

# SOIL SURVEY OF RANSOM COUNTY, NORTH DAKOTA.

By CHARLES W. ELY, assisted by REX E. WILLARD and J. T. WEAVER.

## DESCRIPTION OF THE AREA.

Ransom County, which comprises the present survey, is located in the southeastern part of North Dakota. Lisbon, near the center of the county, is about 60 miles southwest of Fargo, on the Fargo and Southwestern branch of the Northern Pacific Railroad. The county boundaries lie within  $97^{\circ} 13'$  and  $98^{\circ} 2'$  west longitude and  $46^{\circ} 18'$  and  $46^{\circ} 38'$  north latitude. Its area is 856 square miles, or 24 Congressional townships, these comprising townships 133 to 137, inclusive, north, ranges 53 to 58, inclusive, west.

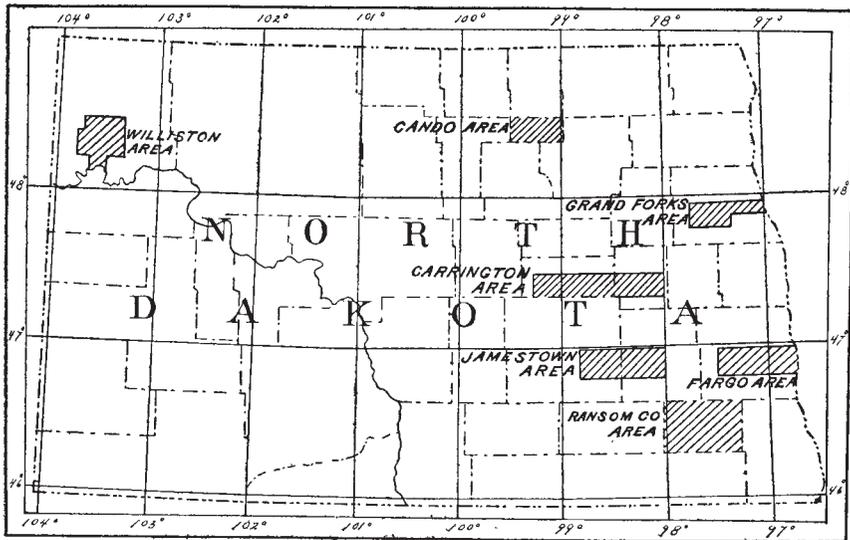


FIG. 33.—Sketch map showing location of the Ransom County area, North Dakota.

There are two rather distinct topographic divisions in Ransom County. The most important covers about two-thirds of its area and is almost level to gently rolling, having the characteristic topography of the prairies of Illinois, Iowa, and the Dakotas. Two prominent lines of scattered hills or moraines traverse this division, entering the county from the north, one on the west side of the Sheyenne River, continuing thence southeast, and the other on the east side, extending in the same general direction. These for the most part are low knolls, not high enough to interfere much with cultivation,

but some in the western part are sharp and hilly. Over much of this area drainage is somewhat imperfectly established, and small, marshy places, from one-half acre up to 40 acres in extent, are found, the greater number ranging in size from 5 to 20 acres. A few are wet enough to be really called lakes.

Sheyenne River has cut its way from 50 to 200 feet deep through the drift material, leaving bluffs or broken escarpments along the stream bed. From Fort Ransom northward these rise almost 300 feet above the valley, the elevation gradually becoming less down the stream. This belt of broken country varies from one-half to 1 mile in width, though rarely over three-quarters of a mile. The valley is about one-half mile wide at the bottom, where is found a rich alluvial flat, through which the river winds its way. Various long, narrow sloughs and a more or less well-defined valley a few feet below the general level mark an old channel from Fort Ransom southward. A particularly level spot in the northeast corner of the county, occupied by the Sioux loam, also marks an old waterway of the Sheyenne and possibly a small glacial lake.

The second topographic division is comprised in the Sheyenne delta, covering the eastern third of the county. The surface here varies from level to gently rolling, the slope is uniform, and the general level of the country appears to be the same. The most level portion is in the southeastern part of the county. Here are found sections where no change, as determined with instruments, occurs in elevation from one section corner to the next. Naturally, unless the rainfall is very light, trouble is experienced in drainage, and a ditch is now (fall of 1906) being constructed starting from the river near Scovill and extending in a general southeast direction along section lines, leaving the county north of De Lamere. The fall for this ditch averages  $1\frac{1}{2}$  feet to the mile, which gives an idea of the topography of that section. A part of the water carried will empty into the Sheyenne River, but the most of it will flow in the opposite direction and finally find its way into the Red River of the North.

Farther north and northwest of McLeod the slopes are greater and the drainage more complete. There are, however, extensive areas entirely too wet for cultivation. The areas of Dunesand, shown on the map, are wind-formed hills of sand too choppy and broken even to drive through, but even here the water table is always near the surface, as is shown by the shallow wells 10 to 15 feet deep, dug near the bottoms of the hills, and by the depressions, in which water or moist soil may always be found.

That portion of the delta east of Sheldon is more rolling in topography, and comparatively little of the land is too wet to cultivate. Water in wells is found here at about 18 feet. Except in the southern portion, the line between the delta formations and the pure gla-

cial till is nowhere very sharp. A more or less prominent bluff marks the line of separation in the extreme south.

The Sheyenne River drains all the area that is drained naturally. It is now only a sluggish stream, carrying a small volume of water for the territory it drains in this and other counties, and it never overflows its banks. It has only one tributary in Ransom County, and that a small stream in the southern part, and there are few even intermittent drainage channels. Drainage over most of the county is almost entirely undeveloped. Water falling as rain is either absorbed by the ground or runs into the sloughs, and that falling only a mile away may never reach the stream. However, the subsoil and the topography of most of the soil types are such that except in the delta region and in very low places the rainfall is readily taken care of and nearly all of it saved for the use of plants. In a very wet year the penetration of rain in the Marshall clay loam varies from  $2\frac{1}{2}$  to 4 feet.

The population of Ransom County, as well as elsewhere in the State, has been drawn largely from Minnesota, Iowa, Wisconsin, Illinois, and Indiana. A number of the very early settlers came from New York. There are also a great many Norwegians and Swedes, particularly the former, in some neighborhoods. Immigration has been very rapid in the last ten years. The population of Ransom County in 1900 was about 7,000, and has increased considerably since that time.

The county is capable of supporting a much larger population. There are about 700 sections of strictly first-class land in the area, land as fertile as can be obtained anywhere in this country. Lisbon, Enderlin, and Sheldon are the chief towns. Lisbon has a population at present of about 2,000, Enderlin 1,500, and Sheldon 600 or 700.

The Fargo and Southwestern Branch of the Northern Pacific Railway runs through the county in a general northeast and southwest direction, passing through Sheldon and Lisbon. The main line of the Minneapolis, St. Paul and Sault Ste. Marie passes through the eastern part of the county in a general northwest and southeast direction. Enderlin is on this line and is a division point on the railroad. Besides these the Fergus Falls and the Casselton branches of the Northern Pacific run about east and west, from 1 to 6 miles south and north of these respective county lines, and some products of this county are shipped on these railroads. Ransom County is not especially well supplied with railroads, a north and south line in the western part of the area being badly needed. Many places are more than 10 miles distant from any railroad. A wagon road is legally left on nearly every section line. While these lines are left open little attention is ever paid to working the roads. Still they do not become very poor except in the sloughs.

Grain prices are ruled by the Minneapolis market, but live stock is occasionally shipped to Chicago. All the towns mentioned have from one to three elevators, besides which there are elevators at Butzville, Coburn, Englevale, Elliot, Venlo, and McLeod, which handle most of the grain grown in their respective vicinities.

## CLIMATE.

The appended tables, compiled from the records of the Weather Bureau at the stations named, show in a general way the climate of this county. The total precipitation during the year is light, but the rainfall is so distributed that a very large proportion falls during the growing season. The records of the total rainfall during April, May, June, July, August, and September for each of the last ten years show some variations, but the precipitation is sufficient to produce a fair crop on good land if cultural methods to conserve the moisture are employed. There is a wide range in the temperature during the year. In winter it occasionally drops to  $-30^{\circ}$  F. or lower and may remain there for several days at a time. It is stated, however, that owing to the dry atmosphere the effect of the extreme temperature is not so marked as one would expect. Summer temperatures rarely if ever exceed  $100^{\circ}$  F., and even with the hottest days the nights are always cool.

*Normal monthly and annual temperature and precipitation.*

Month.	Power.		Berlin.		Lisbon.	
	Tempera- ture.	Precipi- tation.	Tempera- ture.	Precipi- tation.	Tempera- ture.	Precipi- tation.
	$^{\circ}$ F.	Inches.	$^{\circ}$ F.	Inches.	$^{\circ}$ F.	Inches.
January.....	6.0	0.49	7.0	0.59	7.0	a 0.17
February.....	7.0	.60	7.0	.98	7.0	a .40
March.....	19.0	.81	19.0	1.29	21.0	a .83
April.....	41.0	1.88	41.0	2.68	41.0	2.13
May.....	54.0	1.99	53.0	2.06	54.6	2.93
June.....	65.0	3.73	63.0	4.14	59.8	3.48
July.....	69.0	3.80	65.0	2.68	68.0	3.12
August.....	67.0	1.79	66.0	1.99	66.7	3.35
September.....	60.0	1.16	58.0	.66	58.8	2.08
October.....	45.0	1.35	43.9	1.05	45.0	1.38
November.....	23.0	.61	22.0	1.09	30.0	a .54
December.....	13.0	.39	14.0	.72	12.0	a .20
Year.....	39.1	18.60	38.2	19.93	.....	20.61

<sup>a</sup> Averages for three years; the remainder for ten years.

