles from the northern boundary, extends generally in an east-southeasterly direction to the Dawes County line just west of the city of Crawford, then swings back into Sioux County around the head of White River, and leaves the county about 10 miles southwest of Crawford. extending northeasterly through Dawes County.

This escarpment has a drop of 300 to 500 feet at the western border of the county and from 700 to 900 feet in the eastern part. The precipitous portion is from nearly half to nearly two-thirds of the total drop.

Pine Ridge is usually steepest near the top, merging from the steep, dissected topography into the broad residual-colluvial slopes along its base. Though developed in the plains this ridge has a mountainous topography. Erosion has carved the escarpment into numerous ridges and canyons, each with its individual topographic peculiarities. The surface ranges from cliffs to steep slopes with a few small included areas of rather smooth land, these latter generally having only a shallow soil cover. Pine Ridge is the largest area of rugged land in Nebraska.

Dawes Table extends from Pine Ridge southward to the Niobrara Valley. It has a normal general slope south-southeastward, although this is usually quite imperceptible to the eye. Here and there are local isolated areas of table-land which have escaped severe dissection, but almost all parts of this area are broken by draws or canyons. Drainage northward and eastward has lowered the northeastern border of the table, and has, in places, severely eroded a considerable proportion of the entire upland area. This is particularly true of the Soldiers Creek and White River watersheds, where drainage has reduced Pine Ridge from its usual precipitous character to a gentler topograhpy, a long, sloping drop several miles in length.

The headwaters of this northeastward drainage mark the north line of the relatively undissected part of Dawes Table, which, from this divide, slopes southeastward and southward. Draws extending to the south and southeast are shallow at first, but constantly become more deeply intrenched below the upland. The entire table becomes increasingly rugged southeastward, reaching a ruggedness approximating that of Pine Ridge in the rougher parts of the "Niobrara

breaks," which form the southern border of the table. Thus broad rolling ridges and wide undulating depressions, all somewhat broken by lines of southerly drainage more or less deeply cut, characterize this table. Occasional rock outcrops occur throughout all parts of the area, but become increasingly numerous and important in the areas of greatest relief.

The valley of the Niobrara River lies from 400 to 600 feet below the adjoining uplands, usually with very abrupt "breaks" or valley sides. The valley floor generally ranges in width from one-fourth to three-fourths mile, in places broadening out to more than a mile. The valley sides are very much broken by tributary draws, resulting in an irregular valley outline. The valley proper usually consists of very narrow first bottoms, slightly above the stream level, bordered by alluvial terraces of much greater width, extending back to the valley sides. Residual-colluvial slopes sometimes separate the steep valley sides from the terraces in the valley. Local dissection has resulted in some portions of the valley slopes along the Niobrara River becoming very inaccessible areas of rugged topography, with intervening areas of lower relief.

Whistle Creek, which drains into the Niobrara from the south, has similar conditions of smaller extent. Narrow terraces and flood plains extend for several miles along this valley.

Box Butte Table is the largest physiographic unit in Sioux County. It occupies the entire area south of the Niobrara Valley to the North Platte Valley in the southwestern corner of the county. Box Butte Table here is very unlike the table as it occurs in Box Butte County.

Along the north and south borders of the table the drainage toward the adjoining valleys has considerably dissected the upland. Whistle Creek, a tributary of the Niobrara River, in the northeastern part of this table, and Sheep Creek, a tributary of the North Platte River, in the southwestern part, have developed local areas of rough topography within the table-land area. Drainage usually penetrates but a short distance into the upland, much of the table being practically without surface drainage. Near the east line of the county surface drainage becomes a prominent feature, the headwater channels of Snake Creek being slightly intrenched below the general level.

The Box Butte Table, as it occurs here, consists of undulating to gently rolling swells, having a general southeasterly trend, with a belt of sand hills of intermittent occurrence extending across the area from northwest to southeast. Occasional rock outcrops in various parts of the area give rise to numerous rugged sharp points or hills.

The area of sand hills includes all land phases characteristic of such areas. Here are some of the most rugged dune areas of Nebraska. Dry valleys separate the various Dunesand areas, a "shoestring" occurrence of this type frequently resulting.

The North Platte Valley borders the Box Butte Table on the southwest. The "breaks" from the table to the valley are usually abrupt, a drop of from 200 to 500 feet generally occurring within a distance of less than a mile. The valley, as it occurs within Sioux County, consists of a series of southward-sloping terraces or terrace like slopes, the upper edge, which adjoins the "breaks," being from 200 to 300 feet above the river and approximately 10 to 20 miles distant from the stream. Occasional terrace escarpments parallel the valley course, these varying individually from 5 to 75 feet in height.

Residual hills are scattered rather irregularly through parts of the terrace area. Drainage which has developed since the formation of these valley slopes has intrenched itself to a depth of from 10 to 75 feet. This drainage leads southward toward the North Platte River. The surface of this broad terrace land is usually a gentle south slope of uniform character. Sand dunes occur over small areas.

The various parts of the county have a wide range in altitude. The table-land is the highest, generally ranging from about 5,000 feet in the northwestern corner of this upland to 4,500 feet in the southeastern corner of the county, with a general slope to the southeast. The land in the North Platte Valley, in the southwestern corner, has a minimum elevation of slightly more than 4,000 feet.

Along the base of Pine Ridge Hat Creek Basin has an elevation of from 4,000 to 4,500 feet. From this higher edge the basin slopes gently toward Ardmore, just outside of the county, which has an elevation of 3,553 feet. The elevation where White River leaves Sioux County, west of Crawford (Dawes County), is approximately 3,800 feet.

The Hat Creek system drains about 450 square miles in the northern part of Sioux County. The White River system drains about 290 square miles in the northeastern part. The Niobrara River, which crosses the table-land of the county, drains about 600 square miles. Snake Creek, which rises in the southeastern part of the county, drains about 180 square miles, though this estimate includes a considerable area which consists dominantly of sand dunes without surface drainage. The Platte River and its immediate tributaries drain about 530 square miles of Sioux County.

Drainage ways are numerous in all the lowland areas of the county, very numerous in the rougher areas, less frequent on the undulating to hilly table-land, and quite lacking in the area dominated by the sand hills. Some table-land areas have drainage ways only at intervals of several miles, although drainage of these areas is very good, because of the sandy character of the soil. Many farms and ranches are entirely separated from a surface drainage system.

These several drainage systems have valleys of varying depth. Hat Creek and White River and their tributaries have eroded the

entire northern part of the county from 600 to 1,000 feet below the prevailing upland level. The Niobrara River is intrenched from 400 to 500 feet below the adjoining table, the Snake River generally less than 100 feet. The North Platte Valley lands are from 500 to 1,000 feet below the upland. In general, the drainage is still cutting down, especially in the more dissected parts of the upland. Water gradients are generally high.

The total amount of running water in the county is very low. The larger canyons draining Pine Ridge have permanent streams, although these generally become dry within a few miles. Hat Creek is a permanently flowing stream for several miles before it leaves the county. Soldiers Creek and White River are the only other permanent streams north of Pine Ridge. Many springs, which flow only a short distance, occur along most of the canyons in Pine Ridge. The Niobrara River is a small stream throughout its course across the county, and receives very little additional volume from tributaries or springs. Good springs at Agate and along Whistle Creek are well known.

The Dawes and Box Butte Tables are entirely without natural surface-water supply. Along the south escarpment of the Box Butte Table, and still lower on the terrace lands of the North Platte Valley, are numerous springs, although they occur much less frequently than along Pine Ridge. The Flowing Well, East Springs, Wind Springs, Spottedtail Springs, and Mud Springs are among the best known. Sheep and Spottedtail Creeks, and several others which are augmented by seepage water from the irrigation canals, are the flowing streams in this part of the county. The Interstate Canal and numerous laterals flow throughout the irrigation season.

Floods are infrequent and generally occur during the summer season immediately following heavy showers.

Sioux County, organized from unorganized territory in 1877, was given its present area in 1885. Settlement which had then barely begun in the region was retarded by Indian troubles during the greater part of the following decade.

In 1910 the population of the county was 5,599, of which 91 per cent consisted of native white persons and 9 per cent of foreign born. The population in 1920 was 4,528. The principal foreign nationalities represented are German, Danish, Swedish, Irish, and Russian. The Russian population has increased greatly since 1910, with the development of the sugar-beet industry in the North Platte Valley. The entire population of the county is classed as rural, and averages a little more than two persons to the square mile. The most densely populated area is below the Interstate Canal, in the southwestern part. All of the cultivable lands along Pine Ridge, including the table-lands along the summit and the lowlands along its base, have a

greater than average number of settlers to the square mile. In the vicinity of Canton and Curly is another center of settlement. The population in other parts of the county is very sparse.

Harrison, the county seat, is in the north-central part of the county. It had a population in 1910 of 186 and in 1920 of 401. It is on the Omaha-Casper line of the Chicago & North Western Railway and serves as the trading center for most of the northern half of the county. Andrews and Glen are railway stations east of Harrison, Orella is a station on the Chicago, Burlington & Quincy Railroad in the northeastern part of the county. Montrose and Story are inland post offices in Hat Creek Basin. Agate in the Niobrara Valley, and Ashbrook, Canton, Curly, and Aldine on the table-land, are inland ranch post offices in the south-central part of the county.

The Chicago & North Western Railway between Omaha, Nebr., and Lander, Wyo., crosses the county from east to west. The main line of the Chicago, Burlington & Quincy Railroad between Lincoln, Nebr., and Billings, Mont., extends diagonally across the northeast corner of the county. A branch line of the same road between Bridgeport, Nebr., and Wendover, Wyo., crosses the extreme southwest corner of Sioux County. A spur line built especially for hauling sugar beets is being extended into the Dutch Flats country from Mitchell.

Marketing facilities are generally not so good as in any of the adjoining counties. For the northwestern, south-central, and southeastern parts, these facilities are very poor. The areas immediately adjoining the two railways in the northern part of the county and the irrigated areas in the southwestern corner of the county are well situated in this respect. The more distant inland areas market some grain and other crops at Harrison; at Crawford, Belmont, and Marsland in Dawes County; at Hemingford and Alliance in Box Butte County; and at Scottsbluff, Mitchell, Morrill, and Henry in Scotts Bluff County. Ardmore, S. Dak., on the Chicago, Burlington & Quincy, is the market for the extreme northern part of the county. Van Tassel, Wyo., on the Chicago & North Western Railway, is a market for some farmers near the Wyoming line. Stock in Chicago & North Western territory is usually marketed at Omaha, while that in Chicago, Burlington & Quincy territory is divided between Omaha, Denver, Kansas City, and St. Joseph. The wagon roads are generally poor. Many roads once laid out along section lines over rough hills or through very sandy areas have been given little care, and in some cases have been abandoned. Section-line roads prevail in the irrigated section of the North Platte Valley. Well-kept graded roads are becoming common in this section.

