Issued December 31, 1915.

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE NEBRASKA SOIL SURVEY,
G. E. CONDRA, DIRECTOR, UNIVERSITY OF NEBRASKA.

SOIL SURVEY OF SCOTTS BLUFF COUNTY, NEBRASKA.

BY

L. T. SKINNER, OF THE NEBRASKA SOIL SURVEY, AND M. W. BECK, OF THE U. S. DEPARTMENT OF AGRICULTURE.

THOMAS D. RICE, INSPECTOR, NORTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1913.]

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1915.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., June 12, 1915.

SIR: In the extension of the soil survey in the State of Nebraska a survey was made of Scotts Bluff County during the field season of 1913. This work was done in cooperation with the University of Nebraska, and the selection of this area was made after conference with State officials.

I have the honor to transmit herewith the manuscript report and map covering this area, and to recommend their publication as advance sheets of Field Operations of the Bureau of Soils for 1913, as provided by law.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

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SOIL SURVEY OF SCOTTS BLUFF COUNTY, NEBRASKA.

By L. T. SKINNER, of the Nebraska Soil Survey, and M. W. BECK, of the U. S. Department of Agriculture.

DESCRIPTION OF THE AREA.

Scotts Bluff County, Nebr., is one of the western tier of counties, bordering Wyoming. Surrounding it are Sioux and Box Butte counties on the north, Morrill County on the east, Banner County on the south, and Goshen County, Wyo., on the west. The boundaries are marked by straight lines which lie approximately on parallels 41° 40′ and 42° north latitude and meridians 103° 20′ and 104° west longitude. The county embraces an area of 723 square miles, or 462,720 acres. It is 21 miles wide north and south and its length east and west averages almost 35.5 miles.

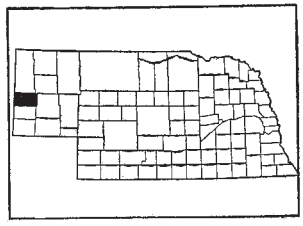

FIG. 1.—Sketch map showing location of the Scotts Bluff County area, Nebraska.

The county lies west of the general eastern boundary of the High Plains, and for that reason is technically within the geographic limits of that physiographic region, though only a very small part of its area lies on the true High Plains. Originally these plains extended over the entire area included in the county, but through erosion effected by the Platte River most of the surface now lies several hundred feet below its original level and on formations below the surface formations of the High Plains.

On account of the physical character of the rock underlying the High Plains the erosion of the region has resulted in the formation along the Platte River of a lowland belt bounded on both its northern and southern sides by a steep slope or escarpment, above which are the High Plains proper. The escarpment is a true one in every sense of the word and is not merely the bluff bounding the river valley. The latter is a shallow trough within the lowland. The river valley, or existing flood plain, not including the terraces, is only a few miles wide from bluff to bluff, while the lowland belt between the escarpment on the south and that on the north includes the greater part of the county. On both sides of the lowland the escarpment is marked by the narrow belt of Rough broken land and the Rosebud stony fine sand, while the High Plains area is rep-

resented by these types and the Rosebud loamy fine sand. A reference to the map will show that the escarpment and High Plains country lie for the most part entirely beyond the northern boundary of the county, while in the southern part only a narrow strip of very irregular width lies within the county.

A large part of the lowland belt between the northern and southern escarpments was originally a broad, flat, alluvial plain, lying about 400 feet above the existing river level. It was formed as the flood plain of the Platte River at a time when that stream flowed at a higher level than at present and when it carried a load of material much coarser than is carried now. Since the formation of this old flood plain the river has excavated its valley to its present level, but in doing so has halted at several levels and built flood plains similar to the older ones, but narrower. These still exist as terraces. The highest flood plain has been subjected to erosion during the time that is represented by the formation of the lower terraces and the existing flood plain, as well as the time taken to cut the valley from terrace level to terrace level and to flood-plain level, so that it is now nothing more than a rolling lowland belt. Only a few small patches of its original smooth constructicnal surface still exist. A large part of its area has been so thoroughly eroded that the flood-plain deposits have been removed, the surface now lying on much older formations that are the same as those underlying the High Plains at a corresponding horizon. This is not true, however, of the other terraces, which retain their original constructional topography to a very great extent. They are terraces in origin and in topography, while the older one no longer is a terrace as a whole and can show its origin only through the existence of very small remnants. The boundary line between the smooth terraces of late age and the eroded area occupied by the old terrace is clearly shown on the soil map, running approximately along the southern boundary of the Tripp loamy fine sand.

On the south side of the Platte River all traces of the ancient flood plain seem to have been nearly effaced. The surface now consists of long, grade slopes sweeping downward from the foot of the steep part of the escarpment in long concave curves, becoming flatter as the distance from the escarpment increases. They slope down from the three exposed sides of every escarpment salient and from both sides of every little valley that has been pushed backward into the escarpment face. Along the river, except where it lies close to a salient, this surface is a broad, smooth, nearly flat plain. On its flat as well as on its sloping portions it is a true grade plain and constructional, therefore, in form. Ravining of its surface is practically lacking. On the steep slopes the soil is relatively shallow and the shape of the surface is essentially the shape of the under-

lying rock. On the flatter slopes the layer of soil and underlying unconsolidated material is thicker and the surface is the result of accumulation. The topography south of the river is therefore entirely different from that north of it, except a narrow belt at the foot of the escarpment across the northeastern corner of the county.

The topographic features of the county consist therefore of the following: (1) The remnants of the High Plains; (2) the escarpments; (3) the grade plains on the south side and across the northeast corner; (4) the ancient terrace on the north side, now eroded into a rolling topography; and (5) the modern undissected terraces and existing river flood plain.

The North Platte River traverses the county diagonally from northwest to southeast. It enters a little less than a mile south of the northwest corner and leaves about 3 miles north of the southeast corner. The larger part of the county lies south of the river. Since the gravel beds which constitute remnants of the ancient Platte flood plain are confined to the northern half of the valley, it may be true that the Platte River Valley lay in that position at that time and did not extend as far south as the existing river channel. This is by no means certain, however. The gravel in these gravel beds are mainly crystalline rock material, consisting of granites, volcanic rocks, metamorphic rocks, quartz, and quartzites.

Since no terraces, either old or young, except a very narrow belt immediately adjoining the channel of the stream, exist south of the river, the driving back of the escarpment and the opening out of the lowland on this side of the river are probably the work of the small, intermittent streams which drain this side. The wind has doubtless aided somewhat, but that its effect has been small is shown in the form or alignment of the escarpment. It does not present a straight or even front, but consists of salients running outward along divides and recessions along hollows or ravines exactly like escarpment fronts in well-wooded, humid regions where there is no possibility of effective wind action. In fact, the main effect of the wind has been the movement and redeposition of the upper few inches of the soil and the local accumulation in a few protected places of larger masses of sand and silt.

Throughout its course across the county the North Platte River receives the water of but one natural constant tributary flowing in its own channel and fed principally by springs. This is Horse Creek, which enters the county from Wyoming and joins the North Platte a few miles from the State line. The channel of Kiowa Creek, southeast of Horse Creek, does not extend to the river but loses itself in a marshy area south of the Mitchell Canal. The original channels of Winter Creek and of other intermittent streams spread out upon the broad, sandy second bottom. Drainage ditches have

been constructed from the upper part of each of these old channels to the river. The upper parts of these channels consist of deeply incised canyons along the border of the uplands. Toward the river the channels become shallower and broader until they finally fade away on the surface of the terraces. The waters which they carry after heavy showers and the spring thaws spread out upon the plain and drop their sediment in small, flat, alluvial fans. There are many such short, deep-water courses along the edge of the upland throughout this part of the country. They are typical of the High Plains region.

The lowest elevation in the county is at the point where the North Platte River leaves it, being approximately 3,765 feet above sea level. As the river enters the county at an approximate elevation of 4,036 feet, it thus has a fall of 270 feet within the county. The highest elevation in the county—4,920 feet—is on the Wyoming line, 1½ miles north of the southwest corner of the county, giving an extreme range in elevation of 1,155 feet. The most abrupt change in elevation exists between the foot of Scotts Bluff, the chief landmark of the county, and its summit. The summit is 4,662 feet above sea level, while the elevation of the river at its foot, less than a mile distant, is approximately 3,880 feet. An elevation of 4,880 feet is attained on the crest of the divide southwest of Gering Valley, in section 31, township 21 north, range 56 west. The elevations of other prominent landmarks are: Castle Rock, 4,473 feet; Dome Rock, 4,560 feet; Mitchell Pass, 4,190 feet; Roubedeau Pass, 4,490 feet; Signal Butte, 4,583 feet; Eagle Nest, 4,760 feet; and Bald Peak, 4,420 feet. The maximum elevation of the upland in the northeastern part of the county is approximately 4,600 feet. This is attained at a point 5 miles west and 1 mile south of the northeast corner of the county. The greater part of Scotts Bluff County lies at elevations between 3,800 and 4,200 feet.

Scotts Bluff County was organized as a separate county in 1888. In 1890, according to the census, the population was 1,888, and by 1900 it had increased to 2,552. During the next decade the growth was much more rapid, and the population in 1910 was 8,355.

The growth of population from 1890 to 1910 was due primarily to the development and extension of irrigation and the accompanying development of intensive farming. Outside the irrigated district there has been little change during this period except for the advent of a few homesteaders. The population of this county has been drawn principally from other communities in Nebraska. In 1910 74.9 per cent of the inhabitants were native white of native parentage, 15 per cent native white of foreign or mixed parentage, 8.6 per cent foreign-born white, and 1.5 per cent of races other than the Caucasian, chiefly Japanese.

The Bridgeport and Guernsey line of the Burlington Route was built through this county in 1900–1901. The town of Scottsbluff, established in 1899, has a present estimated population of 3,600. One of the largest beet-sugar plants in the United States, employing 700 persons during the operating season, is located just east of the town. Mitchell, which had 640 inhabitants in 1910, is the headquarters of the Reclamation Service for the North Platte Project. Minatare, with a population of 338, is an important shipping point for hay, and Morrill, population 346, is the shipping center for the rich agricultural section which extends north into Sioux County. Henry is a small village recently established. Gering, the county seat, has a population of about 1,200.