The last killing frost in spring occurs from the middle of May to the first week in June, and the first in the fall about the middle of September, thus giving a growing season of from ninety to one hundred and twenty days. The shortest recorded season in the last

ten years was in 1902, when there were only seventy-six days between frosts at Power and Berlin, though the Lisbon station reported no frosts after the middle of May. The longest growing season, which was one hundred and fifty-one days, was reported in 1905 at Lisbon. The length of the growing season is very important in this area, especially if corn is to be grown, as even at the best a very early maturing variety must be grown to make it successful.

*Dates of first and last killing frosts.*

Year.	Lisbon.		Berlin.		Power.	
	Last in spring.	First in fall.	Last in spring.	First in fall.	Last in spring.	First in fall.
1896 .....	.....	Sept. 11	.....	.....	.....	.....
1897 .....	June 6	Sept. 17	.....	.....	.....	.....
1898 .....	May 11	Sept. 9	.....	Sept. 9	May 16	Sept. 8
1899 .....	May 17	Sept. 22	May 18	Sept. 17	May 18	Sept. 12
1900 .....	June 8	Sept. 17	June 11	Sept. 17	June 11	Sept. 16
1901 .....	June 7	Sept. 18	June 7	Sept. 18	June 7	Sept. 18
1902 .....	May 14	Sept. 4	June 21	Sept. 4	June 21	Sept. 4
1903 .....	May 9	Sept. 11	June 11	Sept. 4	June 22	Sept. 13
1904 .....	May 2	Sept. 2	May 14	Sept. 11	May 15	Sept. 20
1905 .....	May 11	Oct. 9	.....	.....	.....	.....
1906 .....	May 31	Oct. 6	.....	.....	.....	.....
Average.....	May 21	Sept. 16	June 3	Sept. 11	June 2	Sept. 13

AGRICULTURE.

Compared with many Western States North Dakota has only recently been settled. Twenty-five years ago there was scarcely any farming carried on within the present limits of Ransom County. The Fargo and Southwestern Railroad reached Lisbon about 1882, and the Minneapolis, St. Paul and Sault Ste. Marie was built through the county only fourteen years ago.

The first settlements within the county were made in the north-western part, near Old Fort Ransom, by people coming from the north, but the greater part of the population has come since the railroads were built. The early settlers found a seemingly never ending prairie covered with a dense growth of wild grasses, and with only a few trees near the streams. The first step in agriculture was the breaking up of the prairie sod, and planting of some crop, very frequently flax, on the newly plowed land. Often the same crop was sown again the next year, after which wheat or oats was generally sown, the ground frequently being prepared by simply disking it. In some cases the sod was plowed one spring and allowed to rot until the next, when the land was plowed again and seeded to wheat. Ransom County, and indeed this whole section of the State, soon acquired a reputation as a wheat-producing country, and in the early

nineties people began settling in this county in great numbers. At that time, and indeed until several years later, the best land in the county could be bought for \$5 or \$6 an acre, whereas it now sells for from \$25 to \$40 an acre, and it is not uncommon to find land that has doubled and trebled in value in the last five years.

The area being so recently settled, agricultural practices are yet rather imperfect. In this northwest country flax and wheat have always been the first crops to be planted in a newly settled community. Both of these crops are well adapted to culture on a large scale, and being nonperishable can easily be shipped long distances. Where wheat growing is practiced to the exclusion of other crops, the yields will almost invariably decline, and the need of a cultivated crop, like corn, is sooner or later felt. This is hardly yet the case in Ransom County, and the need of crop rotation is not yet apparent.

Wheat is the chief crop, over one-half of the cultivated land being every year seeded to that cereal. The average yield in 1900, according to the Twelfth Census, was 12 bushels per acre, but, generally speaking, with good farming methods the yield is nearer 20 bushels. Macaroni wheat has become an extensive crop in the last seven or eight years, and the yield of this variety is heavier, though the price is somewhat less. Probably 1,500,000 to 2,500,000 bushels of wheat are annually produced, with a total value of \$750,000 to \$1,500,000. In sections fairly thickly settled the prairies seem an almost endless wheat field.

After wheat flax is the most important crop, occupying about one-fourth of the cultivated land. The average yield is from 8 to 15 bushels per acre, and prices ordinarily range from 80 cents to \$1.25 a bushel. The annual value of the flax crop ranges from \$500,000 to \$1,000,000. Next to flax, and in the order named, oats, barley, and rye are the important crops. Corn is just beginning to be grown. Scarcely any tame grasses are grown, the hay from the prairie not yet broken and from the sloughs being sufficient to supply all demand at present. Scarcely any live stock, except work animals, is kept, and the most of the land is entirely unfenced. There is still considerable wild land or unbroken prairie in various parts of the county, generally some distance from the railroad.

No special idea of the adaptation of soils to crops is prevalent among the farmers of Ransom County. It is true, however, that a large part of the county is covered by one soil type, and that all the good land in the area is more or less adapted to the same crops. Markets are far away and there is little or no home market for garden crops and small fruits. Macaroni wheat is grown much more extensively on the heavier soils—the Marshall clay loam and other types—and seems to do better on these than on the more sandy land.

Corn thus far has been somewhat more successful on the more sandy and hence earlier soils. This will continue to be the case until the farmers as a class learn more about the growing of corn, the proper varieties to plant, methods of cultivation, etc. If the Marshall clay loam were in the recognized corn belt it would there be considered one of the best corn soils. The climate is somewhat different here, however, and there is greater difficulty in getting corn to mature, but with suitable varieties and proper cultivation it can be grown successfully. If more live stock were kept the forage could be utilized even when the season prevented the maturing of the grain. Both the Marshall clay loam and the Fargo fine sandy loam, where well drained, would produce good sugar beets, but there is no convenient market in which to dispose of them. Alfalfa, probably clover, corn, and timothy, redtop, and brome grass should also do well on these soils. Redtop will stand a great deal of water; timothy some, but not so much as redtop; but for clover and alfalfa the land must be well drained.

As already pointed out, little attention is paid to the rotation of crops for the reason that there has been very little apparent need for it so far. In the general practice wheat may follow wheat for a number of years, with only an occasional summer fallow to "rest" the land. The best farmers plan to summer fallow every four or five years in order to get rid of weeds and also to increase the crop yield the next year. The natural fertility of much of the land is such that for the first eight or ten years the use of farm manure is considered actually injurious, as it may cause small grain to lodge; but after that period of time well-rotted manure frequently gives good results, and a few manure spreaders are at present in use. Manure will be found beneficial on the sandier soils of the delta. If well rotted, it can be safely applied to corn land without danger of overproduction of stalks by that plant. It will also be found very beneficial to tame-grass meadows should they ever become common in the county. A five-course rotation has been recommended by the North Dakota experiment station as suited to North Dakota conditions—corn one year, small grains two years, flax one year, and timothy and clover, and meadow or pasture one year. The small grains or flax may follow each other as desired, but it is best not to grow flax oftener than once in five years, though it should be stated there has not been the trouble with flax wilt in Ransom County that has been experienced in the Red River Valley.

In general, there is great need of improved agricultural practices among the farmers of Ransom County. The present idea seems to be to grow as much wheat as possible, without any thought of maintaining the productiveness of the soil. To a large extent the land

is hurriedly plowed, perhaps dragged or harrowed once, and a crop of grain sown. There is then very little work for farmers until harvest, when there is a great demand for men, and wages become almost prohibitive—from \$2.25 to \$2.50 a day. Labor is a serious item in the farm expense account. Ordinarily hands receive \$30 a month and board by the year, and those only employed for the harvest season are paid by the day as mentioned above. The harvest hands often come from distant points and remain only a short time. All work is as far as possible done with machinery—3 to 8 horse gang plows, some steam plows, and large binders and thrashing outfits. The general lack of care for the machinery is noticeable and shelter for tools is not considered.

The average sized farm, as reported by the Twelfth Census, was 423.6 acres. The farms range from 160 acres to several sections, and there are but few as small as 160 acres. Comparatively little land is rented. There are large tracts owned by nonresidents, who, instead of leasing to tenants, prefer to hire the labor necessary to sow and harvest their crops. Where land is rented on shares, the landlord usually receives about one-half of the crop. The price of farm lands ranges from \$12 to \$45 an acre. Very little first-class land can be bought for less than \$25 an acre, and this is generally wild land. Some exceptionally well improved farms are held at \$50 an acre, but as a general rule good improved land can be bought for \$25 to \$35 an acre.

Notwithstanding the extensive and sometimes wasteful methods employed by the farmers of this region, as a general rule they have been successful. By attention to a few broad principles, by the rotation of crops, the protection of farm machinery, the introduction of live stock, the return of straw and other roughage to the land instead of burning it as at present, and by greater care in plowing and cultivating the soil itself, the profits from crops grown and from the increment due to improvement of the farm property may be greatly increased.

#### SOILS.

The whole surface of Ransom County, as well as a great portion of North Dakota, was once covered by an extension of the ice sheet known as the Dakota glacier. As this ice moved slowly southward it ground up the rocks, granite, gneiss, limestone, etc., over which it passed, and this ground-up rock, deposited over large areas, and in some places reworked in streams and lakes, forms the material from which the soils have been derived. Various temporary halts of the glacier gave rise to lines of morainal hills, which changed the drainage systems of the country. At one time in its history the Sheyenne River flowed southward through Bearden Creek, at which time the

line of morainal hills of the western side of the county was probably formed. A valley of greater or less extent was formed in which gravel and sand were deposited, all other finer material being carried onward by the swift current from the melting ice. This coarse material forms the subsoil of the Sioux loam, locally known as "sand prairie." The levelness of this country suggests that at one time it may have been a lake. Later something checked the velocity of the current and the present loam covering, or soil, was deposited.