CLIMATE.

The climate of Sioux County is typical of the High Plains country, being characterized by wide temperature variation, low rainfall, abundant sunshine, and free wind movement. The winters are fairly long and cold, and the summers have warm days and cool nights. Conditions become increasingly dry from east to west, so that most of the county is probably slightly less favorably situated as regards rainfall than the accompanying precipitation data for Fort Robinson, in the western part of Dawes County, would indicate.

About 75 per cent of the mean annual rainfall of 16.94 inches normally occurs from April 1 to September 30, and about 50 per cent occurs during the three summer months. June has the greatest precipitation. The rainfall varies greatly from year to year. In the year of lowest recorded rainfall (1897) less than 6 inches fell during the growing season, and only 10.49 inches during the year. In the wettest recorded year (1892) the rainfall during the growing season was more than 20 inches, and for the entire year 32.34 inches. The summer rains generally occur as thunderstorms, frequently with hail, which may seriously damage crops in narrow, local belts. About 2 feet of snow falls in an average winter.

The mean annual temperature, according to the records of the Weather Bureau, is 46.4° F. January is the coldest month, with a mean of 22.8° F., and July the warmest, with a mean of 71° F. The lowest recorded temperature is —37° F. in February and the highest is 106° F. in July. The average date of the last killing frost in spring is May 14 and of the first in the fall, September 20. This gives 128 days for the average frost-free growing season, which restricts somewhat the kinds of crops that can be grown. These figures are representative of the lowland areas. The table-lands probably have a slightly shorter season, though definite records to show this are not available. The latest recorded killing frost in the spring occurred on June 9 and the earliest in the fall on August 25.

The prevailing winds are from the northwest in winter and from the southwest in summer. Tornadoes occur very infrequently. The records give 205 clear, 72 partly cloudy, and 88 cloudy days per average year.

The climate is not always favorable to the production of crops, but better adaptation to conditions as they exist is seen with each succeeding year. The rainfall is generally sufficient to produce a fair yield, and better selection and development of varieties will improve the crop prospects of the region. Agriculture is already on an established basis, with mixed farming and stock raising the most commonly accepted type.

The following table gives climatic data compiled from the records of the Weather Bureau station at Fort Robinson in Dawes County:

Normal monthly, seasonal, and annual temperature and precipitation at Fort Robinson, Dawes County.

[Elevation, 3,764 feet.]

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1897).	Total amount for the wettest year (1892).
	°F.	°F.	°F.	Inches.	Inches.	Inches.
December	26.7	70	−28	0.72	1.30	0.50
January	22.8	74	−32	.61	1.90	1.56
February	23.2	72	−37	.82	T.	.19
Winter	24.2	74	−37	2.15	3.20	2.25
March	33.1	89	−25	1.15	.50	.56
April	46.2	92	2	1.76	.40	3.93
May	54.6	96	7	2.69	.65	5.02
Spring	44.6	96	−25	5.60	1.55	9.51
June	64.8	104	31	2.74	1.49	11.91
July	71.0	106	32	1.99	3.60	1.64
August	69.8	103	28	1.63	T.	1.94
Summer	68.5	106	28	6.36	5.09	15.49
September	60.5	100	9	1.18	T.	.28
October	47.9	94	− 3	1.29	T.	4.74
November	35.7	81	−18	.36	.65	.07
Fall	48.0	100	−18	2.83	.65	5.09
Year	46.4	106	−37	16.94	10.49	32.34

AGRICULTURE.

Until 1876 the area now in Sioux County was included in the Sioux Indian Reservation. From that time until 1885, when Sioux County was finally organized, the region was almost entirely given over to grazing. Some land was cultivated after 1880, mainly for domestic supplies of corn, oats, and potatoes. In 1885, and for several years thereafter, the most valuable ranch sites were homesteaded. The valley lands and the better lands near Pine Ridge were the first to be taken. Settlement was retarded, however, by Indian uprisings, which lasted until about 1895. Even after these had subsided there was little increase in population, until with the passage of the Kincaid law in 1904 the great wave of settlement took place. Until the year 1910 settlement continued at a rapid rate over the greater part of the county. A series of dry years followed 1910, however, result-

ing in a decline of population in certain parts of the area. The rapidly increasing settlement of southwestern Sioux County on the Government-irrigated lands in part offset this loss.

Agriculture in Sioux County to-day is rather varied in character. In the southwestern corner crops are very successfully grown with the aid of irrigation. Above the irrigation ditch are similar lands, used for dry farming and for grazing. The table-lands, chiefly used for grazing but with considerable dry farming, occupy the central portion of the county. The sand-hill areas, entirely given over to grazing, occupy parts of this table-land. The valley of the Niobrara River has irrigated and subirrigated valley lands and much grazing land. Pine Ridge is chiefly grazing land, but there are many farms along its base and extending out onto the lowlands, though only for a few miles. The major part of the lowlands extends beyond this farmed area, with only an occasional ranch base along some one of the several creeks. These lands are used chiefly for grazing and less commonly are cultivated, either with or without irrigation.

The irrigated lands of the North Platte Valley are chiefly devoted to alfalfa, sugar beets, small grain, corn, and potatoes. Alfalfa is the leading crop and is either pastured or cut for hay to be fed on the ground or sold. Many cattle and sheep are fed on these farms during the winter. Sugar-beet acreages will be much greater in 1920 than heretofore, because a railroad spur now in course of construction will give added facilities for transportation. The beet tops furnish much stock feed. Wheat ranks first among small grains in the irrigated section, but it is decreasing in favor. Corn is rather widely grown, considering the short growing season which prevails here. Potatoes are rapidly increasing in acreage in this area and promise to become one of the leading crops. They give the largest returns of any crop grown, sugar beets occupying second place. Dairy and beef cattle, hogs, and sheep are being raised in increasing numbers in this irrigated section. Much winter feeding of range stock is done.

Agricultural conditions in Sioux County are changing with such rapidity that the relative acreages and relative values of the several leading crops are but temporary. Some conditions which were true of the county in 1910 are entirely changed to-day.

In 1917, according to the report of the Nebraska State Board of Agriculture, alfalfa had the largest acreage of the cultivated crops, with 13,831 acres. This increased to 19,670 acres in 1918 and to 23,816 in 1919. The acreage of this crop is increasing, especially in the southwestern corner of the county. It is grown almost entirely on irrigated lands, along the base of Pine Ridge and along the White and the Niobrara Rivers, but chiefly in the North Platte Valley. Very little of the hay is sold, except in the North Platte Valley, where

most of the farmers grow a surplus and sell it to stockmen, either to be fed on the ground or hauled to feed lots near by. Some alfalfa is shipped to more distant markets.

Wheat, which had 12,563 acres in 1919, has greatly increased in acreage since the last census. It is second in acreage among the cultivated crops. The average wheat yield ranges from 12 to 15 bushels per acre without irrigation. Irrigated wheat generally yields from 25 to 35 bushels per acre. Spring planting of this grain is the general practice.

In 1919 oats ranked third in acreage, with 7,176 acres. In 1909, according to the United States census, 11,675 acres of oats were grown. This crop is all used locally for feeding stock. Irrigated oats generally yield from 20 to 40 bushels per acre, dry-land oats from 12 to 20 bushels.

Corn occupied 6,943 acres in 1919 and 7,124 acres in 1909, and is fourth in acreage. No corn is shipped from the county; on the contrary large amounts are annually imported from the corn belt. Average annual yields range from 12 to 25 bushels per acre on the best dry lands. Irrigated corn yields from 20 to 40 bushels.

Irish potatoes are rapidly increasing in importance in Sioux County, especially on the irrigated lands of the North Platte Valley, where the sandier soils are well suited to the crop. According to the Nebraska State Board of Agriculture, 4,302 acres were grown in 1919. The average yield in that year was 130 bushels per acre. Yields exceeding 500 bushels per acre were obtained in 1919 on irrigated land. Rye is an important crop, with 4,116 acres in 1919. The average yield that year was 10 bushels per acre. Most of the rye is shipped out of the county. Barley is a relatively unimportant crop, occupying 2,131 acres in 1919. The average yield for the county was 18 bushels per acre. High yields are reported from irrigated fields. The acreage of sugar beets is annually increasing. In 1919 Sioux County had 2,025 acres of the crop, all in the North Platte Valley. Yields average slightly less than 10 tons per acre.

According to the 1910 census, about 51,000 acres were given to the production of hay and forage other than alfalfa. Of this acreage about 36,000 acres was in native grasses, yielding from one-fourth to three-fourths ton per acre. Practically all this hay is fed locally to range stock. Cultivated grass and forage crops yield from one-half to 2 tons on dry lands and from 2 to 4 tons under irrigation.

Fruits and vegetables are grown to a very small extent. The cool, dry climate is not favorable to fruit production.

Sioux County is peculiarly well adapted to the production of live stock. A sufficient proportional area of cultivable lands to grow feed for wintering stock exists in nearly all parts of the county outside of the irrigated section of the North Platte Valley. Most

of the farms have more pasture than farm land. The intensively developed North Platte Valley needs the range stock to maintain its productivity and to use its crops. Most of Sioux County is best suited to grazing. The rougher lands are better suited to grazing than are the smoother lands. The cured grasses possess practically the same nutritive value as grasses in the growing season.

The rougher land possesses several advantages, such as natural shelter from snow and from wind, earlier grass in the spring on sheltered slopes, more lands, and feed drifted or melted bare of snow during and after severe winter storms. The rough and the smooth lands combine very well, the smoother lands being used for summer pasture, the rougher areas for winter grazing. Water supplies for stock are readily obtained from wells over most of the county, except in the northern part, where the Pierre shales are exposed. The inadequate water supply in the latter area is a hindrance to the development of the grazing industry. Those areas having natural springs, notably the Pine Ridge area, are especially well suited to use as pasture.

Live-stock production is the most important industry in Sioux County. The value of live-stock products in 1910 exceeded the value of all cultivated crops combined. Cattle raising and horse raising lead. The census reports 19,373 head of cattle sold or slaughtered in 1909, and 1,206 horses sold. The 1919 report of the State department of agriculture credits Sioux County with 56,381 head of cattle, 2,213 of these being dairy stock. The county is credited with 10,415 horses, 335 mules, 4,385 hogs, and 7,255 sheep. The cattle are either shipped to market from the range when 2 or 3 years old or they are fed and marketed as fat stock. The latter method is becoming quite general in the southern part of the county, where much feed is produced. The grade Hereford is most generally raised, although many other grade cattle are grown. Several purebred herds occur in different parts of the county, notably on the table-lands and in the Niobrara and North Platte Valleys.