The Union Pacific Railroad constructed a branch line up the North Platte Valley to Gering in 1911–12. In 1913 an addition was made to this line, and this was followed by the establishment of the villages of McGrew, Melbeta, and Haig. The extension of this branch across the county and into Wyoming is planned.

The county is well supplied with schools and churches. The roads are good where not affected by overflow from the irrigation of adjacent fields.

CLIMATE.

The climate of Scotts Bluff County is typical of the High Plains country and of regions situated at some distance from large bodies of water. It is subject to great extremes of temperature, and the rainfall, always low, is extremely variable and comes in showers of local extent and short duration.

The following table gives in detail the monthly and annual precipitation for each of the 19 years for which the record is complete, beginning with 1890. The observing station was moved from Gering to Scottsbluff, a distance of 3 miles, on January 1, 1909.

Monthly and annual precipitation at Gering-Scottsbluff Station.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
	In.	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*
1890	0.35	0.43	0.37	3.19	1.95	0.62	1.75	1.41	T.	0.16	0.56	0.27	11.06
1891	1.80	.74	1.47	1.30	2.95	3.87	2.45	2.25	2.01	.13	1.12	1.03	21.12
1892	1.31	.40	.96	3.71	3.82	5.13	1.22	1.16	.25	1.75	.05	.75	20.51
1893	.25	.45	.32	.77	.77	1.89	1.01	2.29	.15	.52	.17	1.33	9.82
1894	.29	.47	.70	1.68	.16	3.18	2.67	.70	.90	.14	.49	.40	11.78
1895	.75	.21	.63	.43	2.12	4.06	1.63	.18	.27	.16	.61	.09	11.14
1896	.40	.36	1.50	.66	2.42	3.44	1.90	1.31	1.89	.33	.48	.....	14.69
1897	.19	.30	1.08	1.40	1.79	.67	2.76	1.96	.30	.10	.68	.40	11.63
1900	T.	1.78	.26	4.16	.67	.55	4.14	.67	1.50	.01	.08	.37	15.19
1901	T.	.75	.76	2.31	1.75	4.01	1.20	1.64	2.32	.98	.....	1.54	17.26
1902	.15	.74	1.26	1.29	2.44	3.63	1.71	1.00	4.12	.66	.12	1.13	18.25
1904	.18	.25	.32	1.38	2.61	2.12	2.15	.54	.90	.73	.01	.11	11.30
1905	1.17	.65	.69	4.41	4.57	4.53	2.87	1.62	1.63	1.22	.14	T.	23.50

Monthly and annual precipitation at Gering-Scottsbluff Station—Continued.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
	In.	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*
1908	0.40	T.	0.37	1.75	4.54	1.85	3.01	2.49	0.13	3.05	0.40	0.66	18.65
1909	.73	1.47	.70	.74	4.04	4.58	2.53	.25	1.77	.97	.72	.70	19.18
1910	.16	.16	.33	1.18	1.93	3.05	1.15	.24	1.15	.17	.03	.36	9.91
1911	.57	.20	.01	4.40	1.30	2.71	1.53	1.04	.98	1.96	.03	.54	15.27
1912	.56	.98	1.38	1.63	1.13	1.65	5.33	3.73	2.93	1.46	.67	.15	21.60
1913	.25	.77	1.18	.34	3.12	2.39	2.52	2.03	1.27	.44	.13	2.22	16.61
Mean	.47	.57	.76	1.77	2.86	2.68	2.19	1.47	1.10	.89	.36	.49	15.71

T. indicates an amount of precipitation too small to measure.

The above figures show the variability of the rainfall from month to month and from year to year. It should be remembered also that these figures represent the rainfall at only a single place within the county and that a rain extending over the whole county is a rare occurrence. However, the mean may be taken as fairly representative of the general conditions throughout the county.

The table below gives the normal monthly, seasonal, and annual temperature and precipitation at the Gering-Scottsbluff station:

Normal monthly, seasonal, and annual temperature and precipitation at Gering-Scottsbluff.

	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total for driest year.	Total for wettest year.
	° *F.*	° *F.*	° *F.*	*Inches.*	*Inches.*	*Inches.*
December	30.3	69	−21	0.49	1.33	T.
January	25.8	67	−29	.47	.25	1.17
February	24.5	70	−45	.57	.45	.65
Winter	26.9			1.53	2.03	1.82
March	33.9	85	−20	.76	.32	.69
April	46.5	91	4	1.77	.77	4.41
May	55.3	98	12	2.86	.77	4.57
Spring	45.2			5.39	1.86	9.67
June	66.1	104	33	2.68	1.89	4.53
July	71.8	106	35	2.19	1.01	2.87
August	71.7	106	40	1.47	2.29	1.62
Summer	69.9			6.34	5.19	9.02
September	62.1	101	18	1.10	.05	1.63
October	49.0	92	10	.89	.52	1.22
November	36.0	79	−21	.36	.17	.14
Fall	49.0			2.35	.74	2.99
Annual	47.8	106	−45	15.61	9.82	23.50

In 1913 there were 94 rainy days, 215 clear days, 99 partly cloudy days, and 51 cloudy days. The yearly average is 180 to 190 clear days, 60 to 70 cloudy days, and the rest partly cloudy.

The extreme variability in the amount of rainfall makes the best and most carefully practiced methods of dry farming uncertain in results. This region is seldom without wind, and evaporation from the soil under these conditions is so rapid that a light shower has little effect upon vegetation. The average annual snowfall is about 30 inches, two-thirds of which occurs in the four months of December, January, February, and March. The usual amount is slightly more than 6 inches in March and about 5 inches in each of the other three months. The first snow generally falls in the latter part of September and the last flurry in the spring may occur after May 1.

The daily range in temperature during the warmer months is very great. Owing to the low humidity the atmosphere heats rapidly in the daytime and cools rapidly after sunset. Even in the hottest weather the nights, with few exceptions, are chilly. This has a retarding effect on the growth of some crops that are in all other respects well adapted to this region.

The average growing season is about 130 days. The average date of the last killing frost in spring is May 13, and of the first in autumn September 22. The date of the latest killing frost in spring recorded was May 27, and of the earliest in autumn September 6.

The prevailing wind direction for the year is from the northwest. The wind blows from the south the greater part of the time during the months of June, July, and August, and with more or less frequency during the rest of the year, but from the middle of September to the middle of May the prevailing wind is from the northwest. The average wind velocity is between 10 and 11 miles per hour. In storms a velocity of 30 to 50 miles an hour is frequently attained. Tornadoes are of rare occurrence, though not entirely unknown. Heavy and destructive hailstorms, usually covering small areas, occur occasionally during the growing season, but the annual loss from hail is slight.

AGRICULTURE.

The region which embraces Scotts Bluff County was first visited by white men in 1739, when a party of French explorers crossed the river a short distance above where Mitchell now stands, and went up Horse Creek Valley. Later the North Platte Valley became a part of the route of the main Oregon, Mormon, and California trails, and prior to the building of the Union Pacific Railroad across the plains and mountains the greater part of the transcontinental travel passed through Scotts Bluff County along one side of the river or the other.

The first agricultural settlers were people who in passing through or hunting over the area recognized its value for stock raising. The first cattle ranch was established in the valley a short distance east of the present site of Gering in 1871 by men who had for years been in the freighting business in this part of the country. In 1884 this ranch alone owned 25,000 cattle, and other ranches had been established in various parts of the valley.

Farming began on a small scale on the river bottoms. The great influx of permanent settlers began in 1885, when a group of farmers settled in the neighborhood of the present site of Minatare. The first town within the county was established on the present site of Gering in 1886 by a colony of settlers from Broken Bow, Nebr. At that time the nearest trading post was at Sidney, Nebr., 75 miles away.

Scotts Bluff County lies in the "short-grass country" of the High Plains region, and prior to the development of irrigation in the river bottoms live-stock raising was the sole source of livelihood for the inhabitants.

The lower bottoms provided a good growth of hay for winter feeding, and the higher terraces and the uplands furnished a vast expanse of grazing land. No cultivation was attempted except on lowlands near the river.

In 1889 the value of live stock was four times that of all other farm products combined. Of the 92,333 acres that were then in farms and ranches only 24,476 acres was classed as improved land.

The following table, compiled from returns of the census, shows the acreage and production of the principal crops cultivated in the county in 1909, and, for comparison, the acreage and production of each of these crops for 1889 and 1899:

Acreage and production of various staple crops.

Crop.	1889		1899		1909	
	Acres.	*Bushels.*	*Acres.*	*Bushels.*	*Acres.*	*Bushels.*
Corn	4,787	28,507	3,163	64,110	9,692	145,660
Potatoes	388	13,768	101	9,002	6,452	774,815
Oats	199	3,139	1,676	53,150	15,709	431,443
Wheat	147	1,311	2,291	39,950	5,677	84,063
Rye	11	42	.....	.....	443	5,525
Buckwheat	5	20	8	120	4	35
Barley	2	14	91	2,500	2,634	72,368
Total	5,539	46,801	7,330	168,832	40,611	1,513,909

The extension of irrigation is causing a rapid increase in the acreage under cultivation and in the number of crops produced. The total acreage in farms increased from 92,333 acres in 1889 to 247,629

acres in 1909. Sugar beets were introduced about 1899. In 1909 2,219 acres were planted to the crop, this being over half the total acreage of beets for the entire State that year. Following the establishment of the sugar factory at Scottsbluff in 1910 there was further increase in production, 13,699[1] acres being devoted to the crop in 1913. The acreage is increasing rapidly.

The beets grown in Scotts Bluff County are of average quality. The sugar content ranges from 14.5 per cent to 15.2 per cent. The ordinary yield is from 11 to 12 tons per acre. The heaviest yields are obtained on the soils of the second bottoms, owing largely to the continued cultivation, deep plowing, and fertilization of these lands, which have been under cultivation for a good many years, and partly to the high level of the water table. The soils of the higher terraces have only recently been brought under cultivation and have not been deeply plowed or extensively fertilized as a rule. Owing to the better drainage of the terrace soils, however, the beets grown on them average 1 per cent higher in sugar content than those grown on the bottom lands.