At a subsequent time the ice retreated farther north and a new valley, stretching south from Fort Ransom through Englevale and the so-called "big slough country," was formed. The drainage through this valley flowed into a lake<sup>a</sup> lying south of the county line. An immense volume of water passed down this channel and the current was very swift, as the vast deposits of coarse sand, gravel, and boulders forming the subsoil of the Sioux gravelly loam evidence. At that time the present channel was covered by the glacier, but the ice finally melted, exposing the present channel. Then the waters ceased flowing into Lake Sargent and went eastward down the present valley and southeastward into glacial Lake Agassiz, which covered all of the present Red River Valley and extended north into Canada. Terraces of greater or less extent were built up at various places along the river. These are occupied by the Sioux gravelly loam. During this time the edge of the ice stood not very far away from the river, and hence much sand, gravel, silt, and clay were brought down into that stream to be carried into the lake, there forming a delta. The eastern third of the county, or that part of it east of a line directly south from Sheldon, has been formed in this manner. Naturally the coarser material was deposited at the first checking of the current and the finer sediments were carried out farther into the lake. These deposits have given rise to the Sioux gravelly loam and the soils of the Fargo series. The ice finally melted, from causes not at present thoroughly understood, and disappeared from the present rolling prairie, and the water finally drained out of Lake Agassiz. But before this took place the water from the melting ice had cut the present valley of the Sheyenne, leaving the coarse gravel, rock, and boulders on the hillsides. This material has produced the type of soil mapped as the Marshall stony loam. Very little erosion is being accomplished by this stream at present and it never overflows, but at some time during its history the Wabash loam or the soil of the valley was built up as an alluvial deposit.

The geological newness of this region is shown by the numerous small but marshy places found scattered over the western two-thirds of the county. These have no outlet and no possible means of getting rid of water save by percolation and evaporation. The topog-

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<sup>a</sup> Lake Sargent of Willard.

raphy is much as the glacier left it. The broad rolling areas of Marshall clay loam are the ground-up rock material carried beneath or in the ice and dropped where it was when the ice melted. If for any cause a small depression was left where there was no means of escape for the water a marshy place was formed, and it remains today, being shown on the soil map as Meadow.

Seventeen different types of soil, including Meadow, have been recognized in the present survey. The basis for their classification is mainly texture, either of soil or subsoil or both, but to some extent also topographical position, geological origin, and agricultural value enter. The Marshall clay loam covers the greater part of the western two-thirds of the county and represents pure glacial material, unchanged save in minor respects due to weathering and the incorporation of organic matter. The Marshall stony loam is practically the same in origin, but is badly eroded and very rolling. The Marshall gravelly loam, occupying generally small morainal hills, probably differed somewhat originally from the Marshall clay loam and has suffered from more severe erosion since deposition. The Marshall fine sandy loam is a deposit of unworked glacial material and differs from the Marshall clay loam chiefly in its texture.

Soils to which the name Sioux is applied represent reworked glacial material overlying gravel or sand, generally within less than 3 feet. Two soils of this character are found in Ransom County—the Sioux loam and the Sioux gravelly loam—the chief difference between the two being the amount of gravel in the surface soil and the nearness of the gravelly subsoil to the surface.

All the soils in the delta except Dunesand and McLeod sand belong to the Fargo series. Material from which these soils are derived was originally glacial material, but this has been reworked and the various particles of sand, silt, clay, etc., reassorted and redistributed so that little evidence of its glacial nature remains.

The separation of the Fargo soils is based entirely upon texture. The McLeod sand differs from the various Fargo soils in texture, amount of organic matter in soil, and topography. The basis of separation of the Dunesand from the other soils is chiefly topography. It is a type practically worthless for farming purposes, whatever its texture may be.

The Wabash loam is an alluvial soil and is separated from the Marshall clay loam chiefly on that basis. There are no stones in soil or subsoil. In some respects it strongly resembles the Fargo silt loam, and there is no doubt these soils grade into one another in this area, so that no definite line can be drawn between them.

Meadow represents a condition of deficient drainage rather than any certain soil texture or formation. Some wet areas in the delta could have consistently been mapped as Meadow.

The following table gives the areas of the several soil types in Ransom County:

*Areas of different soils.*

Soil.	Acres.	Percent.	Soil.	Acres.	Per cent.
Marshall clay loam.....	268,800	49.1	Wabash loam .....	14,976	2.7
Fargo fine sandy loam.....	40,192	7.3	Meadow.....	12,416	2.3
McLeod sand.....	33,728	6.2	Dunesand.....	11,968	2.2
Sioux gravelly loam.....	30,400	5.5	Fargo silt loam .....	7,040	1.3
Fargo sand .....	22,016	4.0	Marshall fine sandy loam....	6,080	1.1
Marshall stony loam .....	21,696	4.0	Bearden loam .....	3,584	.7
Fargo loam.....	20,800	3.8	Fargo clay.....	2,368	.4
Fargo fine sand.....	19,904	3.6	Total.....	547,584	.....
Marshall gravelly loam .....	15,872	2.9			
Sioux loam .....	15,744	2.7			

BEARDEN LOAM.

The Bearden loam is a dark loam from 14 to 20 inches deep, underlain by a gray or sometimes yellow loam or silty loam. Frequently fragments of shale are found at lower depths, and beneath this, 3 to 6 feet from the surface, a water-bearing sand. Occasionally glacial boulders are seen in small spots, especially in the most western part of the area. Generally, however, the soil is entirely free from stones or gravel and is very easy to cultivate, being level enough for the use of the heaviest machinery.

The Bearden loam is found only in the extreme northwestern part of the county and is fairly level in topography, somewhat lower than the surrounding country, and always near a more or less well-defined stream. Nearly all of it is sufficiently drained to produce good crops, the water passing down into the sand and there slowly flowing away. Some areas along the western county line are wet in spots, and these places are frequently more or less alkaline.

This soil was deposited in much the same way as the Sioux loam, but conditions were such as to produce a deeper layer of surface soil. It was originally covered with prairie grass and should prove fair grass land even in the poorer drained areas. In the best drained portions alfalfa might be made to grow, water always being near enough the surface to supply moisture to deep-rooted plants. At present the type is devoted chiefly to small grains, flax, and wild hay. Wheat yields from 14 to 25 bushels and flax from 10 to 18 bushels per acre. It would prove a very good soil for corn, but no fields of this crop were seen upon it. Where it has been cultivated the farms and buildings are well kept and the general appearance indicates prosperity. It is regarded as an excellent soil by those working it. Some well-improved farms can not be bought for less than \$45 or \$50 an acre. Others not so improved may be had for \$30, and wild land is much

cheaper. Little of this land is changing hands, which is true of all land in the northwestern part of the county.

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

*Mechanical analyses of Bearden loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>				
15468.....	Soil.....	1.0	8.1	15.9	23.9	3.4	29.2	17.7
15469.....	Subsoil.....	1.5	11.2	19.8	23.6	1.9	20.6	20.6

The following sample contains more than one-half of 1 per cent of calcium carbonate ( $\text{CaCO}_3$ ); No. 15469, 10.12 per cent.

FARGO FINE SANDY LOAM.

There are two somewhat distinct phases of the Fargo fine sandy loam. The first, which may be considered the typical soil, is a dark-brown or black fine sandy loam, from 12 to 24 inches deep, underlain by a yellow or gray fine sandy loam, locally known as clay, which rests upon clay at 12 to 24 feet. This phase is most prominent in the large body of the type east of Sheldon, and is rather uniform in texture. Most of the Fargo fine sandy loam belongs to this phase. It is here considered a very fine soil and by many is preferred to the Marshall clay loam. No stones or pebbles are found in either soil or subsoil. It is easily cultivated and is from one to two weeks earlier than the heavier soils. Very little of it is too wet for cultivation, and it withstands dry weather very well. Toward the east and southeast this type grades into the Fargo fine sand, there being no sharp line between them.

The second phase is developed in the southeastern part of the county and in the vicinity of McLeod. It is not so uniform in texture as the typical soil. The soil is a dark fine sandy loam, underlain by a gray or yellowish sticky fine sand or fine sandy loam. Included in this soil type are also various wet places in the McLeod sand in which, generally speaking, the soil and subsoil are fine sandy loam, though there are sand mounds characteristic of the latter type scattered over the surface. Only general separation between these two types was possible here. In some places near McLeod the subsoil is rather clayey in nature. About 62 square miles, or 7.3 per cent of the entire area of the county, are included in this type.

The Fargo fine sandy loam is level to gently rolling in topography. Drainage over that portion occupied by the typical soil is generally good, but practically all of the areas of the described phase are too wet for cultivation, unless artificially drained. All very wet spots are

shown by swamp symbols on the map. No drainage channels are found, and all water falling on the surface must pass downward and into the subsoil. Naturally, when the surface is below the general level of the surrounding country, wet places are found. Artificial drainage, where necessary, is not easily accomplished, on account of the slight fall and the difficulty in finding an outlet, but with properly-constructed ditches the soil and subsoil are open enough to be readily drained.

The Fargo fine sandy loam is a delta formation exclusively, in most instances being formed directly from materials as deposited, in other cases receiving considerable wash material from surrounding types. A few wet spots show symptoms of alkali, but these could be corrected by drainage.