Dairying is but poorly developed throughout most of the county. It reaches its highest development in the irrigated section in the southwestern part. Here nearly every farmer has several milk cows, and the cream is separated and hauled to shipping points. Most of this cream goes to Alliance and Denver. Dairying is locally developed near the Chicago & North Western Railway, but for most of the county the distance to market prohibits the large development of this industry.

The raising of hogs is constantly assuming greater importance in the irrigated section of the county, because of the dominance of alfalfa and other feed crops. All conditions in this section favor successful hog raising. In the greater part of the county practi-

cally no hogs are raised, the entire attention being given to production of grazing stock. Some of the small farmers in the ranch area produce a few hogs to supply pork and lard for domestic use.

Sheep raising is increasing in importance. Many irrigated farms have a small flock of sheep, and a few large flocks are run in the grazing lands. Many range sheep from other regions are wintered on the irrigated lands in southern Sioux County.

Commercial poultry raising is practically confined to the irrigated North Platte Valley lands and to farms near the Chicago & North Western Railway, although occasionally a farm or ranch well removed from the railroad shows unusual activity in this line. Most of the settlers have a few chickens to supply home needs. Over most of the ranching sections little attention is given to poultry.

The land of Sioux County is, to a considerable extent, owned in large tracts. Much of it, homesteaded 10 or more years ago, has passed into the hands of large landowners. The irrigated areas and the table-land areas of better quality are mostly owned by small farmers. According to the 1910 census, nearly 98 per cent of the farms of the county were operated by owners, and in 1920 the percentage was 77.9. The average farm in 1910 contained 676.7 acres and in 1920 1,281.9 acres. In the irrigated section of the North Platte Valley the farms commonly contain 80 acres. There are a number of ranches with acreages between 5,000 and 10,000 acres.

Irrigation development is largely in the southwestern corner of the county under the Interstate Canal, a Government project. Approximately 35,000 acres are irrigated from this canal within Sioux County. Irrigation by means of private ditches along the Niobrara River is developed to some extent, and there is opportunity here for considerable expansion. Some irrigation is done along the White River in the lower part of its course through the county. Irrigation is practiced along all the small streams issuing from Pine Ridge.

SOILS.[1]

The soils of Sioux County have been greatly influenced by the climate. The moisture supply in this region is too low to permit the accumulation of a great deal of organic matter in the surface soil,

[1] Sioux County joins Dawes and Box Butte Counties on the east and Scotts Bluff County on the south. In certain cases the maps of these counties do not seem to agree along the boundaries. This is due in most cases to changes in correlation resulting from a fuller understanding of the soils of the State. On account of its very small area the Orman silt loam of Dawes County was not extended into Sioux County, but was combined with the Tripp very fine sandy loam. The Laurel very fine sandy loam was also combined with the Laurel fine sandy loam and the Orman clay loam of Sioux County.

Several soils mapped with the Tripp series in Scotts Bluff County are now classed with the recently established Bridgeport series, and areas of Valentine soils of that area are also mapped as Bridgeport types. The Rosebud stony loam was not extended into Sioux County, but was changed to Rough broken land or to Rosebud loamy fine sand.

notwithstanding the fact that the native vegetation consists of grasses. The rainfall is also too low to allow the leaching of the whole soil layer. Thus the carbonates are leached from the surface layer, but are found in abundance in the subsoil. The well-drained soil of the upland has reached a stage of maturity and is fairly uniform. It is typical of the High Plains region of western Nebraska and is characterized by a dark-brown surface soil, a light-colored, compact middle layer, and a highly calcareous subsoil. The remaining soils of the county, occupying the slopes and eroded escarpments and valley floors, differ from the upland soils chiefly in location, topography, and elevation.

With respect to the origin of the parent material, the soils of Sioux County are grouped into three general classes: (1) Residual soils, formed through the weathering of the underlying bedrock; (2) alluvial and colluvial soils; (3) wind-formed soils.

The most extensive residual soils of Sioux County are derived from the Arikaree formation, which underlies all of the table land and adjoining "breaks" and some of the lower slopes which are not yet eroded through to older formations. The Arikaree formation is of late Tertiary age and is one of the Loup Fork beds. It consists of sedimentary material washed down and deposited over much of the Great Plains from the higher regions on the west and later consolidated into a light to dark gray soft calcareous sandstone. It weathers into soils ranging from sand to a rather light textured silt loam.

Heavy erosion of the northern third of the county has resulted in the removal of the Arikaree material, exposing over a considerable area the Brule clay, but more extensively the underlying Pierre shale. The Brule clay consists of comparatively unstratified and massive deposits of sandy silt and clay. The texture of this formation becomes increasingly sandy from north to south within the county. In color it ranges from cream to a pale-pinkish shade. It usually weathers into the silty soils found in the northern part of Sioux County. At the base of the Brule clay lies a thin bed, known as the Chadron formation, which ranges in texture from clay to coarse gravel and gives rise to very spotted soil conditions. In the soil section material coming from this formation is usually mixed with material from the overlying Brule clay or the underlying Pierre shale, or both. The Chadron thus forms no distinct soil series. Over an area extending across the entire north end of the county the Pierre shale is exposed. It consists mostly of dark-brown to olive or drab-colored shale, and weathers into heavy clay or clay loam soils.

In the southwestern corner of the county erosion has largely removed the Arikaree sandstones, leaving the Brule clay as the surface

bedrock, covered to a greater or less depth with alluvial and colluvial materials.

The alluvial and colluvial soils of the county occupy the high terraces and terracelike benches and the flood plains along the larger drainage channels. The materials are derived from the various geological formations encountered in the county and from the mountain areas on the west. The origin of the alluvial is thus more often mixed than is that of the residual soils. The terraces of the Platte Valley consist chiefly of soil materials washed down from the mountainous regions to the west; the other terraces are formed of materials washed from the Arikaree, Brule, Chadron, or Pierre formations. In places one of these formations supplies all the material; in others it may come from two or more. The flood plains are of similar origin, but the soil is of less fixed character.

The wind-blown soils occur chiefly in an irregular strip extending diagonally from the middle of the west side of the county southeastward to the southeast corner. The soil areas classed as wind-formed are in numerous areas, large and small, separated by broad intervening depressions, which are all more or less affected by wind action. The material of these wind-blown soils is derived chiefly from the soft sandstones of the Arikaree formation, upon which the soils generally lie, and to a less extent from the alluvial terraces and flood plains. The wind-blown soils vary in texture from fine sand to loamy very fine sand.

There are few large areas of uniform soil within Sioux County. The Pierre clay area in the northern extremity of the county is the most extensive single area. Less extensive in area, but rather uniform, are the terrace lands in the southwestern corner of the county. Over most of the county, however, the most spotted conditions prevail, in contrast to the large uniform areas which occur in adjoining counties.

In the system of mapping employed by the Bureau of Soils and the Nebraska soil survey, the soils are grouped in series on the basis of common characteristics in color, structure, and origin, and the series are subdivided into types on the basis of texture, or the relative proportions of different-sized mineral particles present in the soil material. Eleven series, represented by 23 soil types, and 4 miscellaneous types—Marsh, Rough broken land, Badlands, and Dune-sand—are identified in the present survey.

The surface soils of the types in the Rosebud series are dark gray or brown, and the subsoil is light brown in the upper part and almost white in the lower part, and very calcareous. The white color of the deeper subsoil is the characteristic feature of this series. These soils are derived from light-colored calcareous sandstone and shales of Tertiary age, mainly of the Arikaree formation. The to-

pography ranges from undulating to steeply rolling. The soils erode easily, and the more hilly areas are dotted with bare white spots. The series is represented in Sioux County by the loamy fine sand, very fine sandy loam, and silt loam.

The surface soils of the types included in the Dawes series are brown in color and are not unlike the soils of the Rosebud series. The upper subsoil is brown, usually darker than the soil and heavier in texture, ranging from a compact heavy silt loam to a gray loam. This layer is 6 to 12 inches in thickness. The lower subsoil is a light-yellow to almost white calcareous silt loam or heavy silt loam. This series differs from the Rosebud only in the heavy intermediate layer. The topography ranges from gently to sharply rolling and the drainage is always good. These soils are mainly residual in origin, being derived from gravelly, light-colored, silty, and fine sandy formations. The surface soil is in many places modified by wind-laid and colluvial materials. The very fine sandy loam and silt loam of this series are mapped in the present survey.

The surface soils of the types in the Pierre series are light brown, brown, or olive brown. They are compact and refractory when dry and very sticky when wet. The subsoil is brown to olive brown or slate colored and heavy in texture. It grades into a substratum of partly weathered shale usually lying within 6 feet of the surface. The topography is characteristic, consisting of rounded hills and ridges. Surface drainage is usually good. This series is of residual origin, coming mainly from the Pierre shale. The soils frequently contain excessive amounts of alkali. The Pierre loam, clay loam, and clay are mapped in this county.

The surface soils of the types in the Epping series are light gray to buff. The subsoil is similar in color and general character to the surface soil. The soils occur on recently exposed outcrops of silty shales and indurated clays, where little weathering has taken place. Drainage conditions vary widely; normally the soils are well drained. They occupy undulating or dissected plains to sloping or comparatively level flats and are severely eroded. The soils are deficient in organic matter and are rather difficult to maintain in a favorable condition when first cultivated. The very fine sandy loam, silt loam, and silty clay loam of this series are shown on the accompanying map.

The Valentine series includes types with brown to dark-brown surface soils and light-brown to brown subsoils usually heavier in texture than the surface soil. The members of this series occupy valley slopes, stream valleys, and basins in the semiarid region. They have been derived by partial weathering of wind-laid and colluvial sands, coming originally from the sandy deposits of Tertiary age. Weathering has produced a heavier texture in soil and sub-

soil, but there has not been developed the white calcareous layer in the lower subsoil which is characteristic of the Rosebud series. Both soils and subsoil have a relatively low lime content. The topography varies from nearly level to dunelike, depending upon the extent of wind action. Drainage is everywhere good and in the more sandy types it may be excessive. One type of this series, the loamy fine sand, is mapped.

The surface soils of the types in the Gannett series are dark gray to black and contain a large amount of organic matter, the proportion in many places being almost large enough to give true Muck. The subsoil is a light-brown to grayish-white sandy loam or sand, which at lower depths passes into yellowish-brown sand. These soils are developed in inclosed pockets or swales in the sand-hill region and represent wind-blown material mixed with fine wash from the hills and modified by the incorporation of organic matter. The areas are always poorly drained, and the lower parts are often occupied by marshes or lakes. One type—Gannett fine sand—is mapped in this area.