The sugar industry has furnished the basis for an enormous increase in the winter feeding of cattle and sheep, the pulp left after the sugar has been extracted from the beets being an excellent feed for this purpose. An extensive feeding plant is operated each winter in direct connection with the sugar factory, and a large and annually increasing quantity of pulp is sold to independent feeders and farmers. Each year the sugar company alone feeds over 2,000 head of cattle on a ration of pulp, molasses, cottonseed meal, alfalfa, and grain. The feeding industry has outgrown the production of feeders on adjacent ranges, and a large number of cattle and sheep are shipped in from distant ranges each season.

Hog raising is increasing rapidly and becoming an important factor in the live-stock industry of the county.

The total value of live stock in 1889, 1899, and 1909 was $208,290, $921,352, and $1,369,339, respectively, an increase of about 557 per cent in 20 years.

While the sugar beet is the chief money crop of the county, alfalfa exceeds it in acreage and equals it in importance. Alfalfa was not grown in the county prior to 1888. After this year the crop steadily became important, and in 1899 the crop was reported on 8,899 acres. In 1909 this had increased to 13,834 acres. The crop is valued chiefly for its beneficial effect upon the soil. Owing to the semiarid climate of this section, the organic-matter content of the virgin soil is low and the lime content is relatively high. The soils are predominantly sandy, and when first broken for cultivation the problem of blowing is a seri-

[1] Annual Report of the Nebraska State Board of Agriculture, 1913.

ous one. In addition to enriching the soil alfalfa acts as a soil binder the year round, and is the most generally used crop for the purpose on new land. It is also a valuable feed for stock. Hundreds of acres of alfalfa are plowed up each year to make way for sugar beets or potatoes. There is not much alfalfa shipped out of the county, owing to the distance to markets. The ordinary yield of alfalfa is about 3 tons per acre. Under exceptionally favorable conditions 5 tons per acre is occasionally obtained. The quality of the product is excellent.

Prior to the enormous increase in the production of sugar beets, the potato was the chief money crop of the county. In 1909 the average yield of potatoes was 120 bushels per acre. The product is of high quality. During the last few years the acreage and yield have been somewhat reduced and the quality of the tubers impaired by blight, but this is being controlled and the crop is fast resuming its position as one of the more important and profitable crops of the county.

Scotts Bluff County is one of the leading counties in Nebraska in the production of oats as a market crop. In 1909 the acreage of oats exceeded that of alfalfa. Excellent yields are obtained. This crop is especially popular as a nurse crop for spring-sown alfalfa.

The corn acreage exceeds that of oats, but the crop is not so profitable. On account of the shortness of the growing season and the comparatively low temperature of the nights, the grain does not always reach maturity. This tendency to late maturity is usually increased in the irrigated district by the use of too much water. The crop is used mainly for feeding as fodder or ensilage. There is need for the development of a quickly maturing corn.

The acreage of wheat has steadily increased each year. Formerly very little winter wheat was sowed, but owing to the introduction of hardy varieties and the advantage in having the land covered with a crop during the fall, winter, and spring, almost one-half the crop now sowed is of the winter variety. The yields of winter and spring wheats are about the same. Both are popular as nurse crops for alfalfa.

Barley is better suited to sandy soils and dry conditions than oats, and its cultivation is rapidly increasing. It is grown largely for feed.

A comparatively new crop, but one which exceeded barley in acreage in 1909, is emmer (commonly called spelt). In 1909 there were grown 3,069 acres of emmer, as compared with 2,634 acres of barley. Emmer is grown purely as a feed crop. For horses it is a good substitute for oats. It is grown chiefly on the dry lands, and is said by many farmers to be the most profitable dry-land crop they can produce.

Rye is not extensively grown. It is valued chiefly as a winter cover crop and as a nurse crop for alfalfa.

Of the 39,022 acres of hay and forage harvested in 1909 there were 23,698 acres of wild, salt, and prairie grasses; 13,834 acres of alfalfa; 619 acres of millet; 51 acres of timothy; and 820 acres of miscellaneous tame and cultivated grasses and grains cut green for hay. Many kinds of vegetables are produced, but for home consumption only.

Originally this was a prairie country, for the most part barren of trees, and few trees were planted until the problem of obtaining water for irrigation had been solved. In the older communities there are a great many shade trees, usually of good size, and in the newer communities many have been planted. Certain wild fruits grow abundantly in ravines and on river sand bars, and during the last three years the farmers have discovered that they can produce cultivated fruits, of which apples and plums do best. Many varieties of small fruits are easily grown, particularly berries.

As yet very little attention has been given to dairying, although the conditions are very favorable for the future development of this industry.

On the southeast quarter of section 21, township 23 north, range 55 west, 5 miles east of Mitchell, the State operates an experiment substation in cooperation with the United States Department of Agriculture for the study of irrigation methods and crop production in the North Platte Valley. Experimental work in crop rotations, in the use of water, and in other matters relating to the development of local agriculture is in progress. Dry-land agriculture is also being studied on land suited for that purpose, though within the irrigated district. In addition the sugar company advises the beet growers with a view to improving the quantity and quality of the product.

SOILS.

On the basis of origin the soils of Scotts Bluff County have been classified under five main heads. These are (1) residual soils, which have been derived in place from the geological formations underlying them; (2) alluvial, or stream-deposited soils; (3) eolian, or wind-blown soils; (4) colluvial and alluvial-fan soils, which have been accumulated by wash from the slopes of the High Plains escarpment either as colluvial-wash or as alluvial-fan material; and (5) miscellaneous types. The rather constant winds of this region have considerably modified the surface of practically all the soils of the county.

The rock formations that underlie this portion of the Great Plains and outcrop in Scotts Bluff County are of Tertiary age. They belong to two main groups, the White River and the Loup Fork forma-

tions, which have weathered to produce the residual soils. Both consist of beds of sedimentary deposits, as a whole fine grained in character and weakly resistant to erosion.

The White River group includes the Chadron and the Brule formations, the oldest and the lowest of the Tertiary deposits. The Chadron formation consists of greenish-gray and greenish-pink sandy clays and silts. It is exposed only in small areas in the western part of the county and enters into the composition of the soil to a very small extent. The total thickness of the strata is estimated at about 70 feet, but only the upper part of the formation has been exposed.

Above the Chadron lies the Brule formation, which is more than 500 feet in thickness and is one of the most important soil-forming materials of the county. The most extensive beds of this formation consist of compact silts or silty clays containing much fine and very fine sand and having a characteristic whitish-pink or pale flesh color. When this material in its original compact, impervious structure is encountered in the lower subsoil, it is locally known as "hardpan." The formation where exposed yields readily to erosion and many bad-land areas have resulted from its rapid and unequal erosion. As a rule, however, the Brule forms long, gradual slopes at the foot of escarpments. The slopes of the Brule clay rise abruptly in places, as around Scottsbluff, where the formation is eroded by the river and protected by overlying harder beds.

The beds of the Loup Fork group are on the whole made up of coarser textured materials than the underlying White River group. Only two members of the group, the Gering and the Arikaree, are important as soil-forming materials. The Gering formation has no extensive outcrops, as it has a thickness of only 100 feet or less. It is usually a soft, fine-grained sandstone, with occasional beds of coarser material. It occurs as comparatively narrow belts outcropping below the Arikaree formation and forming steep slopes. The soil weathered from it is not to be distinguished from that of the overlying Arikaree, with which it is usually intermingled.

The Arikaree formation in its unweathered state consists of sands of gray color and soft, sandy, calcareous shales and sandstones. By virtue of its greater resistance to erosion, it caps the upland ridges, buttes, and escarpments. It is characterized by layers of very hard, fine-grained, dark-gray concretions, usually in the form of long, irregular, cylindrical masses, lying side by side with their longitudinal axes in a northwest and southeast direction. The soils of the highest upland are derived mainly from the Arikaree formation, while the residual soils of the slopes and the rolling lowland between the sandstone cliffs and the alluvial deposits are derived from the

formations of the White River group. There is little difference between the residual soils and the formations from which they have been derived, except in degree of consolidation. All the residual soils are very shallow and include many exposures of the parent geological formations. Owing to the lack of moisture, weathering of surfaces protected with even a thin soil layer is slow, and the removal of surface accumulations by the wind is therefore an important factor.

The alluvial soils cover two sets of terraces—the high, ancient, well-drained terraces and the flat, poorly drained lower bottoms. The higher terraces represent two ages. The oldest and highest terrace, as was explained in the discussion of the topography, is no longer a true terrace, and the soils, except in very small areas, are not true terrace soils. They consist of a mixture of terrace material and more or less material from the older underlying formations, with doubtless more or less wind-blown material which has become thoroughly mixed through the thorough dissection of the old terrace. The younger intermediate terrace deposits are from 75 to 150 feet deep, below which depth the Brule clay is encountered. The lower bottoms, of which there are also two divisions, are from 20 to 50 feet below the intermediate terraces. The first bottom or flood plain of the river is very little elevated above the river level, and was periodically subject to overflow before the impounding of the North Platte flood waters was accomplished by the Pathfinder Dam. The second bottom is but slightly higher than the first, its elevation ranging from 1 foot to 4 feet. Over some of its area this second bottom resembles the first bottom in soil and drainage conditions, and such soils have been mapped in the same series with those of the first bottom. The greater part of the second bottom, however, being very similar to the higher terraces in soil, drainage conditions, and agricultural adaptations, has been classed therewith.

The eolian soils are composed of materials from both residual and alluvial soils. They are distributed chiefly over the slopes and residual terraces which lie between the cliffs and the alluvial deposits. Certain areas of the alluvial terraces have been so greatly modified by the action of the wind that the soils have been classified as eolian.

On the south side of the North Platte Valley are large areas of soils that have accumulated as colluvial, residual, and alluvial-fan material on evenly graded slopes. Like the other soils, these have been modified on the surface by the wind. They are underlain at no great depth by the Brule and Chadron formations, and large areas are of almost pure Brule material. They are free from any evidence of the action of the river, but have been largely contributed to by wash from canyons, gullies, and slopes.