The Fargo fine sandy loam in the wet places was originally covered with a dense growth of prairie and slough grass and in the better drained areas by prairie grasses alone. This shows its natural adaptation. Under conditions of cultivation it is a good soil for celery, onions, potatoes, small fruits, corn, and probably for sugar beets, if well drained. At present it produces good crops of hard wheat, oats, barley, corn, and wild hay. Where drained it is from one to two weeks earlier than the Marshall clay loam and for this reason it will be somewhat better for corn, until a variety has been developed that will unquestionably mature in an ordinary season. The earliness of the soil has another advantage in that it enables farmers to complete their thrashing in time for fall plowing. Bluestem and Fife wheats yield from 10 to 25 bushels per acre, corn from 20 to 35 bushels, and oats about the same as corn. Macaroni wheat is not grown so extensively as on the Marshall clay loam and so far has not proved as profitable as on the latter type. Corn, however, is grown to a much greater extent. On all the well-drained areas it is probable alfalfa could be grown, though as on other soils more or less difficulty would be encountered in getting it started. The same is true of Red clover. Redtop and possibly brome grass would grow in the wetter areas, if these were partially drained, and give heavier yields of much better hay than the present wild hay, though on the market they might not sell for as much as timothy. On areas just a little wet timothy would grow and produce heavy yields of the best quality of hay.

Near Sheldon this land has been very well developed and there is every appearance of prosperity. Some well-improved farms here are held at \$40 an acre or even more. When farther away from the town land with few improvements is held at \$26 to \$35 an acre. On the other hand, on the very wet areas the farmers are in poor circumstances, having had serious difficulty in growing crops for the past three years. Land here can be obtained at much lower prices. It is

the prevailing opinion that it is not necessary to plow this land so deeply as the Marshall clay loam on account of the loose character of the soil. The possibilities in the line of stock raising and of growing corn, clover, and hay on the well-drained areas and pasture and tame hay on the poorly drained areas are as yet unrealized.

#### M'LEOD SAND.

The McLeod sand areas are composed of a succession of low, rounded mounds, from 3 to 8 feet high and only a few feet in diameter, and intervening depressions usually only a few feet in width. The soil on the tops of these mounds is a brown sand of medium to fine texture from 8 to 18 inches in depth, and the subsoil is a yellow sand of the same grades to a depth of 5 to 10 feet or more. In the depressions the soil is a dark sandy loam or fine sandy loam from 6 to 16 inches in depth, and the subsoil a gray or yellow sand.

Over most of the area mapped as McLeod sand the mounds occupy nearly all the surface and the depressions are comparatively limited in extent, but in the same territory there are areas of the same general formation, yet with the depressions or wet places of much greater relative extent than the knolls, and in different areas the proportions vary between these two extremes. The most of these depressions where the dunes are scattering have been mapped as Fargo fine sandy loam and the wet condition shown by swamp symbols. The peculiar topography makes cultivation somewhat difficult, owing to the fact that while the top of the knoll may be very dry the depression may be very wet, and it is hard to find a season which suits both. It is also difficult to use heavy machinery on such areas. In general the soil contains considerable organic matter, does not hold much moisture, and crops are apt to suffer in dry weather. More or less damage may be done by the drifting of the soil after it is broken. Little cultivation is attempted and so far this is limited to the better spots.

The McLeod sand is found only in the delta region and most of it occurs in one extended area west of McLeod. There it occurs in a broad plainlike area, the top of one knoll being apparently no higher than another miles away. No stream channels are found and nearly all water which falls passes downward through the soil and ultimately finds its way into the depressions. The mounds in this way are excessively drained, while only a few feet away are spots poorly drained.

The McLeod sand is a delta deposit which, after the lake disappeared, was reworked to some extent by winds. Afterwards grasses established themselves and bound the soil together, and very little of the type is drifting at present unless the sod has been destroyed. No trees or shrubs are found.

During wet seasons considerable grass is cut for hay, but for a series of years the hay yields have not been as good as on heavier soils. Much of the McLeod sand is used for pasture land, and this and the production of hay are the principal sources of revenue from the type. On the small cultivated areas good yields of grain are secured during favorable years. The soil is not as durable as the Marshall clay loam, and yields decline rapidly unless careful attention is paid to incorporating some form of organic matter.

With present conditions as to market, price of other types of soil, etc., this soil is best adapted to grazing. If cultivated, clover or some other leguminous crop—for instance, Canadian field peas—should be grown as often as once in three years, and the greater part of the crop turned under. This land is held at from \$12 to \$25 an acre. For general farming purposes or the small grains other soils in the area are to be preferred. The type is as yet almost entirely undeveloped.

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

*Mechanical analyses of McLeod sand.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>				
15498.....	Soil .....	0.1	2 2	8.6	66.6	13.2	4.4	4.8
15499.....	Subsoil.....	.1	2.3	8.6	66.4	13.3	4.0	5 2

FARGO LOAM.

The Fargo loam, which is rather variable in texture and depth of surface soil, generally consists of 10 or 12 inches of dark loam, overlying usually a yellow or drab loam, but sometimes resting on a heavy loam, or heavy sandy loam. Occasionally there are found areas where a layer of sand occurs at depths of 24 to 36 inches. These are nearly always near the borders of the Fargo sand. The type frequently passes gradually into other soil types, more especially into the Fargo sand and the Fargo fine sand.

In general the Fargo loam is rather a wet soil, and there are numerous small low places where the soil is considerably heavier than the average of the type. This is especially true in the large area in the southeastern part of the county. Here the central portion is considerably heavier than that nearer the boundaries. In the area south and east of Englevale the Fargo loam represents phases where the material forming the surface soil of the Sioux gravelly loam is more than 3 feet deep, or where the gravelly subsoil of the latter type did not extend, and hence there is a belt of much better soil

along the eastern side of the old Sheyenne valley. There is not much sand or gravel nearer than 4 feet from the surface in that body. The southern portion also receives considerable drainage and seepage water from surrounding types. The areas near Sheldon are more nearly a mixture of the materials forming the Marshall clay loam and the delta deposits, the latter being somewhat thin at that point.

Nearly all the Fargo loam is low and flat and has no drainage channels. A considerable part of the type is too wet for cultivation. This is due not so much to impermeability of the soil and subsoil as to low, flat topography, a fall of 1 or 2 feet to the mile being about the average. An impervious stratum may occur at considerable depths, preventing the escape of the drainage downward. The proposed ditch will probably remedy this to a great extent, but even with a main ditch it will be necessary to dig other ditches along the section lines, probably along the quarter lines, and perhaps much nearer to complete the reclamation of this type.

In general the Fargo loam is formed of reworked glacial material. The larger area in the southeastern part of the county has some indications of being a portion of an old channel of the Sheyenne when it flowed to the south, which later was partially filled by delta deposits.

Some of the wetter parts of this type show the presence of more or less alkali. Thorough drainage will remove these injurious salts. There is little if any of the type that is too alkaline to grow the tame grasses.

Except the area near Sheldon, most of the Fargo loam has been left in native prairie and slough grasses, which, when the land is not too wet to allow cutting, yield from 1 ton to 2½ tons of hay per acre. On the better-drained areas timothy and prairie grass do well, while on the wetter areas, if surface water does not stand too long, redtop will give heavy yields. Well-drained areas produce good wheat, flax, and oats, and should produce good corn. Little of the latter is grown at present. Yields of the small grains are about the same as on the Marshall clay loam. It is believed that were the wetter parts of the type even partially drained as much profit could be made in the production of hay and pasturage of suitable grasses as in growing small grains on the better-drained areas. The Fargo loam is held at from \$15 to \$35 an acre.

#### FARGO FINE SAND.

The Fargo fine sand is another soil formed from reworked glacial material. The type consists of dark-brown loamy fine sand from 10 to 24 inches deep, averaging about 16 inches, beneath which is found a yellow loamy fine sand. Both soil and subsoil grade

toward a fine sandy loam, and there is no sharp boundary between this soil and the Fargo fine sandy loam. There are no stones or gravel in either soil or subsoil. There are, however, occasional wet and sloughlike places of small extent where the soil is considerably heavier than the average of the type. These interfere with cultivation to some extent, but on the whole the Fargo fine sand is easily tilled.

There are two distinct areas of this soil type in Ransom County, each several square miles in extent. One is found in the southeastern and the other in the northeastern part of the county. The latter area lies east of Sheldon. Smaller areas are found in other parts of the delta region and scattered areas occur in the old Sheyenne Valley south of Englevale.

Most of the area occupied by the Fargo fine sand can be described as level to gently rolling, while some smaller bodies are almost perfectly flat. No streams are found in the areas of this type, yet as most of the soil is at a slight elevation and the material is naturally porous for the most part it is fairly well drained. Small wet spots are seen, however, and it is almost impossible to drain some of these or to grow anything upon them. Other areas, very level and somewhat low, while dry enough to produce crops, may become too wet for harvesting machinery during wet years. Some small areas have become wind blown and have some of the characteristics of the McLeod sand.

The Fargo fine sand is a delta deposit of glacial material carried into glacial Lake Agassiz by the Sheyenne River and dropped as the current became less strong. It is rather uniform in texture, with only such differences as may have been caused by later changes. The dark color of the soil is due to the growth and decay of the native grasses. A very large proportion of the type, probably more than one-half, is yet unbroken and utilized chiefly for the production of wild hay.

The Fargo fine sand when well drained is a very good soil for potatoes, small fruits, corn, etc. Timothy will do well in the poorly drained areas. Wheat, flax, and wild hay are the chief crops at present. Wheat yields from 10 to 25 bushels, flax from 10 to 18 bushels, and wild hay from 1 ton to 2 tons per acre.