The surface soils of the types in the Tripp series are brown to light gray, the immediate surface in places being ashy gray. The subsoil is light gray to white, and strongly calcareous. The series occupies terraces where drainage is fairly well established. The greater part of the subsoil is of alluvial origin. The soil has in places been modified by an admixture of wind-laid material subsequent to its deposition. The surface ranges from comparatively level to eroded. The Tripp series is represented in this county by three types—the very fine sandy loam, silt loam, and silty clay loam.

The Orman series includes types with brown surface soils and brown or yellowish-brown subsoil. Both soil and subsoil have the olive-brown or slaty tinge characteristic of the Pierre soils. The series occurs on terraces within or bordering exposures of Pierre shale, and the material consists mainly of sediments from the Pierre soils. The soils are sticky when wet and bake hard when dry. The topography is level, and natural drainage is poor on account of the impervious nature of the subsoil. Only the clay loam of this series is mapped.

The surface soils of the types included in the Yale series are brown to light brown. The upper subsoil is a light-brown compact silt loam or silty clay loam having a hardpan structure 8 to 12 inches thick. The lower subsoil is a light-gray or light yellowish brown, floury silt loam. The surface soil and upper subsoil are only moderately calcareous, but the lower subsoil has a high lime content. These soils occupy old terraces lying above overflow. The surface is flat, but as the soils occur in regions of low rainfall, drainage is adequate.

This series differs from the Tripp only in the compact structure of the upper subsoil. Only the Yale silt loam is developed in this area.

The surface soils of the types included in the Laurel series are light gray to gray or light grayish brown. The subsoil is lighter in color, but of similar or only slightly heavier texture. As a rule the underdrainage is good, but surface drainage of the heavier types may be deficient. The topography is flat to undulating. Both surface soils and subsoil contain a high percentage of lime and often some alkali salts. The series occupies recent river valleys and is for the most part subject to overflow. The sediments from which it is derived have been brought down mainly from the brown calcareous, residual soils, including the Rosebud and the Epping. The fine sandy loam is the only member of the series in this county.

The following table gives the name and the actual and relative extent of the soil types mapped in Sioux County:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Rosebud very fine sandy loam	336,960	33.1	Epping very fine sandy loam	14,016	1.1
Shallow phase	98,624		Tripp silt loam	13,696	1.0
Rosebud loamy fine sand	147,968	17.7	Dawes silt loam	11,648	.9
Shallow phase	84,672		Bridgeport gravelly sandy loam	6,784	.5
Rough broken land	116,480	8.9	Epping silty clay loam	5,312	.4
Pierre clay	96,640	7.3	Pierre clay loam	4,928	.4
Dunesand	59,392	4.5	Pierre loam	4,096	.3
Valentine loamy fine sand	45,312	3.4	Yale silt loam	3,904	.3
Epping silt loam	43,136	3.3	Laurel fine sandy loam	3,072	.2
Bridgeport very fine sandy loam	39,296	3.0	Orman clay loam	2,496	.2
Rosebud silt loam	37,952	2.9	Marsh	1,792	.1
Bridgeport loamy very fine sand	33,536	2.5	Dawes very fine sandy loam	320	.1
Tripp silty clay loam	32,320	2.5	Gannett fine sand	192	.1
Badlands	26,240	2.0	Total	1,315,200	
Tripp very fine sandy loam	25,600	1.9			
Bridgeport fine sandy loam	18,816	1.4			

ROSEBUD LOAMY FINE SAND.

The surface soil of the Rosebud loamy fine sand is a gray to grayish-brown loamy very fine sand to loamy fine sand, from 6 to 10 inches deep. The subsoil, except for a slightly lighter color due to the absence of organic matter, is practically the same as the surface soil to a depth of 3 feet or more. A substratum of white, powdered or crumbled, decayed Arikaree material in places lies within the 3-foot section, but generally at a greater depth. The surface soil is deficient in organic matter. This soil generally represents a condition intermediate between that of the Valentine loamy fine sand and the Rosebud very fine sandy loam.

This type is common in practically all parts of the table-land region of the county. Areas were also mapped on the sloping parts of the table escarpments. It occurs in both large and small areas.

The topography ranges from nearly flat to very hilly, most of the type being of sufficiently gentle slope to allow cultivation. Owing to the open character of the soil and the generally rolling topography, the type is well drained.

A very small proportion of this type is cultivated. It is largely used for pasture and hay land.

The Rosebud loamy fine sand has a vegetative cover different from that of the heavier Rosebud types. Blackroot (a sedge), needle grass, buffalo grass, and grama grass are the more important plants. There is also scattered sagebrush in some parts of the county.

This land is likely to "blow" when cultivated. Generally it is better suited to grazing than to cultivation, but it must be pastured carefully to prevent overgrazing. The land will support from 30 to 45 head of cattle per section.

Land of this type sells for $10 to $20 an acre, depending upon location and other varying conditions.

Rosebud loamy fine sand, shallow phase.—The shallow phase of the Rosebud loamy fine sand includes areas where the variation in soil depth is too local to permit separation into types, and ranges from the typical Rosebud loamy fine sand, through all intermediate stages of soil formation to a bare rock surface with all soil eroded away. Probably most of the area shown within this shallow phase has deep soil, but it is so uneven in depth as to warrant separation as a distinct phase.

The shallow phase can be detected by the outcrops of the Arikaree material, which give the phase a distinctly spotted appearance.

This phase occurs in scattered areas, generally small, in all parts of the table-land and less commonly in the lower parts of the county. The areas are generally fewer and smaller in the smoother parts, and more numerous and larger in the more dissected parts of the table-land bordering the valleys.

The topography is for the most part rolling, although it ranges from nearly level to very rough. In the rougher parts of the "breaks" it is usually very hilly to broken. Drainage is everywhere excessive.

This phase is generally unsuited to cultivation, because of the irregular occurrence of rock outcrops and the liability of this sandy soil to "blow." It is at present used only for pasture. The rolling topography renders it peculiarly valuable for grazing, as it retards blowing of the soil and affords protection to stock. The native vegetation is the same as that of the type proper, but makes somewhat slower growth, owing to the unfavorable natural conditions. Yucca

is a very conspicuous plant on the bare or nearly bare points and ridges of this soil.

This phase supports from 30 to 40 head of cattle per section during the entire year. The land sells for $8 to $20 an acre, depending upon location and improvements.

ROSEBUD VERY FINE SANDY LOAM.

The surface soil of the Rosebud very fine sandy loam is a grayish-brown to brown very fine sandy loam, 8 to 15 inches deep, with an average depth of 10 to 12 inches. It is underlain by a light grayish brown to light-brown very fine sandy loam to fine sandy loam, which becomes more grayish with increasing depth. In places the surface soil may vary to a fine sandy loam, but such areas are too small to warrant separation. The increasingly light color in the lower material is due to the smaller content of organic matter. Hardpan conditions are practically unknown in this type, except in "buffalo wallows," of which there are but few. The lower subsoil generally merges into a bed of fine chalky or limy material. Beneath this lies the undisturbed Tertiary material.

This type occurs in large areas on the table-land, and less extensively on the adjoining slopes or "breaks." Some areas lie at the base of these breaks and these in places have more or less colluvial material mixed with the residual material.

The Rosebud very fine sandy loam normally has an undulating to gently rolling topography, but is locally hilly. The surface and underground drainage are good. There are, however, relatively few distinct drainage ways within this type.

A very small proportion of the Rosebud very fine sandy loam is under cultivation, though most of the cultivated dry land is of this type. The noncultivated areas support a heavy stand of native grasses of many species, among which grama grass and buffalo grass are most common. Blackroot sedge is also common. Loco weed and death camass also occur. These lands are used for grazing and to some extent for hay. The usual cultivated crops are wheat, rye, barley, and potatoes.

The stock includes beef cattle, sheep, and horses, the last two in relatively small numbers. The dairy industry is unimportant. A section of the land will support 50 to 60 head of cattle during the entire year, if they are fed through the worst winter storms.

Land of this type usually sells for $12 to $25 an acre, depending upon the location, improvements, and nature of the individual tract.

Rosebud very fine sandy loam, shallow phase.—The surface soil of the Rosebud very fine sandy loam, shallow phase, consists of a light-gray to brown very fine sandy loam. The lighter colored areas are underlain at depths of 3 to 12 inches by decomposed white calcareous

rock of the Arikaree formation. The darker colored soil areas are underlain at 6 to 15 inches by a light-brown to light-gray very fine sandy loam, and this gives way at depths of 24 to 40 inches to the white calcareous rock. Local outcrops of this rock give the land a very mottled appearance.

This phase is found in practically all parts of the table-land within the county, and scattered areas occur also on the slopes below Pine Ridge and on the terraces in the southern part of the county. The largest areas lie around the head of White River, above Pine Ridge, and in places along the Niobrara watershed. The phase occupies eroded areas that have not yet been severely dissected. The topography ranges from rolling to very hilly. Drainage is for the most part excessive. Conditions within the phase are so local that separation of the several variations is impossible. Each of these different conditions may occur within a distance of 10 feet. The phase includes all stages of soil accumulation, from the bare consolidated rock to the deep soil of the typical Rosebud very fine sandy loam.

Because of the varying depths of soil cover, this phase is not suited to cultivation. Certain areas, ordinarily very small, can be farmed, and small patches serve as gardens. Its important use is for the grazing of range stock. The rough topography increases its value for winter grazing, owing to the protection afforded. The native vegetation is mainly buffalo grass, grama grass, wheat grass, and blackroot. The phase will support 35 to 40 head of cattle per section the entire year.

Land of this phase sells for $10 to $25 an acre, depending on the improvements, location, and character of individual tracts.

ROSEBUD SILT LOAM.

The surface soil of the Rosebud silt loam is a brown to grayish-brown silt loam to silty very fine sandy loam. It is underlain at a depth of 6 to 15 inches by a light-brown to light grayish brown silty very fine sandy loam, rather compact but seldom in the condition known as "hardpan." This changes gradually, at depths of 30 inches or more, into a floury material containing a large percentage of lime accumulated in the processes of weathering. The unweathered Arikaree material is generally encountered at depths of from 5 to 10 feet. The depth and color of the surface soil vary greatly within the type, because of difference in topographic position and consequent stage of erosion. The surface soil of the Rosebud silt loam is generally darker than that of the other Rosebud types in this area, owing to a relatively high organic content, but this constituent decreases rapidly with increasing depth and is lacking below 15 to 24 inches.

The Rosebud silt loam is not extensive, but it is one of the best agricultural soils in the county. It occurs almost entirely on the divide and some adjoining upper slopes between the White River and the Niobrara River, occupying most of the gradual slopes in this upland area. Two areas of considerable size are situated below Pine Ridge. The topography ranges from gently undulating and rolling to very rolling, with most of it rolling. The type has a heavier surface soil at the eastern edge of the county, becoming lighter in texture westward and grading into the Rosebud very fine sandy loam at its western limit.