The following table shows the actual and relative extent of the various soil types mapped in the county:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Mitchell very fine sandy loam	59,072	12.8	Tripp gravelly sandy loam	13,184	2.8
Tripp very fine sandy loam	47,936	10.4	Meadow	11,712	2.5
Epping silt loam	47,488	10.3	Laurel fine sandy loam	9,920	2.1
Mitchell silt loam	41,536	9.0	Goshen loam	7,104	1.5
Valentine very fine sand	32,512	7.0	Marsh	3,200	.7
Tripp loamy fine sand	12,544	6.9	Goshen silty clay loam	1,856	.4
Rolling phase	19,264		Bad lands	1,152	.2
Dunesand	27,072	5.9	Laurel very fine sandy loam	960	.2
Rosebud loamy fine sand	26,176	5.6	Tripp loamy sand	832	.2
Valentine loamy fine sand	26,112	5.6	Orella very fine sandy loam	704	.2
Tripp fine sandy loam	19,008	4.1	Tripp loam	384	.1
Minatare silt loam	18,944	4.1			
Rosebud stony fine sand	17,408	3.8	Total	462,720	
Rough broken land	16,640	3.6			

ROSEBUD SERIES.

The extensive exposures of the Arikaree formation over portions of the Great Plains have weathered into a distinct group of soils, to which the name Rosebud series has been given. The parent rocks, consisting of fine-grained, loosely consolidated, calcareous sandstones, break down into gray or grayish-brown soils, which become lighter in color with depth. In some places the lower subsoil is almost white from the large amount of finely divided white calcareous material.

The distinguishing characteristics of the Rosebud soils are not well developed in this county, since the soil areas are badly eroded and the winds have shifted the surface soil and brought in materials from other formations. The soils of the exposures of the Arikaree formation, however, have been classed with this series and two principal types have been mapped, the stony fine sand and the loamy fine sand.

ROSEBUD STONY FINE SAND.

The Rosebud stony fine sand consists of a gray fine sand to very fine sandy loam ranging in depth from 3 inches to 3 feet. The material becomes lighter in color as the parent rock is approached, but otherwise there is very little change in the soil section. The type is very deficient in organic matter. Both soil and subsoil contain fragments of the Arikaree concretions already described. In most of the areas of this type much of the weathered material has been removed by wind or water erosion and the Arikaree sandstone is so close to the surface that it makes cultivation very difficult.

The surface soil has been modified nearly everywhere by wind-blown material of local derivation and not to be distinguished from the purely residual soils.

The type occurs entirely upon the slopes which break away from the High Plains toward the North Platte Valley and in the northeastern part of the county and upon the tops of a few high bluffs south of the river.

On the gentler slopes, where the soil is deeper, there is a fair growth of buffalo, grama, and blackroot grasses. On the south side of the valley there is a scant growth of pine and some soapweed (yucca).

This type is of practically no agricultural value except for grazing. It has a very poor water-holding capacity, owing to the nearness of the rock to the surface and the porous texture of the subsoil.

ROSEBUD LOAMY FINE SAND.

The soil of the Rosebud loamy fine sand is a grayish-brown loamy fine sand to very fine sand. The subsoil, beginning at about 8 to 15 inches, is lighter in color and slightly less coherent than the surface soil, but otherwise there is very little change in the material to a depth of 3 feet or more. Remnants of the Arikaree sandstone are common in the soil and subsoil. Both soil and subsoil are very incoherent in structure, owing to the fact that there is very little silt present.

The largest area of this type occupies the slopes bordering the highest upland. Other areas occur on the slopes where there is protection from erosion by the wind. The topography is gently rolling to hilly.

Only a very small percentage of this type is under cultivation, owing principally to the fact that when plowed it is subject to severe wind erosion. There is also insufficient rainfall to mature most of the general crops. Where it is cultivated moderate yields of corn, barley, spelt, and millet are obtained. The greater part of the type is utilized for grazing.

The native vegetation consists of buffalo, grama, blackroot, and coarse sand grasses and sagebrush.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Rosebud loamy fine sand:

Mechanical analyses of Rosebud loamy fine sand.

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.*
371201	Soil	0.0	2.6	6.6	36.8	39.4	9.5	5.4
371202	Subsoil	.1	4.2	8.4	43.4	36.3	4.6	3.2

Epping Series.

The formation known to geologists as Brule clay weathers into a distinct group of soils known as the Epping series. The pure weathered product of this formation consists of very fine sands and silts having a characteristic buff or flesh color. It is, however, rarely found in position as purely residual soil, the surface having usually been shifted and reworked by wind or water. The transported and redeposited material, however, is hardly to be distinguished from that which has weathered in position. Only one type of this series, the Epping silt loam, has been mapped in Scotts Bluff County.

EPPING SILT LOAM.

The soil of the Epping silt loam is a light yellowish brown to brown silt loam, 5 to 8 inches deep. The subsoil is usually lighter in color than the soil, but often there is little change in color or texture to a depth of 3 feet or more. When first brought under cultivation the type is lacking in organic matter, but gradually improves. The compact, unweathered Brule clay is often encountered at less than 3 feet below the surface, and at this depth it affects unfavorably the growth of plants and lowers the moisture-holding capacity of the soil. On the slopes southwest of Kiowa Creek the soil is deep, less compact, and contains a large percentage of organic matter.

This type occurs between the alluvial land and the Chadron and Arikaree formations which cap the higher divides. The largest area is crossed by Kiowa Creek. Small areas were mapped all along the upland where the Arikaree and Chadron formations have been removed by erosion, leaving the Brule clay exposed.

The topography varies from level to gently rolling and the drainage is good, except where the Brule clay is near the surface.

A very small proportion of this type, including most of the area in the vicinity of Kiowa Creek, is under cultivation. An area of sand hills along the edge of the Kiowa valley acts as a reservoir for the rainfall, and the seepage from this sand-hill area keeps the subsoil of the adjoining slopes moist enough to mature crops.

None of the type is under irrigation. Fair dry-land yields of corn, potatoes, and alfalfa are reported. The soil contains some alkali derived from the parent rock. Under dry farming the crops are not likely to suffer from an excess of injurious salts, but under irrigation, unless means are taken to prevent these accumula-

tions at the surface, injury will probably result. The impervious nature of the subsoil will prove a hindrance to the removal of soluble salts by underdrainage and the tendency toward surface accumulations of these salts will be much greater than where sandy subsoils are present.

In the following table the average results of mechanical analyses of samples of the soil and subsoil of the Epping silt loam are given:

Mechanical analyses of Epping 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.*
371203, 371205.....	Soil.....	0.0	0.4	0.7	4.9	34.8	51.9	7.0
371204, 371206.....	Subsoil.....	.1	1.1	1.2	4.4	34.3	50.8	8.1

Orella Series.

The Orella series includes soils derived from the Chadron formation. This material, as described by Darton, is predominantly a sandy clay of light greenish gray color, usually with coarser beds at the bottom, including deposits of gravel. The beds above the gravel often have a pronounced dark-red color. When this formation has been subject to rapid erosion it gives a bad-land topography, but in this county the formation is only slightly exposed on a gentle slope, and the weathered product has remained in position. Only one type, the Orella very fine sandy loam, has been mapped in the county.

Orella very fine sandy loam.

The soil of the Orella very fine sandy loam to a depth of 8 to 30 inches is a silty very fine sandy loam of a yellowish-gray color, with a slight, greenish tinge. The subsoil is similar in texture, but a little more compact than the surface soil, and the color is light yellow, with a greenish tinge. There is very little organic matter present in this soil, and it is accumulated very slowly. The parent rock, the Chadron formation, is encountered at depths ranging from 8 inches to 3 feet or more. This formation, like the Brule clay, is impervious to water.

A very small area of this type was mapped south of the North Platte River, in township 23 north, ranges 56 and 57 west. It occurs on a rolling slope over which the Chadron formation is exposed in places. It is of very little agricultural value.

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

Mechanical analyses of Orella 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.*
371207	Soil	0.1	1.4	3.0	15.7	42.0	30.7	7.3
371208	Subsoil	.2	2.2	5.3	20.0	30.4	31.2	10.8

GOSHEN SERIES.

The Goshen series includes the darker colored soils that occupy basinlike valleys and depressions over the upland. The soil material is partly the weathered product of the upper part of the Chadron formation, reworked and deposited in low undrained areas, but it has been influenced by the silt and fine sand blown and washed in from the Brule clay and Arikaree formations. This series covers rather a wide range of textures and soil materials having the same topographic position. The heavier soil is locally known as "Goshen mud" when wet. As a rule the soils are very compact and plastic. Iron concretions are common in the soils and subsoils, indicating a poor condition of drainage. There is a large percentage of alkali present throughout the series and in many places it is sufficient to kill vegetation. Two types are mapped—the loam and silty clay loam.

GOSHEN LOAM.

The Goshen loam has been made to include a variety of soils of similar topography and drainage conditions, and so small in extent that it was impracticable to separate them. The surface soils vary in color from light to dark gray, the lighter colors being most common. In texture they range from fine sandy loams to silty clay loams. The most extensive soil, however, is a fairly good loam of rather heavy texture, the surface soil ranging from 10 to 20 inches in depth and from light to dark gray in color. The subsoil is lighter in color and much heavier in texture than the surface soil, and in many places iron concretions are abundant. In some localities the subsoil is a silty clay loam, but typically it contains sufficient sand to give it a loamy character.

The type occurs in the western and southwestern parts of the county, occupying basinlike areas where drainage has been obstructed. At certain seasons of the year much of the type is under water. The inundated area, however, is much reduced in the summer by evaporation. The lack of drainage and the constant evaporation of water containing salt in solution have caused an accumu-

lation of alkali in sufficient quantities to affect vegetation. The plant growth is very sparse and consists of sagebrush and grasses that are tolerant of alkali. This type is utilized only for grazing and has but a small value for this.

GOSHEN SILTY CLAY LOAM.