If well drained, this type of soil is earlier than the Marshall clay loam and therefore better suited for the production of corn where earliness of maturity is as important as it is in this area. It is a soil which would find its best use in stock raising or dairying or in any system of agriculture which returns a large amount of organic matter to the soil. It is valued at present at \$15 to \$30 an acre.

The following table gives the average results of mechanical analyses of this soil type.

*Mechanical analyses of Fargo fine sand.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>				
15478, 15480.....	Soil.....	0.1	0.9	2.3	71.9	12.9	6.8	4.9
15479, 15481.....	Subsoil.....	.1	.6	2.2	77.8	10.7	3.5	4.7

MARSHALL FINE SANDY LOAM.

The Marshall fine sandy loam is a brown fine sandy loam or loamy sand from 8 to 18 inches deep, overlying a yellow subsoil of about the same texture. In limited areas, and generally the more rolling ones, the soil is light enough to be classed as the Marshall fine sand. On the tops of knolls some gravel is occasionally found. In other areas the soil becomes a rather heavy fine sandy loam, and frequently clay is encountered at less than 3 feet below the surface. The type, therefore, is somewhat variable in texture and agricultural value. It is cultivated with comparative ease and readily kept in good condition.

The largest body of Marshall fine sandy loam lies about 7 miles southeast of Lisbon. Other smaller bodies are found in the southeastern part of the county. In the northwestern part of the larger body are some hills, but in the main the surface is gently rolling. The soil is somewhat heavier in the more level portions. It is a glacial soil, largely morainal. The area lying south of Scoville occupies a line of disconnected morainal ridges and varies greatly in texture. The natural drainage is good, in fact is excessive over the more hilly portions, and here crops suffer from lack of water, especially in a dry season.

The Marshall fine sandy loam was originally covered with prairie grass, but a considerable proportion has now been plowed and gives good returns of wheat, oats, corn, and flax. Wheat yields from 8 to 20 bushels, corn 20 to 35 bushels, and other crops in proportion. It is a good corn soil, being one or two weeks earlier than the Marshall clay loam, which gives time for corn to mature before frost. Probably at the present time more corn in proportion to area is grown on this type than on any other in the county. It would also prove a fine soil for Irish potatoes. It is not quite so good for hay as a heavier soil, but timothy and clover will grow on the lower lying areas. The growing of a crop of clover every four or five years will do much toward maintaining and even increasing the productiveness of this land. The type does not yet show any unfavorable results from continuous cropping to small grains, but of necessity will do so sooner or later, unless some crop like clover is occasionally grown

and liberal quantities of manure applied. Some farmers prefer this soil to the Marshall clay loam, and the farms range in price from \$18 to \$35 an acre, according to improvements, which are generally good where the soil has been cultivated for any length of time.

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

*Mechanical analyses of Marshall fine sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Me- dium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>
15488.....	Soil.....	0.1	1.4	2.1	55.2	22.5	13.8	5.0
15489.....	Subsoil.....	.0	1.4	1.6	70.1	12.0	8.5	6.0

The following sample contains more than one-half of 1 per cent of calcium carbonate ( $\text{CaCO}_3$ ); No. 15489, 4.06 per cent.

#### FARGO SILT LOAM.

While the Fargo silt loam is comparatively unimportant in extent, in some places it is regarded as the most productive soil in the county. The soil is a brown or black silt loam from 8 to 18 inches deep, averaging about 14 inches. In some places a considerable percentage of fine sand is found in the surface soil. The subsoil consists of yellow or grayish silt loam or silty clay. When typically developed, no stones or gravel are found in either soil or subsoil.

The Fargo silt loam is easily cultivated, does not bake or clod badly, and can be put into a fine state of tilth without great effort. It is found only in the delta region and in scattered areas. A narrow strip occurs along the east side of the Sheyenne River, which in places is very typical, but in others, and particularly next to the river, is underlain by glacial drift at less than 3 feet from the surface.

The topography varies from level to gently rolling. The area east of Sheldon is level, and while cultivated this year (1906) it was stated that the yields were light owing to excess of moisture. This area needs some artificial drainage, but is very productive in a dry year. The portion along the Sheyenne River, being near an outlet for the water, is for the most part fairly well drained, though not excessively so, and even here, in places, it is not unusual to find water on the surface or near the surface until late in the spring. The section in the extreme southeastern part of the county is inclined to be wet and also needs artificial drainage for good cultivated crops. This soil is not too heavy for the laying of tile drains, but whether an outlet and sufficient fall could be obtained and whether the drains would not be damaged by the deep freezing are serious questions.

The Fargo silt loam is exclusively a delta deposit, dropped in comparatively quiet water of glacial Lake Agassiz by the Sheyenne River. No evidences of alkali were observed, though the subsoil has considerable lime, as have nearly all the subsoils of this area. The native vegetation was a luxuriant growth of prairie grass without trees or shrubs.

The Fargo silt loam is well adapted to grass and small grain crops. The area east of Sheldon is sufficiently drained to make fine timothy meadows. Yields of from 1 ton to 2½ tons per acre ought to be secured, and this would unquestionably prove as profitable as growing small grains. Well-drained areas should produce good corn, and probably clover, alfalfa, and sugar beets. Redtop would do well on the poorer drained areas, while brome grass could be grown on almost any part of the type.

At the present time the Fargo silt loam is devoted to wheat, barley, oats, and flax. Hard wheat yields from 12 to 25 bushels, macaroni wheat from 15 to 30 bushels, flax from 12 to 24 bushels, oats from 25 to 40 bushels, and wild hay 1 ton to 2 tons per acre.

Farmers on well-drained areas of this type of soil are apparently in a prosperous condition. The soil withstands drought well, and there is little evidence so far of any decline in productiveness. The land is held at \$25 to \$40 an acre, according to location and value of improvements.

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

*Mechanical analyses of Fargo silt loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Me- dium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>
15501.....	Soil.....	0.1	1.8	2.7	18.0	15.0	45.5	17.1
15502.....	Subsoil.....	.0	.5	.4	3.5	10.0	72.7	12.5

The following samples contain more than one-half of 1 per cent of calcium carbonate (CaCO<sub>3</sub>); No. 15501, 4.23 per cent; No. 15502, 13.62 per cent.

#### WABASH LOAM.

The Wabash loam consists of a brown or dark-brown loam or silty loam from 14 to 24 inches deep, beneath which is found a yellowish or drab silty clay. Occasionally next to the bluffs, where it is low-lying and flat, the soil becomes considerably heavier in texture and darker, or in places where there is considerable wash from the bluffs it may be somewhat more sandy than the average. The main body of the type is, however, fairly uniform throughout. Gravel beds are occasionally found beneath the subsoil at depths varying from 5 to 10

feet, but these are too deep to influence materially the crop-producing power of the soil. No stones or gravel are found in either soil or subsoil.

Practically all of this type in the county lies along the Sheyenne River, both in the glacial and in the delta portions of the county, but small areas, not very typical, occur along other streams.

The Wabash loam is level or gently sloping to gently rolling in topography. It is found in a valley from 60 to 300 feet below the general level of the country. Some few sloughs and wet places occur, the former probably marking the old channels of the river. Excepting these minor places the whole type can be cultivated and will produce good crops. Like nearly all other soils in Ransom County drainage is almost exclusively downward, the soil being porous enough to permit ready percolation. Except in particularly low spots and sloughs no trouble has ever been experienced with this soil as a result of lack of drainage. The depth to the water table, as indicated by the depth of wells, varies from 18 to 25 feet. The Wabash loam is strictly an alluvial soil, having been deposited by the Sheyenne River at an earlier period when the river carried much more water than at the present time. The type is not subject to overflow at present.

The Wabash loam was originally covered with prairie grass, and there was a fringe of elm, ash, soft maple, oak, and other small trees along the stream and in ox-bow bends and sometimes along the small sloughs. The type is well adapted to all grass crops suitable to the climate, as timothy, brome grass, redtop, etc., and in all probability will grow clover and alfalfa. The subsoil contains a large amount of lime. It is very probable that sugar beets could be grown with success. It will also produce fine celery, truck crops, and small fruits. The adaptation of the soil to these special crops is seen on the grounds of the North Dakota Soldiers' Home near Lisbon. It should also produce good corn, though being in the valley it is perhaps more subject to frosts than the higher land. At present it is chiefly devoted to wheat, oats, barley, and flax. Hard wheat yields 10 to 20 bushels, macaroni wheat from 12 to 28 bushels, oats from 30 to 45 bushels, barley from 20 to 30 bushels, and flax from 12 to 20 bushels per acre. It is a soil that responds readily to good methods, and that would be benefited by deep plowing and the cultivation a corn crop ought to receive. Because of the distance to markets it is doubtful if, at present, any crops would prove more profitable than wheat. Where not badly cut by the stream the type is nearly all under cultivation. Such land is held at \$20 to \$40 an acre, but little is changing hands at the present time.

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

*Mechanical analyses of Wabash loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>				
15496.....	Soil.....	0.1	0.8	0.7	9.0	9.9	55.7	22.8
15497.....	Subsoil.....	.0	.7	.4	9.3	12.9	53.3	22.4

The following sample contains more than one-half of 1 per cent of calcium carbonate ( $\text{CaCO}_3$ ): No. 15497, 8.85 per cent.

#### DUNESAND.

The type designated as Dunesand is made up of more or less dry sand, occurring as hills ranging in height from 20 to 60 feet or more above the surrounding prairie. The soil on the hills is a white or grayish sand 4 to 10 inches deep and containing little organic matter, resting on a yellow medium to coarse sand from 5 to 50 feet deep. In the depressions between the hills the soil is darker and more fertile.