Very few drainage channels occur within the type, but surface drainage is everywhere ample. Internal drainage is also good.

A considerable part of this type, probably 30 per cent, is under cultivation, although the total area farmed is not great. The uncultivated areas support a heavy stand of grasses, among which grama grass, buffalo grass, and blackroot are the most common species. These lands are used for grazing and for the production of hay. The most important cultivated crops are wheat, barley, rye, corn, and potatoes. Strictly grain farms are lacking, and stock farms prevail. This type of land supports 50 to 60 head of cattle per section throughout the year.

Wheat yields from 12 to 25 bushels per acre, rye 15 to 30 bushels, barley from 10 to 30 bushels, corn from 5 to 25 bushels, and potatoes from 60 to 125 bushels. Native hay on this type cuts from one-fourth to three-fourths ton per acre.

The Rosebud silt loam is the best upland soil in the county. It is easy to till and retentive of moisture; only in exceptionally droughty seasons are crops on this soil likely to suffer serious injury. No definite rotation of crops is followed; the small grains are generally planted year after year.

As other types of soil are included with this in practically every farm, it is difficult to give it a definite value. The range is probably from $15 to $35 an acre, depending upon improvements, accessibility to market, and the character of the roads. The increasing lightness of this soil from east to west is offset by the more favorable market and road conditions in the western parts of the area.

The Rosebud silt loam is potentially a strong soil, and more thorough cultivation will probably result in increased returns. The easiest and quickest methods of cultivation are too commonly followed.

DAWES VERY FINE SANDY LOAM.

The surface soil of the Dawes very fine sandy loam is a light-brown or light grayish brown very fine sandy loam from 6 to 12 inches deep. Immediately below this is an upper subsoil layer,

generally not exceeding 6 inches in thickness, of relatively impervious, compact, heavy, very fine sandy loam. The lower subsoil, from about 16 inches down, is a light-gray very fine sandy loam of loose, friable structure. The type is high in lime, particularly in the subsoil.

Only two small areas of the Dawes very fine sandy loam are developed in Sioux County. One of these lies near the center of Hat Creek Basin, a few miles south of Montrose. It occurs on a rolling ridge and is well drained. It is not in cultivation, but the soil is friable and easily tilled and should produce as well as any of the soil types which occur near it.

DAWES SILT LOAM.

The surface soil of the Dawes silt loam, to an average depth of 8 to 12 inches, is a grayish-brown to brown silt loam to loam. This is underlain by an upper subsoil layer 6 to 12 inches thick of brown to grayish-brown heavy silt loam to silty loam of more than average compactness. The lower subsoil consists of a rather light yellowish brown silt loam of slightly lighter texture than the upper subsoil. The type shows much variation in texture, color, and in the depths to the different layers. The lighter textures are encountered generally where erosion has been most active.

The Dawes silt loam occurs rather irregularly along the base of Pine Ridge, lying ordinarily several miles out upon the rolling lowlands and generally in rather small areas. The type is chiefly of residual origin, having weathered down from silty layers of the Brule and Chadron formations. The loamy areas have probably been derived largely from the Chadron sands and gravels, but their occurrence is so local that separation of these areas was impracticable. The topography varies from that of an undulating to rolling plain. Some small parts of the type have been subjected to rather severe erosion, but the slopes are rarely steep. The surface of all areas favors complete drainage.

This type is not yet of material agricultural importance. Very little of it has been brought under cultivation, and such areas as are now cultivated are not considered good agricultural land. Some grain crops are planted on these lands, but generally with rather indifferent success. Practically the entire type is used for the grazing of beef cattle, and is probably capable of supporting from 25 to 40 head of cattle per section of land. This type and the Yale silt loam are of about equal value. The more level portions are easily tilled, but the rougher areas are not well suited to farming.

Land values range from $6 an acre upward, averaging about $8. None of the land of this type in Sioux County is near towns or ship-

ping points, and this condition is one factor retarding its development.

The following table gives the results of mechanical analyses of samples of the soil, subsurface, and subsoil of the Dawes silt loam:

Mechanical analyses of Dawes silt loam.

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.*
374007	Soil	0.3	0.9	0.6	6.2	46.4	33.9	11.7
374008	Subsurface	.0	.0	.8	3.6	39.8	31.1	24.8
374009	Subsoil	.0	.3	.1	4.6	33.0	39.5	22.6

PIERRE LOAM.

The surface soil of the Pierre loam, to a depth varying from 6 to 24 inches, is a dark grayish brown to olive-brown loam to gravelly loam. The soil is variable in composition, and in different parts of the area includes textures from stony loam to clay. The subsoil is usually a drab to olive-brown clay or clay loam.

This soil occurs usually in small isolated patches in the northern part of Sioux County, where remnants of the Chadron formation overlie the Pierre shales. The surface soil is a mixture of the Chadron sands and gravels with the clay from the underlying Pierre shales. The type is normally developed in the more elevated areas. The topography is usually rolling, and surface drainage is good.

Very little farming has been attempted on this soil, grazing being the common use. Land of this type sells for $3 to $10 an acre.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Pierre loam:

Mechanical analyses of Pierre loam.

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.*
374022	Soil	1.4	5.2	4.1	25.9	34.2	19.5	9.6
374023	Subsoil	2.3	8.0	3.9	32.9	28.0	14.3	10.7

PIERRE CLAY LOAM.

The surface soil of the Pierre clay loam consists of a brown to olive-brown heavy clay loam 6 to 24 inches deep. The subsoil is generally of a darker shade, merging into the underlying Pierre shales at 3 to 5 feet below the surface.

This soil is developed on the Pierre shale formation, where a remnant of the overlying sands and gravels have become sufficiently mixed with the clay to develop a clay loam soil. It is of local extent and occurrence and lacks uniformity. It occurs mostly on relatively elevated areas near the southern edge of the Pierre outcrops. The topography generally is rolling and the surface drainage is good.

Practically none of the type is cultivated, being generally considered unsuitable for crop production. It is used for grazing.

The Pierre clay loam has a somewhat lighter texture than the Pierre clay, yet the difference is not sufficient to destroy the characteristic stickiness so marked in the latter. The soil is very plastic when wet and extremely hard when dry and baked. It is most difficult to manage under cultivation.

It is usually impossible to obtain water from wells on this soil, and where it can be obtained it is unfit even for the watering of stock. Impounded water usually supplies the needs of stock. This land sells for $3 to $10 an acre.

PIERRE CLAY.

The surface soil of the Pierre clay consists of 8 to 12 inches of a brown to olive-brown heavy clay. The subsoil is usually somewhat darker in color and merges into the slate-colored Pierre shale at depths of 3 to 5 feet. Fragments of the shale are sometimes encountered within the 3-foot section. Although variations in both the color and the texture are numerous, the sticky character of the clay is always dominant. It is everywhere known locally as "gumbo." Many patches in which gravel and larger stones are interspersed through the soil occur in this type; the interstitial soil is always a sticky clay.

The Pierre clay is one of the most extensive soils in the county, and has the most uniform conditions of any of the various types. It occupies a belt of country 6 to 10 miles wide, extending entirely across the northern end of the county, and composed of a uniform succession of rounded hills and hollows, with occasional narrow valleys. It has good surface drainage. Several small areas with topography approaching that of Badlands were mapped with this type.

Only a small percentage of the land is cultivated, most of it being used for grazing. Some wild hay is cut. Wheat and corn are the most commonly grown crops. Because of the droughty nature of the soil the yields are generally low, wheat yielding ordinarily 5 to 8 bushels per acre, with 20 bushels in exceptionally favorable seasons. Corn does little if any better. Wild hay yields an average of less than one-half ton per acre, the lower slopes producing most, the hilltops least. Haying begins early in August and continues until killing frost occurs. The hay is said to have a high feeding value.

The Pierre clay is a strong soil, but its heavy texture makes it very difficult to work and thus lessens its desirability. If tilled when too wet the soil upon drying separates into clods which are difficult to break down. If allowed to get dry the soil is so hard it can not be plowed. Tillage at a certain stage following rains is essential, else the moisture quickly evaporates. Because of the difficulty in handling this soil and its droughty character, any great extension of the cultivated area in the near future appears quite improbable.

The Pierre clay is practically without water supply, even for domestic purposes. The well water, where it can be obtained, is usually alkaline and wholly unfit for use, even for stock. Most of the water used is caught during floods, either in artificial ponds or natural water holes. The selling price of this land ranges between $3 and $10 an acre.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of Pierre clay:

Mechanical analyses of Pierre clay.

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.*
374024	Soil	0.0	0.0	4.1	13.0	9.0	41.9	31.9
374025	Subsoil	.0	1.4	1.3	9.5	10.0	39.8	38.0

EPPING VERY FINE SANDY LOAM.

The surface soil of the Epping very fine sandy loam is a light grayish brown to light-brown very fine sandy loam, 6 to 8 inches deep. Below this, to depths ranging from 12 to 24 inches, is a light-brown very fine sandy loam to silt loam. A light-brown silty very fine sandy loam forms the lower subsoil, which passes gradually into the consolidated Brule formation at a depth of 30 inches or more. This lower layer has a high lime content. While this soil is mainly residual from the Brule, it is modified more or less by admixture of materials from the terrace deposits giving the Bridgeport series.

This type occurs in small areas in the southern part of the county on isolated areas underlain by the Brule formation. These are normally slightly elevated above the terrace levels. The topography ranges from nearly level to gently rolling, but is in most places of a uniform, gentle slope. The areas merge imperceptibly into the bordering soils, generally of the Bridgeport series. The type is well drained.

The Epping very fine sandy loam is not an important agricultural soil. Only a small acreage occurs in the county, and little of

it is cultivated. Practically all of the farmed land of the type is irrigated. Without irrigation the crops are generally poor. In its natural state it supports a rather sparse growth of mixed grasses, affording fair grazing.

Alfalfa, corn, and wheat are grown on this land. It has been farmed a comparatively short time, and it is not known what its producing power will be after the soil is brought into condition. It is locally called "raw soil." In the initial years alfalfa yields from 1 to 2½ tons of hay per acre per season, corn from 15 to 35 bushels, and wheat from 15 to 35 bushels. Land of this type sells for $50 to $75 an acre under irrigation, or $5 to $10 without irrigation.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Epping very fine sandy loam:

Mechanical analyses of Epping very fine sandy loam.

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.*
374010	Soil	0.2	3.0	5.8	45.0	36.5	6.4	3.5
374011	Subsoil	.0	1.1	1.3	13.7	39.3	40.3	4.2

EPPING SILT LOAM.