The soil of the Goshen silty clay loam to a depth of 10 inches is a heavy silty clay loam of a grayish-brown color with a slight drab tinge. The subsoil is a brownish-yellow clay loam with slightly more sand and silt than the soil. This soil is very plastic and sticky when wet and cracks and checks on drying. Iron concretions are common in both soil and subsoil. This type when wet is known locally as "Goshen mud." When dry it is almost impenetrable with an augur. This type occupies a very small total area in range 58 west, townships 21 and 22 north.

The Goshen silty clay loam occupies a basinlike depression and is very poorly drained.

The vegetation on this type consists of sagebrush and alkali-resistant grasses. Bare spots are common owing to the excessive accumulation of alkali. The type is practically worthless for agriculture.

The results of mechanical analyses of samples of the soil and subsoil of this type follow:

Mechanical analyses of Goshen 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.*
371209	Soil	0.1	0.4	0.6	4.4	17.0	45.4	31.9
371210	Subsoil	.1	.6	1.2	5.5	20.3	36.3	36.2

TRIPP SERIES.

The Tripp series includes the soils that cover the river-formed terraces along the North Platte River and the better drained soils of the second bottoms. The soils range in texture from a loam to a gravelly loam. The prevalent color is light brown or yellowish, only slightly darker than that of the Epping silt loam, but there may be local variations of dark brown, grayish brown, and gray. The soil material represents alluvial sediments brought down from a great many formations lying within the drainage basin of the Platte River. In process of weathering the surface soils have been greatly modified by colluvial wash from the surrounding slopes and by wind-blown sands from stream channels or from the extensive sandy areas on each side of the valley. Six types belong-

ing to this series were mapped in the county—the gravelly sandy loam, loamy sand, loamy fine sand, fine sandy loam, very fine sandy loam, and loam.

TRIPP GRAVELLY SANDY LOAM.

The Tripp gravelly sandy loam includes beds of gravel, gravelly sand, and gravelly loam which occur among the older alluvial deposits of the North Platte River. The material varies widely, but the gravelly sand is the most extensively distributed.

There are two topographic phases of this type. The older of these was deposited when the North Platte River, which now lies deep in the Brule clay, had cut through the Loup Fork sandstone only and was flowing in a channel which lay on the Brule formation. This former position of the river is marked by shallow stratified deposits of sand, gravel, and waterworn bowlders, capping the tops of hills and ridges at a common level along the north edge of the river terraces. The Brule clay underlying such portions of this old channel as were not protected by a gravel deposit has been eroded by wind and water to and below the level of the next series of terraces, leaving the protected portions as hills and ridges. This phase of the type has practically no agricultural value, but is utilized as a source of sand and gravel for building purposes. It occurs in irregularly shaped areas, in most cases surrounded by areas of Tripp loamy fine sand, rolling phase, in Winter Creek, Tabor, Dewey, Field, and Highland Townships. The largest of these lie in Winter Creek Township, one immediately south of Lake Alice.

The younger phase flanks the other edge of the terrace system, next to the second bottom. It is a mantle of sand, gravelly sand, and gravelly loam covering the slope between the second bottom and the next higher terrace. This phase is found included within pasture lands and also furnishes sand and gravel for various uses. It occurs in long, narrow areas, practically parallel to the present channel of the North Platte River, and forms an almost continuous strip between the southeast and northwest corners of the county, with narrow extensions extending along slopes of streams issuing from the northern belt of the High Plains. Only two small areas of this type are found south of the North Platte River.

The soil material ranges in depth from 1 foot to 3 feet or more. The higher phase is underlain by Brule clay. The lower phase has a substratum of sand.

TRIPP LOAMY SAND.

The surface soil of the Tripp loamy sand is a yellowish-brown loamy sand ranging in depth from 15 to 24 inches. There is very little difference between the soil and subsoil, the latter being more

loamy and slightly heavier than the soil and grayish brown in color. Both soil and subsoil contain considerable gravel.

This type is associated closely with the Tripp gravelly sandy loam, which lies just above it, and from which it has received much colluvial material. The only area of this type in the county occurs southeast of Mitchell, adjoining the first bottom.

The topography is smooth, sloping gently toward the river. Most of the type is under irrigation, producing fair yields of corn, alfalfa, and potatoes.

Only a small proportion of the Tripp loamy sand is under cultivation, and crop yields are low on account of the droughty condition of the soil and its susceptibility to wind erosion.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of this type:

Mechanical analyses of Tripp loamy sand.

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.*
371217	Soil	2.5	5.4	5.7	30.6	41.8	9.4	4.6
371218	Subsoil	3.6	6.0	6.4	25.6	39.4	13.7	5.3

TRIPP LOAMY FINE SAND.

The surface soil of the Tripp loamy fine sand is a brown loamy fine sand 18 to 24 inches deep. The subsoil is a yellowish-brown loamy fine sand. The type is composed of different grades of sand, with enough silt and organic matter to give it a loamy character. All the areas of this type are fairly uniform in color and texture. Over some small areas the surface soil contains so little fine material that it is subject to wind erosion, and in a few places the subsoil is slightly heavier than usual. Great care must be taken in cultivating this soil in order to prevent drifting. The soil and subsoil are both very loose and easily stirred, but when handled properly they have a good water-holding capacity.

The Tripp loamy fine sand occurs in irregular bodies along the North Platte Valley, mostly north of the river. It begins in the extreme northwestern part of the county, just east of Henry. A more extensive area lies around Morrill, but the most important area from an agricultural standpoint lies north and east of Mitchell. There are only comparatively small patches scattered over the valley.

The surface varies from nearly level to gently undulating, with occasional irregularities caused by sand hills. The sand-hill topography prevails in the large area north of Morrill. Blow-outs are

common on the hillsides, and there is considerable shifting of the surface sand on all parts of this type.

The greater part of the type is below the higher ditches, but irrigation is somewhat difficult on account of the uneven topography.

The native vegetation on this type is similar to that on the loamy sand, but with a larger proportion of buffalo grass and less sagebrush.

The Tripp loamy fine sand when properly handled is exceeded in productiveness by only two types in this series—the sandy loam and the very fine sandy loam. Practically the same crops are grown on it as on the heavier types.

Tripp loamy fine sand, rolling phase.—The Tripp loamy fine sand, rolling phase, consists of a brown loamy fine sand with a slight reddish brown tinge to a depth of 20 inches, below which it gradually changes to a light yellowish gray fine sand. The surface soil contains more organic matter than the typical soil and is not so liable to wind erosion, the greater part of it being still covered with native grasses. The subsoil, however, is much lighter in texture than that of the main type.

The rolling phase occurs mostly south of Lake Alice and south and southeast of Lake Minatare, with a few patches scattered over the higher and older terraces north and northeast of Scottsbluff. It is found associated with the higher areas of the gravelly sandy loam. This phase has a gently rolling to hilly topography, occupying an eroded terrace. The surface has been influenced to some extent by wind action. The same vegetation is found on the phase as on the main type.

The greater part of the rolling phase is above the irrigated district and not much of it is used for any purpose other than grazing. Where irrigation has been practiced results have been obtained almost equal to those obtained on the main type.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the typical Tripp loamy fine sand:

Mechanical analyses of Tripp loamy fine sand.

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.*
371222	Soil	1.0	1.2	2.4	46.4	35.4	7.1	6.3
371223	Subsoil	1.0	2.0	3.0	45.4	34.8	9.1	5.1

TRIPP FINE SANDY LOAM.

The soil of the Tripp fine sandy loam, to a depth of 14 to 18 inches, is a brown to grayish-brown fine sandy loam, containing a small quantity of coarse sand and gravel. The subsoil consists of a lighter

colored material of similar texture to a depth of 30 inches, below which there is a light yellowish gray sand, mostly of the very fine grades. In the areas of this type which lie on the second bottom a gravelly stratum is encountered at 30 inches to 3 feet or more. The areas on the higher terraces are underlain usually below the 3-foot section, but in places at a depth of about 18 inches, by many feet of sand. Very little trouble is experienced with this soil from blowing, unless it is plowed in the fall. Most of the type has a good water-holding capacity and will mature crops under very unfavorable conditions of rainfall, but in places where the layer of sand is less than 3 feet from the surface it is subject to drought.

The Tripp fine sandy loam occurs in large areas on the better drained portions of the second bottom around Scottsbluff, but most of it is found between the rolling phase of the Tripp loamy fine sand and the more recent terraces north of the North Platte River. The native vegetation consists mostly of grama and needle grasses, with a little sagebrush and some coarse grasses.

Almost every crop common to this section, including sugar beets, alfalfa, corn, wheat, oats, barley, and potatoes, is grown on this type. It produces very large yields of all these crops except corn, the yield of which is reduced by the climate. Potatoes do especially well. At present the organic-matter content of this soil is low, but it is greatly improved by very light applications of barnyard manure.

The results of mechanical analyses of samples of the soil, subsoil, and lower subsoil of this type are given in the following table:

Mechanical analyses of Tripp 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.*
371219	Soil	2.0	8.0	8.9	25.4	28.3	17.8	9.9
371220	Subsoil	2.8	7.7	9.6	29.0	28.4	15.3	7.4
371221	Lower subsoil	1.5	6.4	9.2	37.6	29.7	10.2	5.5

TRIPP VERY FINE SANDY LOAM.

The soil of the Tripp very fine sandy loam is a brown to grayish-brown very fine sand or very fine sandy loam to a depth of 18 to 24 inches. The subsoil is a light-brown to grayish-brown very fine sandy loam. This type is quite generally underlain, at depths ranging from 20 inches to 3 feet or more, by a layer of yellowish-brown silt loam, which, according to observations made in various borings, ranges in thickness from 1 foot to 5 feet and is underlain by many feet of sand. In the small areas south of the North Platte River considerable variation was noted, the layer of silt never being reached

within the 3-foot section. The surface soil is rather high in organic matter, and both soil and subsoil contain enough fine material to make the type retentive of moisture. There is also very little removal of soil by the wind, unless the land is fall plowed.

The Tripp very fine sandy loam is the most extensive type of the Tripp series. It occupies practically all of the first terrace north of the North Platte River from the eastern border of the county to a point northwest of Mitchell, with a wide band along the banks of Winter Creek. A few smaller areas occur in the vicinity of McGrew and 5 miles south of Henry.