The hills rise abruptly from the McLeod sand and when seen at a distance appear like mountain ranges on the horizon. They have the choppy, broken topography characteristics of wind-blown sand. Frequently a ridge is 60 feet high and so narrow on top that a buggy can with difficulty be driven along it. In other places a succession of small hills and ridges are seen, through which it is impossible to drive at all.

The depressions between the hills are generally wet and support a fair growth of swamp grasses which may furnish considerable forage. The hills themselves support only a very sparse growth of coarse grass, in which an occasional spear of buffalo grass is seen.

The Dunesand is a delta deposit which has been blown up into its present form by the winds. No attempt has ever been made to cultivate it, and it is entirely too broken and too sandy ever to be of much value for general agricultural crops. It will, however, always afford some pasturage, and for this is valued at \$4 to \$12 an acre.

The character of the material forming this type of soil is shown by the following table, which embodies the results of a mechanical analysis of a typical sample of the Dunesand:

*Mechanical analysis of Dunesand.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>				
15500.....	Soil.....	0.0	0.1	1.1	90.1	4.8	0.7	2.7

## MARSHALL STONY LOAM.

The Marshall stony loam consists of a brown loam from 2 to 10 inches deep, overlying a yellowish or grayish silty clay, similar to the subsoil of the Marshall clay loam. Sometimes there are few stones in either soil or subsoil; in other cases huge granite bowlders may be scattered thickly over the surface, or again the surface may be covered thickly with gravel. In some places also the interstitial soil is distinctly sandy.

The Marshall stony loam occupies the bluffs of the Sheyenne River and the morainal hills that are too steep for cultivation. In the western two-thirds of the county it is best developed in the vicinity of Fort Ransom and northward. Here the bluffs rise 280 to 300 feet above the river and the sides are much broken by dry coulees, so broken, in fact, that it is at times difficult to find a way to construct a road from the river to the prairies above. This belt of broken country is from one-fourth to 1 mile wide and is timbered with small trees, in places chiefly scrub oak. Down the stream the bluffs gradually become less sharp, and at Scoville, where the river enters the old delta region, they are only 40 or 60 feet above the water. None of this soil type is found in the delta region. The surface drainage is rather excessive, and in the very stony places the grass may become very short and parched in dry seasons.

The Marshall stony loam has been derived from bodies of coarse glacial deposits, in part moraines, but is largely the coarser material left behind in the erosive work of the Sheyenne River during the cutting of its present deep gorge. The rolling topography prevents plowing and cultivating this land, except in small spots, and its chief value is as pasture. The principal native growth is grass, much of which remains, and some small timber useless for building purposes. As pasture land the type is generally valued at about \$10 to \$20 an acre. Springs are found on the hillsides, and there are many places where stock may find shelter from the winds.

The following table of results of mechanical analyses of the fine earth of the soil and subsoil of this type shows its average texture:

*Mechanical analyses of Marshall stony loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Me- dium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>
15492.....	Soil .....	1.9	4.8	6.1	18.2	7.0	36.8	24.6
15493.....	Subsoil.....	.2	.9	1.1	4.8	3.5	43.1	43.2

The following samples contain more than one-half of 1 per cent of calcium carbonate ( $\text{CaCO}_3$ ): No. 15492, 32.60 per cent; No. 15493, 71.16 per cent.

## SIOUX GRAVELLY LOAM.

The Sioux gravelly loam is a dark loam or heavy sandy loam, containing some coarse sand particles, underlain by a yellow stratum of about the same texture and of a depth of 8 to 24 inches. Beneath this occasionally occurs a layer of coarse sand a few inches thick, which rests on a bed of gravel. The latter is nearly always stratified, and varies in extreme cases from a coarse sand on the one hand to the coarsest gravel and boulders on the other. Occasionally a little finer material is found mingled with the gravel, and it is nearly always more or less stained with iron. In gravel pits it may possess enough coherence to stand in perpendicular walls of considerable height. The depth of the gravel stratum is unknown, but in some places it is more than 40 feet.

On low knolls and in other places where erosion has been severe gravel is frequently scattered over the surface of the soil and it is not uncommon to find gravel occasionally turned up by the plow. Excepting the very gravelly knolls, however, the soil is easily handled, and all kinds of agricultural machinery can be used. The type is one that can be cultivated almost immediately after a rain, and is readily put in a fine state of tilth. The largest area of the Sioux gravelly loam is found in the vicinity of Englevale and southward. Other areas are found along the river near Lisbon, between Lisbon and Scoville, and on the edge of the delta region between Scoville and Milnor. Most of the type may be described as level to gently rolling, that portion near Englevale being especially level, and it frequently appears to be a very fine soil to one who is not acquainted with the subsoil.

In places there are sloughs of greater or less extent into which water ultimately finds its way, but the greater part of the drainage is downward into the subsoil and is excessive. Excepting the portion retained by the 12 to 24 inches of surface soil, the rainfall is lost to the crop. So rapidly does water percolate the soil that even the roads are never muddy except during the time that rain is actually falling. In a climate like that of this part of North Dakota, where the rainfall is inclined to be somewhat scant, farming on a soil of this character will always be attended with considerable risk.

At present a large proportion of the Sioux gravelly loam is unbroken and used for pasture or hay, which is scant in dry seasons. On the cultivated areas fairly good crops of wheat, barley, flax, etc., are secured in favorable seasons, but practically nothing in dry seasons. The use of large quantities of stable manure would improve its moisture-holding capacity somewhat, but hardly enough to enable

it to grow good crops in dry years. At the present time this land is held at \$10 to \$25 an acre.

#### FARGO CLAY.

The Fargo clay is the heaviest soil found in Ransom County. The first 6 to 10 inches consists of a black or dark-brown clay or clay loam, beneath which is found a grayish or yellowish silty clay or heavy clay. The texture varies somewhat in different sections. The heavier phase occurs along the county line north of De Lamere, while northwest of that point it grades into the Fargo silt loam and Fargo loam.

The largest area is found directly north and northwest of De Lamere, in the southeastern part of the county. Smaller areas occur in other parts of the delta region. It is always flat and level; frequently lines of level run along section lines showing a variation of less than 1 foot from one corner to another. As will be seen by the soil map practically all of the type is too wet for cultivation and needs artificial drainage before ordinary crops can be grown. Drainage would be expensive, as the ditches would have to be extended long distances to reach an outlet. One is being dug through this clay and other soils at the present time (1906), but unless laterals are constructed at frequent intervals in the fields it is very doubtful if much good will be accomplished.

The Fargo clay is a delta deposit dropped in the quietest water. There is considerable evidence of alkali, generally white alkali, which appears on the surface when evaporation is intense. These places may cause some trouble when the land is first brought under cultivation, but surface drainage and deep plowing will nearly always remove the excess of salts and prevent damage from this source.

At the present time nearly all of the Fargo clay is covered with slough grass or a tough prairie grass, and heavy yields of coarse hay are secured when the land is dry enough to permit harvesting. Only one small field as yet has been plowed. Owing both to texture and to topography, the type is probably best adapted to grass crops. If drained so that water does not stand on the surface it will grow fine crops of redtop and possibly brome grass. If somewhat better drained, timothy will grow well and large yields should be secured. If perfectly drained, small grains should do well. The soil is rather heavy for corn, and the crop would be late and exposed to danger of frosts, even if adequate drainage were established.

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

*Mechanical analyses of Fargo clay.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>				
15482.....	Soil.....	0.1	1.4	3.5	19.9	9.2	24.7	41.2
15483.....	Subsoil.....	.7	3.2	2.1	7.8	4.3	31.4	49.6

The following samples contain more than one-half of 1 per cent of calcium carbonate ( $\text{CaCO}_3$ ): No. 15482, 3.86 per cent; No. 15483, 18.50 per cent.

#### MEADOW.

The Meadow consists of low-lying areas, in the western part of the county, which with ordinary rainfall are too wet to produce profitable crops of grain. In the delta region it was found possible to classify the wet areas and to show their condition by swamp symbols on the map. The Meadow has two more or less distinct phases—the first comprising the long, narrow sloughs in the old Sheyenne Valley south from Fort Ransom, and the other the low wet places in the gently rolling prairies. In the latter location the soil for the most part is considerably heavier in texture than the prairie soils, being a black clay loam from 18 to 24 inches deep, overlying a drab clay that is very impervious to water. These low places usually support a dense growth of marsh grass and give a heavy yield of coarse hay. Some are, however, frequently too wet to allow cutting. Some of these low places are the basins of old lakes, with well developed beaches and more or less sand and gravel around the edges. The low, narrow sloughs show rather a mixture of soils—sands, silts, and clays—and most of them were too wet to allow the harvesting of hay in 1906, though they have been dry enough in other seasons.

The areas of Meadow that are not so very wet and where water stands only for a short time could be profitably broken up and sown to redbud (*Agrostis alba*) and a heavier yield of a much better quality of grass secured. Brome grass or timothy might grow in some of these places. Unless too many of them occur on a farm they are not to be considered as waste land, for they give a fair return per acre in the yields of hay secured at little cost. In time some of these areas may become dry enough to cultivate, but as there will be an increased demand for hay in the future they will probably be much more profitable if kept for the production of this crop.