The Epping silt loam consists of three layers: a light-gray to light-brown silt loam, 6 to 10 inches thick, a creamy-gray or white heavy silt loam, 14 to 20 inches thick, and a lighter textured lower subsoil layer, consisting of the pinkish to gray silty Brule formation. The type is not uniform, the depth and color of both the surface soil and the subsoil varying widely within short distances. Differences in topography, and the resulting different erosional stages, are largely responsible for those variations. Dissection of this soil, which is mealy and friable, is rapid. Severely eroded areas, generally without vegetation of any kind, are separated as Badlands. This soil contains considerable quantities of gypsum and other more soluble salts.

The Epping silt loam occurs in the region of Brule formation outcrops, lying several miles out from the base of Pine Ridge in northern Sioux County, and in areas of similar topographic position in the southern part of the county. This type is recently weathered from the Brule formation, and the new raw soil does not have the subsurface lime accumulation of the older residual soils, nor has it accumulated the organic matter necessary to make it a productive soil.

The topography ranges from nearly flat to gently rolling, but is for the most part undulating. Surface drainage is generally well established. Because of the impervious nature of the soil and the

violent character of the average rain, the subsoil rarely receives an abundance of moisture.

Land of this type is largely uncultivated. Most of it is used for grazing, for which purpose it has only moderate value. It supports a very thin stand of grasses which burn dry early in the summer, except in abnormally wet seasons. This land sells for $5 to $10 an acre.

EPPING SILTY CLAY LOAM.

The Epping silty clay loam consists of a light-gray to gray heavy silty loam to silty clay loam, underlain at 6 to 8 inches by an upper subsoil layer of somewhat heavier silty clay loam, approaching in places a clay in texture, and this below 16 to 24 inches generally by a gray silt loam to silty clay loam. Large amounts of soluble alkali salts and gypsum are normally present. The soil is friable and floury and bakes less readily than the Pierre soil of similar texture.

The type is inextensive. It occurs in only a few small areas in the region of Orella and westward, where the Brule clay has escaped rapid erosion and has weathered down to soil. It occurs most frequently as flat and gently undulating areas within areas of Badlands. Surface drainage in the flatter areas is deficient; in other parts of the type it is excessive.

The land is almost entirely undeveloped. Cultivation, where it has been tried, has met with poor success. The native grasses make but scanty growth, and the land is not considered worth much for grazing. It sells for $5 to $8 an acre.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Epping silty clay loam:

Mechanical analyses of Epping silty clay loam.

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.*
374014	Soil	0.4	2.0	2.1	11.1	18.4	46.5	19.7
374015	Subsoil	.3	1.3	.9	5.8	18.8	45.2	27.7

VALENTINE LOAMY FINE SAND.

The Valentine loamy fine sand consists of grayish-brown to dark grayish brown loamy fine sand to loamy very fine sand, 6 to 10 inches deep. In places the upper subsoil is fairly compact, but the lower subsoil is a loose, light grayish brown fine sand extending to a depth of several feet. Both surface soil and subsoil are deficient in humus. This soil is not highly calcareous.

This type occurs in all parts of the table-land, but particularly adjoining or near the sand-dune areas of the southern half of the

upland section. It occupies areas showing some effects of wind erosion, but which have not attained the dune stage. The topography ranges from gently undulating to rolling. There is practically no surface drainage, as the rainfall is all absorbed by the soil.

The Valentine loamy fine sand has about the same value for farming as the Rosebud loamy fine sand. It drifts badly when cultivated, and hence is largely used as pasture and hay land. Some of the depressed areas and valleys where seepage supplies extra moisture are cultivated. The native vegetation consists of needle grass, grama grass, and blackroot. The needle grass is important for hay production and for pasture. The other herbage is suited only for grazing. There is some poison loco and scattered sagebrush in the growth.

Native hay is the most important crop. The chief cultivated crops are rye, corn, potatoes, and wheat, but the acreage is very small. Hay yields from one-fourth to three-fourths ton per acre, depending upon seasonal conditions. The small grains, particularly rye, are not infrequently cut for hay, of which the yield is from 1 to 2 tons per acre. This land will support 30 or 40 head of cattle per section during the entire year. Feed is occasionally necessary during exceptionally bad storms.

The price of the Valentine loamy fine sand ranges from $8 or $10 to $20 an acre, depending upon the improvements, accessibility to market, and the nature of the particular tract.

Great care must be exercised to keep this soil from drifting. Several cultivated fields were seen where destructive wind action had begun. None of the slopes of this type should be plowed. Cultivation should be limited to as few turnings of the soil as can be made to suffice.

GANNETT FINE SAND.

The Gannett fine sand consists of a dark-gray to nearly black fine sand to very fine sand, which gradually changes at depths of 12 to 30 inches to a light-brown fine sand. The surface soil contains a relatively large quantity of organic matter, and local spots of mucky texture occur within the type.

The Gannett fine sand is of very small extent. A few small areas lie within and adjoining the Dunesand areas. It is developed in pockets or valleys which have been eroded down to the water table, such depressions being termed locally "wet valleys." The soil is largely of wind-formed origin, but is now quite stable. The topography is level or gently sloping.

Drainage is always deficient, and in wet seasons water frequently stands on these lands.

This type is almost entirely used for the production of hay and for pasture. It supports a heavy growth of water-loving grasses and sedges and affords excellent grazing. The land is not subject to drought, and a crop of hay is assured.

TRIPP VERY FINE SANDY LOAM.

The surface soil of the Tripp very fine sandy loam is a light grayish brown to light-brown very fine sandy loam, ranging in depth from 8 to 15 inches. The subsoil is a light grayish brown very fine sandy loam, lighter in texture and less coherent than the surface soil, though the surface soil is normally very loose and friable. In places there is practically no difference between the soil and the subsoil. Occasional former soils, darker than usual and buried from one to several feet below the surface, are encountered. The subsoil has the lime accumulation common in the older soils of this region, but seldom is the concentration extreme.

The Tripp very fine sandy loam occurs on the terrace lands along the Niobrara River, White River, and the small creeks at the base of Pine Ridge. It is derived largely from Arikaree material, the underlying formations supplying some material. The topography is generally smooth, although erosion has in places produced a locally rolling or undulating surface. The type is everywhere well drained. The soil is loose and absorbs water readily.

This type has a relatively small acreage in the county, but it is a most important type agriculturally. Probably 50 per cent of it is cultivated.

Alfalfa is the leading crop, followed by corn and wheat. Rye, barley, oats, and potatoes also are grown successfully. Vegetables and fruits are produced in gardens. The crops from these lands serve to winter the range stock, chiefly cattle. Some horses, sheep, and hogs are raised. Dairying is probably better developed on this type than on most of the other soils.

Alfalfa ordinarily yields from 2½ to 3 tons per acre per season. Corn yields from 10 to 20 bushels per acre. It is chiefly fed on the ranch where grown. Wheat yields from 7 to 20 bushels, with an average of 10 or 12 bushels. If within easy reach of market, the wheat is sold, otherwise it is fed. Rye, barley and oats are used locally. Some potatoes are shipped, but this is not an important commercial crop.

Lands of this type vary in value with the location, accessibility, and the nature of the tract in question. The general range of prices is from $25 to $50 an acre. In general this land has not been handled in the best manner, and the improvement of methods should very materially increase its productiveness.

TRIPP SILT LOAM.

The Tripp silt loam is a light-brown to light-gray chalky silt loam, underlain at 12 to 24 inches by a cream-colored to dingy-white floury silt loam. The entire soil section has a rather loesslike appearance and feel. Occasional small areas have a darker color, which is due probably to difference in derivation. Both surface soil and subsoil, though compact, are friable. The surface does not bake badly upon drying. Both soil and subsoil are high in calcium, which occurs in the form of both carbonate and sulphate (gypsum).

The Tripp silt loam occurs mainly as alluvial terraces along the small streams leading northward from the base of Pine Ridge. There are also a few terraces occupied by the soil along similar drainage ways below the Platte Valley "breaks" in the southern part of the county. The soil material is derived largely from the Brule formation, which outcrops near the base of both the north and south escarpments of the table-land. The type is closely associated with the Badlands and the Epping soils, and extends frequently for some distance into the areas of the Pierre series. While generally level, the surface is here and there sloping. The type is, as a rule, fairly well drained.

The Tripp silt loam is largely uncultivated, most of it being used as pasture. The native vegetation consists of mixed grasses, buffalo, grama, and western wheat grass predominating, and the land is capable of supporting from 20 to 35 steers per section during 8 months of the year. A few areas are farmed, some with and some without irrigation.

Land for grazing sells as high as $10 an acre; for dry farming, $20 an acre; and where supplied with facilities for irrigation, for $100 or more an acre.

TRIPP SILTY CLAY LOAM.

The Tripp silty clay loam is generally a grayish-brown or buff floury silty clay loam, from 6 to 10 inches deep, resting on a light-brown or grayish-brown silty clay loam, extending to depths of 3 feet or more. The surface soil is low in organic matter, and the subsoil is altogether lacking in this constituent. The type is high in lime, especially in the subsoil. It is a friable soil in spite of its fine texture, and has none of the characteristics of a "gumbo" soil.

This soil occurs on level to gently sloping terraces along several of the tributaries of Hat Creek. It represents reworked Brule material in but slightly altered condition.

The topography is generally level. The drainage is good. This type is chiefly utilized for pasture, though some areas are farmed, both with and without irrigation. Good yields of alfalfa are ob-

tained with the aid of irrigation, but under dry-farming the results are generally very poor.

Very little farming has been done on this soil, so that its possibilities are largely unknown.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Tripp silty clay loam:

Mechanical analyses of Tripp silty clay loam.

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.*
374018	Soil	0.0	1.4	1.5	10.2	31.6	37.8	17.6
374019	Subsoil	.3	1.2	1.8	10.5	31.5	36.0	18.7

ORMAN CLAY LOAM.

The Orman clay loam consists of a brown to olive-brown clay loam to clay, underlain at 8 to 15 inches by a light olive brown to yellowish-brown subsoil of the same texture as the soil. It is of very similar character to the Pierre soils, from which the material has been washed. The soil is sticky when wet and bakes on drying.

The type has a small acreage in the county. It occurs as alluvial terraces along lower Hat Creek and its tributaries. The topography is level, and, with the impervious soil and subsoil, very deficient drainage is the natural result.

The type is in an uncultivated state, except for a few small patches, on which corn and wheat are grown. The former yields from 10 to 15 bushels per acre; the latter 5 to 10 bushels, the yields varying with the amount of rainfall. Wild hay, consisting chiefly of western wheat grass, is harvested, the average yield approximating one-half ton per acre.

This soil requires careful handling and must be plowed and cultivated only when it is in the right moisture condition. If worked when either too wet or too dry chances of obtaining satisfactory crops are materially decreased. The price of this land ranges from $8 to $20 an acre, depending upon location, improvements, and the quality of the particular tract.

YALE SILT LOAM.