The topography is nearly level, with a few exceptions where it is gently undulating, but there is sufficient elevation to give good drainage. The even topography of the greater part of the type makes it well suited for irrigation. The native vegetation of this type is similar to that of the other types of this series.

This is the best agricultural soil of the Tripp series, all the crops common to this section of the State being profitably grown on it. Sugar beets and alfalfa give the best returns, but such crops as potatoes, barley, oats, and wheat do very well. This soil responds very readily to applications of stable manure.

Mechanical analyses of samples of the soil and subsoil of the Tripp very fine sandy loam are given in the following table:

Mechanical analyses of Tripp 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.*
371226	Soil	2.0	3.5	3.0	8.6	40.3	33.8	8.5
371227	Subsoil	2.8	4.4	4.2	10.9	43.8	27.4	6.7

TRIPP LOAM.

The Tripp loam consists of a brown compact loam containing some fine to medium sand, underlain at an average depth of 12 inches by a subsoil of similar texture but somewhat lighter brown color. Slight iron stains appear throughout the subsoil. The content of organic matter is very low, especially in the subsoil. The compactness of the soil and subsoil and the presence of harmful amounts of alkali make cultivation very difficult.

Only one small area of this type has been mapped. It comprises less than a square mile and is located upon the third terrace 3 miles south of Henry. The topography is practically level and drainage is very poor. Buffalo and grama grasses are the most abundant native plants. Owing to the accumulation of alkali and the hardpan

character of the soil, the growth of grass over the type is very poor. The type is used for pasture and is not well suited for this purpose.

In the following table the results of mechanical analyses of samples of the soil and subsoil of this type are given:

Mechanical analyses of Tripp 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.*
371228	Soil	1.2	2.9	4.6	22.3	24.2	23.2	21.4
371229	Subsoil	.0	.6	2.2	15.6	26.2	27.2	28.3

LAUREL SERIES.

The Laurel series includes the light-brown soils of the lower bottoms. The surface soils are composed of finer materials, principally silts and fine sands, but they overlie beds of various grades of material deposited by the river at different stages of its history. Beds of coarser sands and gravels are found at a depth of several feet. In this county the Laurel soils occupy the lower bottom, which was subject to overflow before the installation of the Pathfinder Reservoir, and the poorly drained portions of the second bottom. They contain variable quantities of soluble salts. Two types were mapped in the county, the fine sandy loam and the very fine sandy loam.

LAUREL FINE SANDY LOAM.

The soil of the Laurel fine sandy loam is a light-brown to gray fine sandy loam to a depth of 15 inches, underlain by a dark-gray fine sandy loam containing a considerable quantity of sand and small gravel. A stratum of gravel is encountered at a depth of 30 inches to 3 feet or more. The soil is rather high in organic matter, but the subsoil is very deficient in this material. In the more poorly drained areas iron-stain mottlings are very common. Over a large percentage of the type there is an accumulation of alkali salts caused by seepage from the canals on the terraces.

The Laurel fine sandy loam occurs in an irregular body south of McGrew. On the north side of the river and following it there is a continuous irregular band of this soil from the eastern part of the county to Mitchell. There is also a small irregular body 2 miles south and another small area southeast of Mitchell, on the south side of the river.

This type occupies the first bottom of the North Platte River, and represents a very recent deposit of alluvium.

Before the Pathfinder Dam was built all of this type was subject to overflow. The topography is nearly level, and drainage is very poor. It is almost impossible to establish artificial drainage, as the water table is in many places within 3 feet of the surface.

The native vegetation consists mostly of wild grasses, including a large proportion of wild wheat. Near the streams there are many trees, mostly cottonwood.

Owing to the excessive accumulations of alkali and the poor drainage, little of this type is suitable for cultivation. The greater part of it is in wild grasses. Most of this area is cut for hay.

LAUREL VERY FINE SANDY LOAM.

The soil of the Laurel very fine sandy loam, to a depth of 24 inches, is a light-brown to gray friable very fine sandy loam, underlain by a gray very fine sand. In many places coarse gravel is reached within the 3-foot section. The content of organic matter is rather high. In places, such as the area north of Scottsbluff, drab mottlings appear in the subsoil, caused by seepage water from the canals. Throughout the type there are well-drained spots which resemble the Tripp soils, but these are too small to indicate on the map.

There are only three areas of this type mapped in the county, one at Melbeta, one north of Scottsbluff, and another 1½ miles south of Henry. The most important area is the one at Melbeta.

The topography is fairly level, and in many places drainage is deficient. It is necessary to establish drainage by tiling or ditching, as the water table is near the surface. The bottom upon which this soil occurs lies a little higher than the other bottoms of the same series. The area south of Henry has been rather badly eroded by recent overflows.

The vegetation on this type consists mainly of the native wild grasses, with a scattering growth of cottonwood trees near the stream channels.

This soil contains less alkali than the Laurel fine sandy loam and is better suited for agriculture. It is very easily tilled. Alfalfa and sugar beets are the chief crops grown, fair yields being obtained.

In the following table the results of mechanical analyses of samples of the soil and subsoil of this type are given:

Mechanical analyses of Laurel 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.*
371236	Soil	0.0	0.2	0.4	9.4	48.5	36.3	5.3
371237	Subsoil	.0	.2	.4	12.6	60.2	22.6	3.9

MINATARE SERIES.

The Minatare series includes gray to grayish-brown soils with gray subsoils. Iron stains and iron concretions are common, and in places the lower subsoil has a mottled drab and yellow color. Both soil and subsoil are highly calcareous, and in many places there is a harmful accumulation of soluble salts. The soils occur on the first and second bottoms. The topography is nearly level and natural drainage is restricted. Only the silt loam type occurs in the county.

MINATARE SILT LOAM.

The soil of the Minatare silt loam, to a depth of 10 inches, is a gray silt loam containing varying quantities of fine and very fine sand. The subsoil to a depth of 30 inches is a yellowish-gray silt loam, below which the color is dark gray, changing to a lighter yellowish gray. Iron stains are common throughout the soil section and in places drab and yellow mottlings occur in the lower subsoil. The soil and subsoil are hard and impenetrable when dry, but under good moisture conditions they are very friable. In a few of the more poorly drained areas, where clay has accumulated, the soil is rather sticky. The soil is deficient in organic matter and is not easily built up.

The most extensive area of this type extends from the eastern boundary line along the north side of the river to a point 5 miles northwest of Minature. On the south side of the river there is another rather large area extending from the eastern county line up to and including McGrew. Small areas are scattered along both sides of the river as far out as the higher terraces, where drainage has been retarded.

The soil material consists of recent alluvium and is composed largely of sediments brought down from the Brule and Chadron formations.

The topography is nearly level, there being only a very gentle slope toward the river, and drainage is poor. The areas of this type not only have been subjected to the use of too much irrigation water, but are so located as to be directly in the path of seepage from higher irrigated areas. The native vegetation consists of buffalo grass, wild wheat, and other alkali-resistant plants.

Thousands of acres of land of this type that were once under cultivation have fallen into disuse on account of the seepage and the increase of alkali deposits. In many places the accumulation of alkali has covered extensive though patchy areas with a crustal deposit. This condition is most noticeable east of Minatare. The greater part of the type has been allowed to return to native salt-resistant grasses and is utilized as hay land. Several drainage dis-

tricts have been promoted to reclaim a large part of this soil, which can be accomplished if thorough drainage is established and the seepage waters from the higher land are intercepted and carried to the river by deep ditches.

Below are the results of mechanical analyses of samples of the soil and subsoil of the Minatare silt loam:

Mechanical analyses of Minatare 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.*
371238	Soil	0.0	0.2	0.2	1.4	41.4	51.0	5.7
371239	Subsoil	.0	.1	.1	.7	16.5	46.1	36.4

VALENTINE SERIES.

The soils of the Valentine series consist of sands and sandy loams of gray to grayish-brown color which have been derived by weathering from wind-blown material. The material was originally derived from the soils of the Rosebud series, which in color and composition these soils greatly resemble. It is only the wind-blown origin and the prevailing dunelike topography of the Valentine series that make a separation of the two series necessary. Two types belonging to this series were mapped, the loamy fine sand and the very fine sand.

VALENTINE LOAMY FINE SAND.

The Valentine loamy fine sand consists of a grayish-brown loamy fine sand to a depth of 3 feet or more. There is no change within the 3-foot section, except that the surface soil for a few inches is very slightly darkened by organic matter. When dry the soil is very loose and incoherent and subject to wind erosion, but when wet it is inclined to be compact and sticky.

This type is most extensively developed in two areas, northwest and southeast of Lake Minatare. There is also a large, irregular area south of the North Platte River, 4 miles south of Morrill, and one 3½ miles east of Gering. A few small areas are scattered over the county.

The surface varies from level to gently rolling. The topography and position of the type as a whole are favorable to irrigation.

The native vegetation on this type consists mostly of buffalo, grama, blackroot, and a few other of the coarser grasses, and needle grass.

Practically all of the irrigated portions of the type are farmed, about the same yields being obtained as on the Tripp loamy fine sand.

Unirrigated areas make fairly good pasture land. This type is more subject to blowing than the Tripp loamy fine sand.

The following table gives the results of a mechanical analysis of a sample of the soil of the Valentine loamy fine sand:

Mechanical analysis of Valentine loamy fine sand.

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.*
371232	Soil	0.1	2.4	4.4	25.6	54.6	9.8	3.1

VALENTINE VERY FINE SAND.

The Valentine very fine sand consists of a grayish-brown very fine sand, which continues without change to a depth of more than 3 feet. The soil becomes rather compact when wet. It retains moisture very well, but not so effectively as the very fine sandy loam types. This type resembles the Valentine loamy fine sand in composition, topography, and crops produced, differing from that type only in texture.

The largest and most important area of this type lies along the northern line of the county, in the vicinity of Lake Alice. There are also large areas in the vicinity of Lake Minatare. A few small areas occur throughout the uplands on both sides of the river.

The topography varies from level to gently undulating and is favorable for irrigation. This soil blows very easily when not covered with vegetation, and blow-outs are very common on this as on other types of the series.