## SIOUX LOAM.

The Sioux loam, the largest body of which is known locally as "sand prairie," has a brown or black loam soil about 14 inches deep, resting on a yellowish material of about the same texture, which in turn is underlain at an average depth of about 24 inches by a coarse sand or gravel. The coarse sand is the deep subsoil over the greater part of the most northwestern area of this type, while in most other places the gravel subsoil prevails. Shale fragments are mixed in varying proportions with the material directly overlying the sand, and the more there are of these the heavier and more claylike the material. The shale content is greater where the soil is deep than where it is more shallow. The depth to the sand varies from 16 to 33 inches. No stones and scarcely any gravel, except what has been brought up by gophers, occur in the surface soil. This absence of coarse material, together with the level topography, renders this type one particularly well suited to the use of machinery. It does not bake, and is readily brought into a fine state of tilth.

The largest and, in fact, almost the only areas of the Sioux loam are found in the extreme northwestern part of the county. An area containing a number of square miles, the most of which is known as "sand prairie," is found in Bear Creek and Fort Ransom townships. Excepting a small portion near the eastern border, this country is apparently perfectly level, there being no hills or knolls to break the even surface of the plain. It is frequently described as being as level as the land in the Red River Valley.

Drainage is exclusively downward and into the subsoil. The thickness of the underlying sand stratum is unknown, but over the greater part of the area it carries permanent water at from 3 to 18 feet below the surface, the depth to water varying considerably with the season. Notwithstanding this high water table, there is scarcely an acre of this type of soil that ever becomes too wet for cultivation, the porous nature of both the soil and subsoil allowing water to drain downward almost immediately after a rain. In dry seasons this characteristic causes excessive drainage, and any moisture beyond that held by capillary power in the 2 feet or so of loam on the surface is lost in the sand and gravel of the subsoil. Even at the close of fairly wet seasons a layer of perfectly dry sand is generally found between the soil and the water table below, and it seems doubtful if the nearness of the water table to the surface is of any benefit to ordinary crops.

The Sioux loam is formed of reworked glacial material. Its position suggests that at one time the Sheyenne River or water from the melting ice flowed down across the largest area of this soil and south by way of Bear Creek, depositing sand and gravel on its way. The

general levelness of the country suggests a lake, probably hemmed in by moraines on the east, west, and north. During a part of the time, however, a considerable current must have flowed across the area. Later the velocity of the current was checked, and the present covering of loam deposited.

The Sioux loam was originally timberless and covered with prairie grass. It is a soil which would give good results with canning crops, such as tomatoes, peas, sweet corn, etc., were it so situated that these could be profitably marketed. It is somewhat earlier than the Marshall clay loam, and in seasons of average rainfall ought to produce good crops of corn, which would have a better chance of maturing here than on soils somewhat heavier and later.

Wheat, barley, oats, and flax are at present the chief crops. Durum wheat yields 10 to 25 bushels, averaging about 10 to 14 bushels, barley 20 to 35 bushels, and flax 10 to 13 bushels per acre. This soil has been cultivated somewhat longer than most of the other soils in the area, and as yet shows no signs of deterioration. Nevertheless, more attention should be paid to manuring the land, and to the maintenance of moisture in the soil by summer fallowing or the growing of some cultivated crop, as corn occasionally, so as to maintain a proper mulch during dry years. The improvements, as a rule, are above the average for the county. Land of this character is valued at \$20 to \$40 an acre, but scarcely any of it is changing hands at present.

The following table gives the average results of mechanical analyses of the soil and subsoil of the Sioux loam:

*Mechanical analyses of Sioux loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Me- dium sand.	Fine sand	Very fine sand.	Silt.	Clay.
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>
14852, 15494.....	Soil .....	2.6	15.5	12.1	10.9	4.9	34.0	19.1
14853, 15495.....	Subsoil.....	2.7	25.2	15.5	14.1	3.8	17.7	18.5

MARSHALL GRAVELLY LOAM.

The Marshall gravelly loam is similar in some respects to the Marshall clay loam and the Marshall stony loam. It differs from the former in having less depth of soil, in places a gravelly subsoil, and in being much more rolling; but it is not so rolling as the Marshall stony loam, contains less stone, and generally can be cultivated to a greater or less extent. The soil is usually a dark loam from 6 to 9 inches deep, with more or less gravel scattered over the surface, and the subsoil is a yellow silty material very similar to that of the Marshall clay loam. In some places the subsoil is pure gravel, in other places a layer of gravel is found at a greater or less depth from the

top of a hill, and this outcrops on the sides. Material of all grades between pure gravel and a silty loam is found as subsoil.

The Marshall gravelly loam is found only in the western two-thirds of the county, in small areas, on morainal hills, which may rise 40 to 60 feet above the general level, or as rolling land near small streams. One area south of Lisbon, in sections 24, 14, and 10, Gilbert Township, is in a region of small lakes that lie from 20 to 40 feet below the general level and are so numerous as to make cultivation more or less difficult. Some gravel and occasionally boulders are piled up around the edges of these lakes, and the material between the lakes is fairly typical Marshall clay loam, but it is not possible to separate these soils here.

The Marshall gravelly loam, while always rolling, is not sufficiently so to preclude farming, although its topography interferes to a greater or less extent with most operations. It is always well-drained, generally excessively so in a dry year, and even in wet seasons it is not uncommon to see light crops on the tops of knolls.

Prairie grass was the principal native plant over most of the type. Some knolls are at present left in grass, but others, where small, are cultivated and given the same treatment as the rest of the land.

Wheat yields from 8 to 14 bushels per acre, and other crops in proportion. Heavy applications of manure will show good and lasting results where the subsoil is not too gravelly. Without fertilizer in some form the soil soon deteriorates in productiveness. The type is as yet largely undeveloped, and when in larger areas is held at \$12 to \$20 an acre. At present prices the more level soils are much to be preferred.

The following table gives the results of mechanical analyses of the fine-earth portion of soil and subsoil of this type:

*Mechanical analyses of Marshall gravelly loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>				
15490.....	Soil .....	1.1	6.5	5.8	31.7	14.0	32.5	8.1
15491.....	Subsoil.....	1.1	3.6	3.3	22.3	15.5	39.7	14.8

The following samples contain more than one-half of 1 per cent of calcium carbonate (CaCO<sub>3</sub>): No. 15490, 7.52 per cent; No. 15491, 22 per cent.

FARGO SAND.

The Fargo sand has a dark surface soil varying in texture from a loamy sand to a heavy sandy loam, the sand particles being for the most part rather coarse. The subsoil is a yellow loamy sand or a

coarse sandy loam, and occasionally clay is found at a depth of about 3 feet. There is no gravel in the soil, but a little fine gravel is sometimes found in the subsoil. The soil varies in depth from 10 to 18 inches, averaging about 14 inches. It is easily cultivated where drainage conditions are favorable, but in other places the drainage is excessive and it is hard to keep crops from suffering in dry weather. There are, however, portions so wet as to interfere more or less seriously with cultivation. A large body of the type borders on the McLeod sand, but it is considered a much better soil than the latter type.

The Fargo sand is found exclusively in the delta region. One large area lies directly east of Lisbon, near the east side of the Sheyenne River and south from Venlo. A small area is found south of Scovill.

Most of the type is very gently rolling to level in topography. It has the appearance of a broad plain, and one can frequently see for several miles over the open prairie. The area south of Scoville is more rolling, and the drainage is inclined to be excessive. As there are no streams, all the rain water must pass down into the subsoil, and, with the coarse open character of the underlying material, where the land is high lying the soil is droughty. In low and flat areas, on the other hand, there is more or less water on or near the surface, and water is never very far from the surface throughout the large area of this type, frequently being found within 5 feet even late in the fall.

The Fargo sand is a delta deposit laid down very near the ancient mouth of the river. In part it is a beach formation along the shore of Lake Agassiz. As in all low places in the county, the subsoil water in this type contains a considerable quantity of soluble salts, which, however, will never be likely to cause trouble, as they rarely accumulate on the surface.

The original vegetation was prairie grass, with a little slough grass in the wetter portions. Little of the type is yet under cultivation. Where it is thoroughly drained it is well adapted to truck and canning crops, and the wet portions are best suited for hay production. In general it is a soil on which the best results can be obtained only by returning a large amount of organic matter to the soil. If a good market were near dairying would be advisable, and the growing of clover or some leguminous crop every three or four years, a large portion of which should be turned under, is recommended. Besides adding as much organic matter to the soil as possible every attention should be paid to reducing evaporation from the surface, so as to preserve as much moisture as possible for the use of plants. On the small area cultivated the usual crops of the county are grown. Some good fields of corn were seen. The yields of

wheat and other small grain are rather light, especially after the soil has been cultivated for some time. The greater part of the Fargo sand is yet wild land, from which some grass is cut for hay. This type of soil is valued at \$20 to \$30 an acre.

The following table gives the results of mechanical analyses of a sample of the soil and of the subsoil of the Fargo sand:

*Mechanical analyses of Fargo sand.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>				
15474.....	Soil .....	0.2	6.7	32.2	35.6	10.0	7.8	6.8
15475.....	Subsoil.....	.3	11.4	31.3	28.0	12.2	10.2	6.3

MARSHALL CLAY LOAM.

The Marshall clay loam is a uniform soil and even in areas widely separated it varies but slightly from the true type. The soil to a depth of 10 to 24 inches is a dark-brown to almost black silty clay loam, the average depth being about 15 inches. The subsoil is a yellow or grayish clay loam or silty clay, in places becoming slightly heavier at 30 inches, carrying occasional gravel, stones, or bowlders, and extending to a depth of from 10 to 20 feet or more. In most borings no gravel or stones are encountered, but a few are always seen in road and railway cuts. The subsoil as a rule contains a large amount of lime. In places bowlders of greater or less size are scattered over the fields, and in some cases it has been necessary to gather these up in piles before attempting cultivation. In small areas on knolls the subsoil sometimes contains considerably more gravel than the average. These stones and gravel are of many varieties of rock—granite, gneiss, and limestone being prominent.