The surface soil of the Yale silt loam consists of a light grayish brown to brown friable silt loam to loam, with prevailing depths between 10 and 15 inches. Below the soil there occurs a rather compact layer of grayish-brown to yellowish-brown silt loam to silty clay

loam, this giving way at 18 to 24 inches to a somewhat less compact stratum of grayish-yellow silt loam. The surface soil has a rather low lime content, the upper subsoil a content somewhat higher, and the lower subsoil is highly calcareous. The soil is very low in organic matter. At depths usually greater than 3 feet, and averaging probably 5 feet, a bed of alluvial calcareous gravel is found.

The Yale silt loam occurs in several areas in the northern part of the county between the base of Pine Ridge and the Pierre shale plains along the South Dakota line. The largest area is 15 miles southeast of the northwestern corner of the county. There are very few areas of the type, however, and they occur within a relatively small section of the county.

This type occupies high terrace areas, now isolated remnants of a level plain formerly continuous. The surface is almost level, varied locally with slight undulations and generally sloping gently to the northeast. Drainage is very good.

Because of its small acreage the type is of relatively little importance. Practically all of it is uncultivated, and is used only as grazing land. The native vegetation consists of a rather sparse growth of wheat grass, grama grass, and blackroot. Beef cattle are grazed on most of these lands. A section of land will support from 25 to 40 head of cattle.

This land is generally valued at about $10 an acre. It would be worth more if it were closer to better developed areas.

This soil is rather poorly suited to farming. It apparently is rather droughty, and its position is such that irrigation is out of the question. In favorable years it is probable that fairly good crops might be obtained from such lands, but it is believed to be best suited to grazing.

BRIDGEPORT GRAVELLY SANDY LOAM.

The Bridgeport gravelly sandy loam includes areas of gravelly soil ranging in texture from pure gravel to fine sandy loam with a low gravel content. The type is developed more or less irregularly along the outer escarpment of the several terrace levels, where erosion has been very active. It occurs most frequently as projecting spurs and points or as small isolated hills. It is not uniform throughout its extent, but is defined to include those areas which have been eroded out of the undissected terrace or upland.

The type occurs largely in the southern part of the county, generally in small, scattered areas distributed from the edge of the undissected upland down to the lowest terrace escarpment adjoining the Platte River channel.

The topography is usually steeply rolling, although some rather smooth and level areas are included. The drainage, both surface and

underground, is excessive, and consequently the soil is exceedingly droughty.

The Bridgeport gravelly sandy loam is not important agriculturally. It has a rather low value even where it receives the benefit of seepage water from irrigated fields, though it supplies some pasturage under those conditions. In its natural state it is practically without value, even for grazing.

BRIDGEPORT LOAMY VERY FINE SAND.

The surface soil of the Bridgeport loamy very fine sand is a light grayish brown to brown loose and incoherent loamy very fine sand to loamy fine sand, ranging in depth from 6 to 12 inches. This surface layer is underlain to a depth usually exceeding 3 feet by a subsoil slightly lighter in color but very similar in texture to, though it may lack the loamy character of, the surface soil. The surface soil contains very little organic matter, and the subsoil is practically lacking in this constituent. Lime is abundant in the subsoil, but there is no definite concentration of the lime salts. Over small areas, where drainage is less perfect, the soil and subsoil are slightly darker colored, owing to accumulated organic matter.

The Bridgeport loamy very fine sand occurs on the high North Platte River terraces in the southwestern part of the county. These terraces are in general slightly undulating and slope very gently to the south. This type usually occupies broad flat swells or divides on these terraces, the intervening broad swales or sags being occupied by the slightly heavier types of the series.

The land surface within the type is generally level to slightly undulating, but includes occasional areas of local extent having a gently rolling topography. Wind has affected some small areas, causing the formation of incipient dunes. The type is well drained, both on the surface and internally.

The Bridgeport loamy very fine sand is the most important agricultural type in the county. Most of the land irrigated by the Interstate Canal is of this type. Probably about 50 per cent of the type is cultivated and almost all of this is farmed intensively under irrigation.

The native vegetation consists of a rather open growth of buffalo grass, grama grass, needle grass, and blackroot.

This type is not good dry-farming land, and attempts to produce crops without irrigation have usually failed. Under irrigation the type is planted to alfalfa, sugar beets, wheat, barley, corn, potatoes, and oats. Dairying and the raising of hogs and beef cattle are increasing steadily in importance. Nearly every irrigated farm has a few head of horses, cattle, and hogs. Sheep are less common. In the

nonirrigated areas horses and beef cattle predominate. The growing of sugar beets promises soon to be a leading agricultural activity as a result of the sugar factory begun at Mitchell in January, 1920.

The yields of irrigated crops are quite uniform from year to year. Alfalfa yields from 3 to 4 tons of hay per acre per season. Corn yields from 20 to 40 bushels, wheat 25 to 45 bushels, barley 25 to 50 bushels, oats 35 to 90 bushels, and sugar beets from 6 to 10 tons per acre.

Land of this description sells for $90 to $200 an acre, depending upon improvements, location, and character of individual tracts.

Owing to the loose structure of this soil it has a tendency to drift, but this is readily prevented by proper care in management. The organic content should be materially increased.

BRIDGEPORT FINE SANDY LOAM.

The Bridgeport fine sandy loam is a light grayish brown to brown fine sandy loam, underlain at 6 to 12 inches by a subsoil of similar texture but somewhat lighter color. The subsoil material normally extends to a depth of several feet without change. Both soil and subsoil are loose and friable. The surface soil contains little organic matter. The subsoil carries lime, but not in large quantities. Locally, in poorly drained spots, the soil is darker and somewhat heavier in texture than typical.

The Bridgeport fine sandy loam occurs generally on the high Platte River terraces in the southwestern part of the county. It is developed in undulating sags and swells rather indiscriminately distributed within the terrace area. It is generally bordered by other types of the same series.

The surface within the type is usually level to gently undulating, with occasional small areas of more rolling topography. Both surface soil and subsoil normally are well drained.

This type is of moderate importance. There is only a small acreage of it in the county, but a large proportion of it is under intensive cultivation and irrigation. The native vegetation consists of a mixture of buffalo grass, grama grass, blackroot, and needle grass.

Unless it has water this type is of low agricultural value; failure of nonirrigated crops is general. Under irrigation the type is mostly planted to alfalfa, corn, wheat, barley, potatoes, sugar beets, and oats. Live stock of all kinds is carried on the farms, and some stock is raised on every farm. Dairying and hog raising are rapidly expanding. Sheep also are growing in favor. In the nonirrigated areas the grazing of cattle and horses prevails. The sugar beet promises soon to become the leading crop throughout the valley.

Under irrigation alfalfa yields 3 to 4 tons of hay per acre per season. Corn yields 20 to 40 bushels, wheat 25 to 50 bushels, barley 25

to 60 bushels, potatoes 100 to 250 bushels, sugar beets from 7 to 10 tons, and oats 35 to 100 bushels per acre.

Land of this character sells at $100 to $200 an acre, depending upon improvements, location, and character of the individual tract.

This soil is deficient in organic matter, as are most of these terrace types, and its condition can be much improved by increasing the supply. Careful attention must also be given to preventing excessive erosion of the soil in the process of irrigation.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Bridgeport fine sandy loam:

Mechanical analyses of Bridgeport fine sandy loam.

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.*
374001	Soil	3.8	13.1	9.8	34.9	25.4	7.4	5.7
374002	Subsoil	2.6	12.2	10.1	39.2	23.2	8.9	4.1

BRIDGEPORT VERY FINE SANDY LOAM.

The surface soil of the Bridgeport very fine sandy loam is a light grayish brown to brown friable very fine sandy loam of uniform character. The subsoil, which begins at 8 to 12 inches, is like the soil in texture and structure, but lighter in color than the soil. The content of organic matter in the soil varies, but is prevailingly low; the subsoil is quite lacking in this constituent. In local, poorly drained spots the organic content is high, and the soil is darker in color and heavier in texture than as described above. The subsoil is slightly calcareous.

This soil occurs on the high Platte River terraces in the southwestern part of the county. Its typical position is in the lower areas of the prevailingly undulating surface, the lighter textured soils occupying the higher positions.

The surface of the type is in general level, less commonly slightly undulating, and rarely in small areas rolling. The type is generally well drained.

The Bridgeport very fine sandy loam is one of the soils of agricultural importance in the county. Approximately one-fourth of it is under the Government irrigation canal. The remainder is largely in a virgin state. The native vegetation is a mixture of buffalo grass, grama grass, needle grass, and blackroot.

Dry farming on this type is only moderately successful. Wheat, barley, and rye are grown, generally with low yields. Under irrigation the type is intensively cultivated to alfalfa, corn, sugar beets, wheat, barley, potatoes, rye, and oats. Live stock is rather generally

carried on the farms. Dairying and the raising of hogs and of sheep are rapidly increasing in importance. Nonirrigated areas are used for grazing cattle and horses. The sugar beet promises soon to become the leading crop on the irrigated part of the type.

Crop yields on irigated land are approximately as follows: Alfalfa from 3 to 4 tons of hay per acre per season, corn from 20 to 50 bushels, wheat 20 to 60 bushels, barley 25 to 65 bushels, potatoes 125 to 275 bushels, sugar beets from 7 to 11 tons, and oats 40 to 100 bushels.

Land of this type is held at $125 to $200 an acre, depending upon improvements, location, and the character of the individual tract.

This soil has a low organic-matter content, and this should be materially increased for the best results. The problem of providing good subdrainage in the irrigated sections presents difficulties not yet overcome.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Bridgeport very fine sandy loam:

Mechanical analyses of Bridgeport very fine sandy loam.

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.*
374003	Soil	0.7	1.2	1.0	19.0	50.5	18.9	8.8
374004	Subsoil	.7	1.5	.6	22.6	47.6	19.7	7.1

LAUREL FINE SANDY LOAM.

The surface soil of the Laurel fine sandy loam is a grayish-brown very fine sandy loam 6 to 12 inches deep. This is underlain by a light grayish brown to gray very fine sand to very fine sandy loam, which generally continues to a depth of several feet. There is considerable variation in texture in this type even within small areas, which is likely to be the case in stream-laid soils. The surface soil contains little and the subsoil practically no organic matter. The surface soil is very loose and friable, and the subsoil is even less coherent. The materials of the entire soil section contain considerable lime, which apparently is evenly distributed.

The Laurel fine sandy loam includes all the bottom lands along the Niobrara River, White River, and many of the smaller creeks of the county. It is the only first-bottom type mapped in the county. It does not occur as a continuous strip along even the larger streams, but rather intermittently, and always only in very narrow strips. The land is low, flat, and frequently overflowed except for occasional depressional areas which mark old stream channels. These depressions, and sometimes other areas, may be poorly drained, but the drainage is usually sufficient to allow cropping.