The native vegetation includes buffalo, grama, blackroot, and needle grasses, buffalo grass predominating. These grasses cover the ground rather thickly and hold the soil in place.

On irrigated portions of this type potatoes, beets, and alfalfa do well, the yields comparing favorably with those of the Tripp loamy sand. The greater part of this type occurs above the line of irrigation, where its liability to blow makes farming nearly impossible.

This is not a good dry-farming soil, and it is not drought resistant. It serves well as pasture land when not grazed too closely.

Results of a mechanical analysis of a sample of soil of the Valentine very fine sand are given in the following table:

Mechanical analysis of Valentine very fine sand.

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.*
371233	Soil	0.0	2.4	5.2	20.8	55.4	11.7	4.5

MITCHELL SERIES.

The Mitchell series consists of light-brown or buff-colored silty soils, which in this county cover terraces, terracelike benches, and gentle slopes south of the North Platte River. They are composed mainly of colluvial and wind-blown materials, derived principally from the Brule clay and to a lesser extent from the Arikaree and Gering formations. These soils have been transported only short distances, and differ but slightly from the soils of the Epping series. The Brule clay formation underlies them at depths ranging from 3 to 40 feet. The topography varies from level to gently rolling, but the drainage is usually good. Two types in the Mitchell series were mapped, the very fine sandy loam and the silt loam.

MITCHELL VERY FINE SANDY LOAM.

The Mitchell very fine sandy loam consists of a light-brown to grayish-brown, rather compact, very fine sandy loam, extending to a depth of more than 3 feet. The level areas have local variations in the vertical section, consisting of alternate layers of coarser or finer material. The area affected by these exceptions is restricted to low-lying patches that have at times been subjected to overflow and sedimentation. The sloping and rolling areas are more uniform in texture and the proportion of Arikaree material is greater. This type includes the greater part of the colluvial slopes of Arikaree material which borders the cliffs along the upland to the south of the North Platte River. It does not differ materially from the soils of the Tripp series, except that it is more uniform in color throughout the 3-foot section. The soil has a rather higher content of organic matter and a good water-holding capacity, and is profitably used for dry farming. In the vicinity of Gering the Brule clay is so close to the surface that it is impossible to grow trees until the hardpan is broken.

This type covers much of the southern part of the county. The topography varies from nearly level to gently rolling and is very favorable for irrigation. The soil is not subject to much wind erosion.

The native vegetation consists of buffalo and grama grasses, with some needle grass, the finer grasses predominating.

The best results in dry-land farming on this type were observed in Gering Valley above the irrigated districts. Under irrigation it is the most highly developed and one of the most productive soils of the county, all the crops common to the irrigated district being produced, including sugar beets, alfalfa, wheat, barley, oats, corn, and potatoes.

Following are the results of mechanical analyses of samples of the soil and subsoil of the Mitchell very fine sandy loam:

Mechanical analyses of Mitchell 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.*
371211	Soil	0.1	0.4	2.2	21.5	40.8	26.5	8.5
371212	Subsoil	.0	.5	2.4	21.4	29.2	33.3	13.5

MITCHELL SILT LOAM.

The Mitchell silt loam consists of a light-brown or buff silt loam which is uniform in texture and structure in most places to a depth of 3 feet or more. At a depth of about 15 inches the color usually changes to a lighter buff. The deeper subsoil in some places contains layers of very fine sand. Both soil and subsoil are rather deficient in organic matter. The soil is loose and friable and easily tilled. When wet the surface soil is rather slippery, but not at all sticky.

This type occurs only south of the North Platte River and is practically the only soil in the Mitchell bottom. There is a large area immediately west of Gering and a few small areas southeast of Coyote Rock and Roubedeau Pass.

The topography is nearly level, with a gentle slope toward the river. It is more uniformly level than that of any other type mapped in the county, and for this reason the type is more easily irrigated than any other type. The drainage is excellent.

The native vegetation consists of buffalo and grama grasses, but these do not maintain a good stand, on account of the droughtiness of land which has not been plowed.

Where irrigated this type is utilized almost entirely for growing sugar beets and alfalfa and is one of the most productive soils in the county. Notwithstanding its fine texture, it retains irrigation water very well. Where it has been impossible to irrigate the land, corn, wheat, and barley have given results as good as or better than on any other soil in the county. When cultivated without irrigation, however, the surface soil is liable to be blown away, unless plowed early in the spring and seeded down.

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

Mechanical analyses of Mitchell 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.*
371213	Soil	0.0	0.4	0.4	2.2	18.2	67.1	11.8
371214	Subsoil	.0	.2	.2	2.0	24.9	54.6	18.2

MISCELLANEOUS MATERIAL.

DUNESAND.

Dunesand consists of a gray to yellowish-gray or brownish-gray sand, with little change in texture to a depth of more than 3 feet. The sand grains vary in size from medium to very fine, with the fine sand predominating. There is usually some organic matter in the surface soil, but not enough to bind the soil and prevent it from drifting.

Dunesand occurs in numerous detached areas in nearly all parts of the county, but usually in association with areas of other sandy soils. A large area, comprising several square miles, occurs in the northwestern part of the county east of Henry. Another area of some importance is found in the extreme southeastern part of the county, and numerous smaller areas are scattered over the hilly section and the more sandy terraces. There are two large areas in the southwestern part of the county. The surface consists of sharply rounded hills and ridges.

The greater portion of this type was derived by weathering from the more sandy strata of the Arikaree formation. It has been accumulated by wind action.

The native vegetation consists of coarse sand grasses. In spring and summer these grasses furnish excellent pasture, but in winter they have less value for grazing. Where vegetation is scanty the surface sand may begin to drift with the wind and form the cavities in the hillsides known as "blow-outs." This tendency to drift would prevent the cultivation of the sand-hill section even if the soil were very productive.

Portions of this type, including the large area east of Morrill and one northwest of Mitchell, have a slightly finer texture and a more gently rolling surface than usual. There are also included small areas having a more loamy texture which were too small to indicate on the map.

The following table gives the results of the mechanical analysis of a typical sample of Dunesand:

Mechanical analysis of Dunesand.

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.*
371231.....	Soil.....	0.2	5.2	13.4	42.8	34.2	2.7	1.6

MEADOW.

The term Meadow has been applied to the lowest alluvial deposits along the North Platte River. It includes coarse river sands and gravel of the river bed over and through which the stream flows, numerous mud flats, and low marshy areas. The materials range in texture from coarse gravel to heavy clays, but the areas of the various types are so small and so intermixed with one another that a separation was impracticable. The greater part of the land under this classification is worthless for agriculture, but small areas are grassed over and have some value as pasture.

MARSH.

The term Marsh has been applied to those areas whose agricultural value has been destroyed by the accumulation of seepage waters. These tracts occur at all levels within the irrigated districts, and their undrained condition has prevented their separation into types. Drainage projects are under way for the reclamation of numerous areas of this type, and when drainage has been established these areas will closely resemble the adjoining types in texture and adaptation. They will be darker in color and richer in organic matter.

ROUGH BROKEN LAND.

The term Rough broken land is applied to areas which are so badly eroded as to have no agricultural value. The greater part of this type is found bordering the upland on both sides of the valley. It includes the cliffs and the steep slopes that are so rough with outcrops of sandstone as to support no vegetation of any value. It borders not only the main valley, but the tributary canyons, and also includes certain canyonlike gullies that have been cut through the residual slopes and terraces on the south side of the valley by streams issuing from canyons.

BAD LANDS.

The Bad lands in Scotts Bluff County have resulted principally from the weathering of the Brule clay formation. The silty material composing this formation breaks down readily when exposed to erosion, but is sufficiently compact to stand up in perpendicular walls and preserve any details of erosion. The result is that running water has cut deep ravines through the formation, and the surface being partly protected in places a very irregular erosion has occurred.

The largest area of Bad lands occurs at the foot of Scotts Bluff, where the soft, silty beds of the Brule clay formation have been

partially capped and protected by remnants of the overlying harder strata. This large area, stretching from the foot of Scotts Bluff southward for nearly a mile and along the river for 2 miles, presents the best development of bad-land topography. It consists of deeply cut ravines, sharp, ragged combs and ridges, and bare, rounded hills. The surface has the light-buff or flesh-colored tint of the Brule clay. This land is nearly devoid of vegetation and has no agricultural value. A small area has been mapped in township 22 north, range 56 west, sections 28 and 29, and numerous other small, narrow strips which were not of sufficient size to indicate on the map were included in the Rough broken land.

IRRIGATION AND DRAINAGE.

Irrigation was first tried in Scotts Bluff County in 1886 on some small fields in Winter Creek Valley, a short distance northeast of the site of Scottsbluff, plow furrows being run to the fields from Winter Creek, a very small spring-fed stream. The use of water from the North Platte River began in 1887, when the Farmers Canal was put into operation.

At present 224,185 acres of irrigable land, or more than one-half the area of Scotts Bluff County, lie within the irrigated district, and the proposed Fort Laramie unit of the North Platte Project of the Reclamation Service includes about 48,000 acres more. Of the irrigable land included within the projects now in operation, only 100,301 acres were actually irrigated in 1909. This represents an increase of 243 per cent during the decade from 1899 to 1909, only 29,244 acres having been irrigated in the former year.

Of the acreage irrigated in 1909, 30,536 acres were watered by the Interstate Canal of the Reclamation Service, 39,803 acres by irrigation districts, 28,800 acres by cooperative enterprises, and 1,162 acres by individual and partnership enterprises.[1]

In 1909 there were 326 miles of main canals and 755 miles of laterals in operation in Scotts Bluff County. This mileage has since been greatly increased by the extension of the two principal systems. Up to July 1, 1910, there had been expended in the construction of existing enterprises $6,204,582. The estimated final cost was $7,891,503, an average of $35.20 per acre of irrigable land included within

[1] Cooperative enterprises are controlled by the water users under some organized form of cooperation. The most common form is the stock company, the stock of which is owned by the water users. Irrigation companies are public corporations that operate under State laws providing for their organization and management. They are empowered by law to issue bonds and levy and collect taxes for the purpose of constructing, operating, and maintaining irrigation works. The interest and principal on the bonds, together with the maintenance tax for operating expenses, are collected by the county treasurer. Delinquent water taxes in this way become a lien upon the land the same as any county or State tax.

the projects. Development to date has shown that this final cost was underestimated.