The Marshall clay loam is a soil that for its texture is rather remarkably easy to cultivate compared with some eastern soils. It rarely, if ever, becomes too wet to plow, and if handled when very wet can with reasonable care be brought into a good state of tilth. This soil, especially when freshly broken, will not bake into hard clods, even if plowed very wet, but it is said to lose this characteristic if cultivated for some years exclusively to wheat or any crop which adds little organic matter to the soil. The soil is heavy enough to hold a relatively large proportion of moisture, and yet it is not so heavy and impervious that water can not pass readily into the subsoil. Generally the borings taken indicated the normal penetration of rainfall to be from 2 to 4 feet. Attention is called to a phase of this soil found in the northwestern part of the county in sections 10, 15, and 28, Bear Creek Township, and parts of sections 9, 10, and

16, Fort Ransom Township. The country here in places is more rolling and morainal in character, and both soil and subsoil have more sand than the average of the type, this being especially true in local spots. It is unquestionably a good soil here, but is not considered quite so productive as in some other areas. There is also more or less territory immediately south of Sheldon where the Fargo fine sandy loam, Fargo loam, and Marshall clay loam grade imperceptibly into one another.

A glance at the accompanying soil map will show that the Marshall clay loam occupies nearly all the western two-thirds of Ransom County. It is found in a nearly level country for several square miles around Elliot, and the general topography of the type varies from nearly level to gently rolling, none, however, being so rolling that the largest machinery can not be advantageously used. Drainage is good over most of the type, except in a few low spots which receive considerable surface water from the surrounding higher land. Such places, larger than 10 acres, if generally too wet for cultivation are mapped as Meadow. There are very few streams running through areas of this soil, and the greater amount of the rainfall passes through the soil and into the subsoil where it is stored for the use of crops.

The material composing the Marshall clay loam is the finely ground rock flour from granite, gneiss, limestone, etc., left by the glacier, and the generally level surface of the type is the result of the action of the ice. The ground-up limestone may account for the relatively large proportion of lime found in the subsoil.

When the first settlers arrived here they found the prairies covered with a dense growth of nutritious grasses of several varieties, which provided hay for live stock. There is yet some wild land of this type, and the ease with which it can be brought under cultivation adds much to its value.

Were the Marshall clay loam of Ransom County found in central Illinois, Iowa, or anywhere in the corn belt, it would be considered one of the finest corn soils of that region. The shortness of the growing season has modified to some extent the desirability of this soil for corn, yet if carefully cultivated and planted as early as possible, using a variety adapted to the region, there is no doubt a good yield can be secured in most seasons. Scarcely any attempt is made to grow corn upon this soil at present. If more live stock were kept on the farm this plant could be utilized as fodder in case an occasional season should happen to be too short to mature the ears. Sugar beets also would probably do well. Timothy and brome grass particularly the former, are very good hay plants, and clover will also grow well for one season. Apples, if protected from severe winds, berries, and small fruits generally would give good results.

The possibilities of this soil are only partially realized. It is chiefly planted to wheat. Bluestem and Fife yield from 10 to 20 bushels per acre and Macaroni wheat from 14 to 30 bushels, probably averaging 20 bushels, or about one-fifth to one-fourth more than the other varieties. Over 80 per cent of the wheat grown at present on this type of soil is Macaroni or Durum. Of the minor crops, oats yield 25 to 50 bushels, barley 25 to 40 bushels, and flax 8 to 18 bushels per acre. On some sections yet unbroken the native prairie grass is cut for hay, the yield being 1 to 2 tons per acre. Hay of this character sells at \$4 to \$6 a ton.

The need of some intertillage crop—as, for instance, corn—and of a rational system of crop rotation, while not marked at present, will sooner or later be realized by the farmers, and it would be well for them to pay considerably more attention to it now. Corn one year, followed by small grains two or three years, flax, and then clover or clover and timothy one year would be a rotation very beneficial to the land and without doubt would result in increased yields of corn and small grains.

Wild land of this type of soil is held at about \$25 an acre and improved land from \$25 to \$45 an acre. Excepting the Fargo fine sandy loam and Wabash loam, it is considerably higher in price than the other types of soil.

The following table gives the average results of mechanical analyses of samples of the Marshall clay loam:

*Mechanical analyses of Marshall clay loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>				
14854, 15484, 15486.....	Soil.....	0.6	2.9	2.1	8.5	9.2	50.6	25.6
14855, 15485, 15487.....	Subsoil.....	.3	2.5	1.9	7.7	8.4	51.1	27.3

The following samples contain more than one-half of 1 per cent of calcium carbonate ( $\text{CaCO}_3$ ): No. 14855, 2.69 per cent; No. 15485, 2.93 per cent; No. 15486, 4.62 per cent; No. 15487, 19.60 per cent.

#### SUMMARY.

Ransom County lies in the southeastern part of North Dakota. Two-thirds of the area is rolling prairie, the remainder, known as the Sheyenne Delta—a part of glacial Lake Agassiz—has a level to gently rolling surface. The regional drainage is slow.

Agricultural development has taken place mainly within the last twenty-five years. The county is not thickly settled, the census of 1900 reporting a population of 7,000. A much larger number could be supported. Lisbon, the largest town, has 2,000 inhabitants.

Minneapolis and Chicago are the controlling markets. Elevators are located at convenient points for storing the grain.

The rainfall, though light—the mean ranges from 18 to 20 inches—occurs mainly in the growing season. Summer temperature rarely exceeds 100° F. In winter, periods of temperature below -30° F. occur. The length of the growing season ranges from ninety to one hundred and twenty days. Wheat is the main crop, between 1,000,000 and 3,000,000 bushels being produced annually. Flax is second in importance, ranging in annual value from \$500,000 to \$1,000,000. Oats, barley, and rye are also important crops, and corn is beginning to be grown. Few live stock other than the work animals are kept.

The soils are derived from glacial material, either as laid down by the ice, or as reworked by the rivers and deposited in ancient Lake Agassiz. The resulting conditions are complex, and 17 distinct types of soil are shown on the map. These range in texture from sand to clay.

The Marshall clay loam, the most extensive type in the county, covers 49.1 per cent of its area. Considering its texture it is a remarkably easy soil to cultivate. Drainage conditions are good. It yields good crops of small grains and flax, and supplies considerable wild prairie hay. Unimproved it is valued at \$25 an acre; improved tracts range from that figure to \$45 an acre.

The Fargo fine sandy loam, covering 7.3 per cent of the county, is a fine type of agricultural land, free from stones, easily cultivated, and slightly earlier than the heavier soils. It is therefore better for corn in this region, where length of season is so important a factor with this crop. The yields of the several crops are fully as large as upon the Marshall clay loam.

The McLeod sand has about the same extent as the Fargo fine sandy loam. The surface consists of a series of low mounds and intervening depressions—the result of wind action. Little of the type is drifting at present. Only a small area is under cultivation. Native hay and pasturage are the chief sources of profit.

The Sioux gravelly loam covers 5.5 per cent of the area, or 30,400 acres. Drainage is apt to be excessive, owing to a gravelly subsoil. Little of the type is under cultivation, but it is used for hay and pasture.

The Fargo sand, of which 22,016 acres were mapped, is a delta type. Only a small acreage is under cultivation. Low yields of the usual crops are obtained. The type is better adapted for trucking than for general farming. It can be purchased for \$20 to \$30 an acre.

The Marshall stony loam occupies an area of 21,696 acres. It has a rough, broken surface and is used chiefly for pasture.

The Fargo loam, of which there is 20,800 acres, is, in the main, poorly drained. It is used almost exclusively for wild hay, of which it gives good yields. Drainage would make this type a valuable soil for wheat and the tame grasses. Prices range from \$15 to \$35 an acre.

The Fargo fine sand (19,904 acres) is an easily tilled soil, early and fairly well drained. About half of it is under cultivation, giving fair yields of the leading crops of the county. The remainder produces fine crops of prairie hay. The type is best adapted to potatoes, small fruits, corn, etc. The present value is \$15 to \$30 an acre.

The Marshall gravelly loam is one of the less valuable types. It occupies 15,872 acres, is rough and rolling, and excessively drained in dry years. Yields are lower than on the heavier and more level soils. It is valued at from \$12 to \$20 an acre.

The Sioux loam (15,744 acres) is a level, easily cultivated soil. It is underlain by sand, and this causes it to be somewhat droughty in dry seasons. It is used for the crops ordinarily grown, but it is better suited to the production of canning crops, for which there is no market at present. Land of this character can be bought for \$20 to \$40 an acre.

The Wabash loam (14,976 acres) is an alluvial type, well suited to the production of celery, truck, and small fruit, but with present markets it is doubtless best to continue to use it in growing wheat and other grains, grasses, and flax. Land of this type can be purchased for \$20 to \$40 an acre.

The Fargo silt loam, Marshall fine sandy loam, Bearden loam, and Fargo clay complete the list of agricultural soils. The total acreage of these four types is only about 19,000 acres. The condition, uses, and values do not differ markedly from the foregoing types of similar texture. Dunesand and Meadow are nonagricultural types. About 12,000 acres of each were mapped. A little hay and some grazing are all these lands afford.

For those desirous of emigrating to this county there is first-class farming land in abundance at very reasonable prices. The Marshall clay loam, Wabash loam, Fargo fine sandy loam, Fargo fine sand, Fargo silt loam, and Fargo loam, the last three when well drained, are very productive soils. But on the other soils of Ransom County, except possibly the Sioux loam and Bearden loam, farming is attended with more or less risk, and at present prices the other lands are much to be preferred.

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