This soil has a very small acreage in Sioux County. Probably one-fourth of this is cultivated, the remainder being used for hay and pasture land. Alfalfa, corn, and small grains are all grown, though not extensively. Alfalfa yields about 3 tons per acre, wild hay about 1 ton per acre, and corn from 10 to 25 bushels. The products are all used locally.

Much of this type, except along the Niobrara River, supports a mixed growth of ash, cottonwood, box elder, and elm. The trees are rather stunted, but are a source of firewood and fence posts.

This land sells for $25 to $60 an acre, depending upon the location and the individual conditions of each tract.

MARSH.

Marsh includes several areas, both large and small, where drainage is so deficient that the soil is either covered by water or in a water-logged condition during the greater part of the year.

The application of irrigation to the higher valley lands has caused seepage water to cover these valley areas, rendering them of very low agricultural value. The soils are similar in texture to the adjoining better drained soils, but normally contain much more organic matter.

These lands are not now suited to agriculture, but are good grazing land. They are covered by a rather dense growth of sedges, marsh grasses, and cat-tails. With artificial drainage they would be valuable farm lands.

ROUGH BROKEN LAND.

Rough broken land includes the greater part of the Pine Ridge escarpment, much of the "breaks" to the larger valleys, and some isolated areas of rugged land. It is usually dominated by outcroppings of rock, and has uniformly a rather thin soil. It is without value for cultivation, if exception is made of occasional plots of an acre or two. Most of the type is characterized by a rather open and variable stand of yellow pine forest, with an undergrowth of brush, weeds, and grasses. Grazing is universal on these lands, which furnish a surprising amount of feed.

Land of this character is in good demand for grazing. It is used in connection with adjoining farm lands. This type will support from 25 to 40 head of cattle to the section during the year. It sells for $6 to $10 an acre, depending upon the location, water supply, and topography.

BADLANDS.

The Badlands consist mainly of the severely eroded parts of the Brule, Chadron, and Pierre formations. They are developed most

frequently from the Brule material, a pinkish sandy clay. Erosion is so rapid and the subsoil material so unfavorable to immediate plant growth that the areas are quite devoid of vegetation. The resulting topography is unique, in some instances very roughly dissected, again quite flat.

The Badlands cover a relatively small part of Sioux County. They are mainly in small tracts lying from 2 to 5 miles distant from the foot of Pine Ridge. One large irregular area occurs south and southwest of Orella, in the northeastern part of the county. Most of the areas lie along draws. The bare areas are separated by tongues and fingers of grass-covered land which has not yet reached the Badlands condition. These undissected lands are usually of the Epping and Dawes series.

This land is without agricultural value. It is not cultivated and furnishes a rather poor grade of pasture. Such lands are seldom sold and have values generally less than $5 an acre.

DUNESAND.

Dunesand consists of gray to grayish-brown incoherent fine to medium sand of very uniform texture, typically extending to a depth of more than 3 feet practically without change. Although the soil contains some organic matter, the proportion is not sufficient to bind the same into a stable soil. On the ridges the material is usually lighter in color than that in the hollows, owing to a lower content of organic matter. It is not calcareous.

This type occurs at irregular intervals, and in areas of every size, along the southwestern rim of the unbroken table-land. It occupies an irregular strip extending from approximately the middle of the western boundary of the county southeastward to the southeastern corner.

The irregular succession of dune and hollow is the result of wind action on this loose soil material. The topography varies from very slightly rolling to sharply rolling and even rugged. Most of the type has an extremely uneven and hummocky surface. The individual dunes usually have a height of from 10 to 75 feet, and in exceptional cases reach a much greater height. Cooks Lookout, in T. 27 N., R. 56 W., is probably the highest sand dune, rising about 200 feet above the surrounding land. Innumerable hummocks, hills, hollows, and blow-outs give variety to the landscape. The blow-outs usually occur on northwest, but occasionally on southwest, exposures.

The type is practically without surface drainage. Springs and seepages are found here and there, and a few old stream channels, now almost obliterated by the drifted sand, can still be traced for short distances. The loose porous sand permits ready absorption of the rainfall and free internal movement of moisture.

Dunesand is practically without value for cultivation, although isolated attempts to farm the land are made. It drifts so easily that the removal of the native vegetation is almost certain to ruin the land. Over rather extensive areas of the type the native grasses are cut for hay, the yield seldom exceeding one-fourth ton per acre. Hay is cut only in the depressions, usually with a basket mower.

Dunesand is used mainly for grazing. The native vegetation consists of a great number of grasses, of which redfieldia and stipa are the most common. Yucca occupies the edges of blow-outs and other exposed places. During the spring and summer these grasses afford excellent grazing, and they keep stock in fair condition even through the winter season. The type will ordinarily support from 30 to 40 head of cattle per section during the entire year.

Dunesand commands from $6 to $15 an acre, depending upon improvements, location, and character of the individual tract.

Dunesand has in the past been more or less injured by overgrazing and by attempts at cultivation. It should be used only for grazing and the cutting of native hay, and care taken to see that the pastures are not overstocked.

SUMMARY.

Sioux County occupies the extreme northwestern corner of Nebraska and is a part of the High Plains. The area is 2,055 square miles, or 1,315,200 acres. The topography is generally rolling, but ranges from nearly flat, in the valley lands, to rugged in the Pine Ridge escarpment. There is a range in elevation from about 3,550 feet to more than 5,000 feet. The surface in general slopes to the southeast. Drainage is generally ample; a few poorly drained areas lie in the several valleys and in the dune area.

Sioux County had a population in 1910 of 5,599 and in 1920 of 4,528. With the exception of the residents of the town of Harrison, nearly all the people live on farms. Parts of the county have good transportation facilities. There are few improved public roads. Telephones and rural free delivery reach a small proportion of the ranches and farms. Omaha, Denver, St. Joseph, and Kansas City are the important live-stock markets.

The climate is subhumid, with about 16 inches annual precipitation and a short growing season.

The agriculture consists chiefly of stock raising, generally with only sufficient crops for feed. Alfalfa, sugar beets, potatoes, and small grain are produced under irrigation in the southwestern part of the county.

Land values range from $3 to $300 an acre, depending upon the soil, location, topography, facilities for irrigation, and character of improvements.

Sioux County is mostly an area of residual soils. The several High Plains formations have weathered into the Rosebud, Epping, Dawes, and Pierre soils. Upland areas with little or no surface soil are classed as Rough broken land and Badlands. Wind-formed areas are mapped as the Valentine soils and Dunesand. The alluvial soils, which are made up of reworked materials washed largely from the residual soils, are of the Tripp, Bridgeport, Yale, Orman, and Laurel series.

The Rosebud loamy fine sand has a wide distribution on the tableland. The surface varies from nearly flat to very hilly, and the drainage is good. The chief use of the type is for grazing. The shallow phase represents eroded areas and has the same use as the typical soil.

The Rosebud very fine sandy loam is the most extensive tableland soil in the county. The surface is undulating to rolling and the drainage is good. A large proportion of the dry-farmed land in the area is of this type. It is used for producing small grains and potatoes. The type affords good grazing and some shelter for cattle.

The Rosebud silt loam is the best upland soil in the county, but it is not extensive. The surface of most areas is rolling and the drainage is good. Nearly one-third of the type is cultivated. It gives good yields of grains and potatoes. The remainder is used for hay and grazing.

The Dawes very fine sandy loam occurs in only two small areas. It is used for grazing.

The Dawes silt loam occurs on the lowlands below Pine Ridge. It has an undulating to rolling surface and good drainage. Its use is restricted practically to grazing.

The Pierre loam represents patches with a surface soil slightly lighter in texture than the other types of the series. It is used mainly for grazing.

The Pierre clay loam occurs in local areas within the Pierre clay. The heavy, sticky character of the soil makes it unsuitable for cultivated crops. Good water is practically unobtainable. The type is used only for grazing.

The Pierre clay occupies a large part of the lowlands in the northern part of the county. It has a rolling surface and good surface drainage. A little of it is cultivated, giving low yields of grains. The soil is droughty, and the heavy texture makes it difficult to work. The type is without good water. Some hay is cut, but most of the land is used for grazing.

The Epping very fine sandy loam occupies gently sloping areas of small extent. A little of this type is cultivated under irrigation. The unirrigated areas afford fair grazing.

The Epping silt loam has a compact, impervious soil, and is droughty. The surface is undulating and well drained. The type provides fair grazing during a part of the year.

The Epping silty clay loam has a varied surface and drainage. It makes poor pasture land.

The Valentine loamy fine sand has an undulating to hummocky surface, showing the effects of wind erosion. This soil drifts badly when cultivated. It is used principally for hay production and pasture.

The Gannett fine sand occupies small depressions in the sand-hill region. The land is nearly always moist and is highly valued for hay and pasture.

The Tripp very fine sandy loam occupies generally smooth, well-drained terraces. It is not extensive but is highly developed and usually produces well. Wild hay, alfalfa, and small grains are the leading crops.

The Tripp silt loam occupies level to gently sloping terraces. It is used chiefly for pasture.

The Tripp silty clay loam occurs on nearly level terraces. Most of it is used for pasture. A little of it is irrigated.

The Bridgeport gravelly sandy loam occupies rolling areas on terraces. It is very droughty and has practically no value for farming.

The Bridgeport loamy very fine sand occupies broad divides on the undulating terraces of the Platte River Valley, and is a very important type. Much of it is irrigated and produces heavy yields of alfalfa, potatoes, sugar beets, and grains.

The Bridgeport fine sandy loam occurs in small scattered areas associated with the other Bridgeport soils. Part of it is irrigated and produces large yields of grains, alfalfa, and sugar beets; the rest is used for grazing.

The Bridgeport very fine sandy loam occupies the lower positions on the undulating terraces of the Platte River Valley. The uncultivated parts afford good grazing. Under irrigation the type produces heavy yields of the usual irrigated crops of this region.

The Orman clay loam is an unimportant terrace soil, poorly drained and difficult to work. It is best suited to grazing.

The Yale silt loam is a terrace soil of limited extent. It is subject to drought, and is valued chiefly for grazing.

The Laurel fine sandy loam is a first-bottom type occurring in narrow strips along streams, and is subject to overflow. Part of it supports a stunted tree growth. Some of it is used for alfalfa and grain; the rest is used for hay and pasture.

Marsh includes permanently wet areas. These provide excellent grazing, but can not be farmed in the present undrained condition.

Rough broken land includes escarpments and other areas too rugged for any other use than grazing. Much of the type supports an open growth of yellow pine.

Badlands occupy areas denuded of soil and vegetation by excessive erosion.

Dunesand owes its topography to the action of wind on incoherent sand. It is not suitable for cultivation, but has a considerable value for grazing.

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