Enumerated below are the chief canals, with the year in which each began operation:

Name.	Year.	Name.	Year.	Name.	Year.
Farmers	1887	Castle Rock	1889	Bayard	1893
Minatare	1888	Mitchell	1889	Steamboat	1895
Enterprise	1888	Central	1890	Gering	[1] 1897

[1] Physically the Gering Canal is an extension of the Mitchell. The head gate of the Mitchell Canal is about one-half mile above the Wyoming line. The Gering head gate is about one-half mile below the State line. These two canals merge into one at a point about 2 miles below the head gate of each. From this point the main Mitchell and Gering ditches are identical and continuous. The Mitchell Canal ends and the Gering Canal proper begins at a point near the center of section 29, township 22 north, range 55 west.

The main ditch of the Interstate Canal enters the county at a point near the middle of the northern boundary. The northwestern part of the county, north of the Farmers Canal, is watered by Interstate laterals, which branch off the main canal some distance to the north in Sioux County. Only an inextensive area in the northwestern part of the county received water from the Interstate Canal in 1908, but this was increased each year with the extension of the canal until its completion in 1914.

The earlier canals were built by associations of landowners, who formed themselves into cooperative companies. Owing to the limited resources of these companies the irrigated areas were confined to the river bottoms. The Farmers Canal was extended on to the terraces in 1905 and 1906. From near its head gate to a point about 4 miles northwest of Scottsbluff it follows the edge of the first terrace. At this point, having reached the level of this terrace, it swings back from the terrace edge and from here on waters terrace land. In the county the Interstate Canal supplies water to terrace land only. All other canals are confined to the river bottoms.

Until the year 1910, when the Pathfinder Reservoir was established, the success of irrigation in Scotts Bluff County was dependent upon the fluctuations in the flow of the North Platte River. This stream derives its water almost entirely from the melting of snow upon the slopes of the Rocky Mountains and minor associated ranges. Normally there was an excessive flow of water after the spring thaws and the river was extremely low during the summer months. Often a serious shortage of water occurred when most needed in the growing season. It was this condition that the Pathfinder Reservoir was intended to relieve. This reservoir, which has a capacity of 1,025,000 acre-feet, was formed by building a dam across a deep gorge through which the North Platte River flows in central Wyoming, its influence being felt from that point to the central part of Nebraska.

The following table indicates the variations in the normal flow of the North Platte River during the main growing season, as measured at the inlet of the Pathfinder Reservoir:

Mean daily flow into Pathfinder Reservoir in second-feet.

Month.	1910	1911	1912	1913
June	3,278	4,626	12,934	4,281
July	414	1,135	4,429	1,081
August	268	369	1,855	539
September	375	277	1,199	361

The table below, giving the mean daily outflow of the Pathfinder Reservoir in second-feet, shows how this storage of flood waters has affected and controlled the supply of irrigation water below the dam:

Mean daily outflow from the Pathfinder Reservoir in second-feet.

Month.	1910	1911	1912	1913
June	2,500	3,250	3,750	3,400
July	2,100	3,400	5,700	3,050
August	1,950	2,600	6,300	2,850
September	1,800	2,400	2,650	2,250

It will be noted that in the month of June the outflow is less than the inflow, but that in July, August, and September it is much greater.

The head gates of the Interstate Canal are located near Whalen, Wyo., about 50 miles above the Nebraska line. This canal has an irrigable area of 126,700 acres, of which 69,900 acres, more than half, lie in Scotts Bluff County. The following table shows the flow of the North Platte River below the head gates of the Interstate Canal. The supply of water having been withdrawn above the place of measurement, this shows approximately the amount of water that approaches the head gates of the Mitchell Canal. A comparison between these figures and those giving the inflow of the Pathfinder Reservoir shows the actual benefit of the reservoir to the local canals which were in operation prior to the installation of the Pathfinder Dam and the construction of the Interstate Canal.

Mean daily flow of North Platte River above Mitchell Head Gate.

Month.	1910	1911	1912	1913
June	1,027	2,060	2,430	2,186
July	1,056	2,430	4,150	1,931
August	555	1,553	5,725	1,548
September	510	1,165	5,125	1,471

The steadiness of water supply for the lower half of Scotts Bluff County's portion of the Interstate project is safeguarded by Lake Alice (capacity, 14,000 acre-feet) and Lake Minatare (capacity, 67,000 acre-feet), both of which are artificial reservoirs formed by damming basinlike valleys.

The problem of artificial drainage is of utmost importance in this county. Owing to the small amount of rainfall and the sandy nature of the soils drainage ways are not well established. There are several instances in which sand hills have been formed in the path of drainage ways by the action of the wind.

The development of irrigation over the first and second bottoms was naturally accompanied by a rise of the water table. Since the area under irrigation was but slightly elevated above the level of the river the water table came to the surface in the lower places. This condition affected a greater area and produced more serious results in the lower part of the valley, where the soil is heavier and underdrainage poorer than elsewhere. Not only was lateral seepage toward the river slower in the heavier soil, but surface evaporation was more pronounced. Hence the surface accumulation of alkali upon the area mapped as Minatare silt loam in the vicinity of Minatare and McGrew.

The recent development of irrigation on the upper terraces north of the Platte River has intensified the drainage problem. Well records show that the surface soil is underlain uniformly by sand, below which lies the Brule formation of heavy clay. This sandy subsoil adds to the value of the terrace land for irrigation purposes, providing efficient drainage which minimizes the danger of surface accumulation of alkali, but when the percolating water reaches the deeper clay subsoil it moves laterally and seeps into basin valleys and lower terrace areas. These older terraces have been considerably dissected by wind and water. Many of the valleys are basinlike or of very slight gradient, with no natural drainage channels. The lateral seepage from the terraces and slopes above has turned into marsh many areas of valuable agricultural land. The same condition has come about in several basinlike areas south and southeast of Gering, in that part of the North Platte Valley locally called Gering Valley. In addition, an extensive seepage area has been developed along the foot of the higher terrace to the north of the river, at the outer edge of the second bottom. This line of seepage extends practically the whole length of the county. A part of it has already been reclaimed by the construction of drainage ditches. The urgent necessity of a drainage system to supplement the irrigation system having been recognized, numerous drainage districts have been formed during the last few years, in some of which the ditch systems have been completed. Several systems are under con-

struction at this time. Within a few years the entire area affected by seepage will probably be reclaimed. The Reclamation Service has been and is caring for this problem in the area included within its irrigation projects, and local organizations are making excellent progress on the lower lands affected by the local canals.

SUMMARY.

Scotts Bluff County is situated in the western part of Nebraska, and has an area of about 723 square miles, or 462,720 acres. It is in the High Plains region, but most of its area lies within the valley of the North Platte River. The High Plains region is one of light rainfall and much wind, hence much of the erosion that has been taking place has been accomplished by wind action. The geological formations of this region are predominantly sandy and most of the soils are of similar nature.

The North Platte River provides water for the irrigation of the river bottoms and terraces. The practice of irrigation was begun in 1887. One-half the area of the county lies within the irrigated district, which is thickly settled. The nonirrigated sections are very sparsely settled.

Sugar beets and alfalfa are the principal crops grown under irrigation. In 1913, 16,426 acres were devoted to sugar beets, and approximately the same number of acres to alfalfa. A market for the sugar beets grown in this and adjacent counties in Nebraska and Wyoming is provided by the factory of the Scottsbluff Sugar Co., a branch of the Great Western Sugar Co. The shipment of alfalfa has been restricted by the distance to outside markets. An alfalfa-meal mill at Mitchell uses a very small proportion of the crop. The rapid expansion of the feeding industry and the development of intensive dairying are causing an increasing demand for alfalfa within the county. Outside the irrigated district cattle raising is the chief industry, being supplemented by some grain farming.

The mean annual rainfall of Scotts Bluff County is 15.61 inches. May, June, and July are the months of heaviest precipitation. Four-fifths of the annual precipitation occurs between April 1 and October 1.

Exclusive of miscellaneous material, which includes Dunesand, Meadow, Marsh, Rough broken land, and Bad lands, 19 soil types were mapped in Scotts Bluff County. These have been grouped in 9 soil series.

The Rosebud series, consisting of two types, occupies the upland area of the county. The Rosebud stony fine sand has practically no agricultural value, except for grazing. The loamy fine sand is a more valuable soil, being used for grazing and for the production of small grains.

The Epping series is represented by a single type, the Epping silt loam, which occupies residual slopes and benches between the river terraces and the upland. Small grains and alfalfa are grown on this type.

The Orella series is likewise represented by but a single type, the Orella very fine sandy loam. This type occupies residual slopes and is of little value except for grazing.

The Goshen series, represented by two types, is of very little agricultural value, owing to the poor drainage and excessive accumulations of alkali.

In the Tripp series six types were mapped. These occupy river terraces and are the most extensive and useful soils of the county. All the types lie within the irrigated district and intensive farming is being rapidly developed on them. Sugar beets, alfalfa, potatoes, oats, barley, and wheat are the principal crops.

The Laurel series, embracing two types, occupies first bottoms and poorly drained portions of second bottoms. Meadow is associated with and closely related to the Laurel soils. These types are used chiefly as pasture land.

In the Minatare series one type, the silt loam, was mapped. This type occurs in the lower bottoms and second terraces and along the North Platte River. Owing to excessive accumulations of alkali caused by poor drainage, the greater part of this type has been allowed to return to the native salt-resistant grasses and is utilized as hay land.

The Valentine series includes two types. These are wind-laid soils and occur throughout the county. They are very useful under irrigation and produce excellent and abundant crops of alfalfa, sugar beets, potatoes, and grains.

The Mitchell series, including two types, occupies residual slopes and terraces on the south side of the North Platte River. Under irrigation these soils produce sugar beets and alfalfa. Under dry farming they are adapted to small grains.

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[PUBLIC RESOLUTION—No. 9.]

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

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

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

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]

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