

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF CHEMISTRY AND SOILS
In Cooperation with the South Dakota Agricultural Experiment Station

SOIL SURVEY
OF
MOODY COUNTY, SOUTH DAKOTA

BY
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COUNTY SURVEYED

Moody County is near the center of the extreme eastern part of South Dakota. The South Dakota-Minnesota State line forms the eastern boundary. The county is almost square and has a land area of 515 square miles or 329,600 acres.

The elevation of most of Moody County ranges between 1,550 and 1,700 feet above sea level. The elevation at Ward, in the northeastern part of the county, is 1,754 feet. The county as a whole has a smooth, uniform surface with few or no outstanding topographic features. The drop from the general upland level to the stream bottoms is in most places abrupt. It is most noticeable along Sioux River, where a drop ranging from 100 to 200 feet occurs in many places within a quarter or half mile. In some places, as in section 8 of Flandreau Township, there is a sheer drop of almost 100 feet.

A strip of rolling land generally follows the larger streams that flow into Sioux River. This rapidly gives way to land of more gentle relief farther upstream. The descent from the upland to the bottom land in the northeastern part of the county is sharp and steep. The drops vary from 20 to 50 feet, and the streams have the appearance of having been cut out by some artificial agency. On the west side of Pipestone Creek the slope to the stream is gentle, but on the east side it is more abrupt.

Most of the land in the county is undulating or gently rolling, and very little of it can not be cultivated on account of unfavorable relief. The largest area of the more gently rolling land lies in the southeastern part of the county and comprises all of Lone Rock and Alliance Townships and the eastern half of Grovena and Blinsmon Townships. The land in Ward Township is also rather smooth. Another level area occupies the northern half of Clare Township, lying between the drainage flowing north and that flowing south. The remainder of the county varies from undulating to rolling. Most of it is strongly undulating. Most of Jefferson and Colman Townships and the western half of Lynn and Fremont Townships have a distinct ground-moraine configuration. Here there is no established drainage system, and a large number of sloughs and poorly drained areas are present.

Moody County was organized in 1873 from parts of Brookings and Minnehaha Counties. The earlier settlers came chiefly from Minnesota, Wisconsin, and Iowa, but others came directly from the Scandinavian countries of Europe. The present population is made up largely of the descendants of the early settlers and is mostly

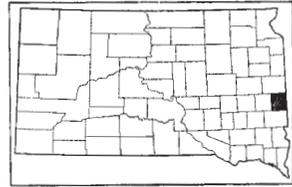


FIGURE 1.—Sketch map showing location of Moody County, S. Dak.

of Norwegian, German, Swedish, Indian, and Scotch extraction. According to the census of 1920, 1,222 of the inhabitants are foreign-born whites. The population of the county increased from 8,695 in 1910 to 9,742 in 1920, and is rather evenly distributed throughout the county. The average number of persons to the square mile is 18.5.

Flandreau, the county seat, is located on Sioux River a little northeast of the center of the county, and in 1920 had a population of 1,929. The Riggs Institute, a Government Indian school which has a large enrollment, is located there. Other towns in the county are Ward in the northeast corner, Colman in the west-central part, Egan in the central part, and Trent in the south-central part.

Very few farms are more than 10 miles from a shipping point. A branch of the Chicago, Milwaukee, St. Paul & Pacific Railroad from Sioux Falls enters the county on the south and follows Sioux River. Another branch enters the county from the west, passing through Colman and forming a junction with the first branch just south of Egan. A branch of the Chicago, Rock Island & Pacific Railway crosses the northeast corner of the county diagonally.

There is a good system of graded county roads throughout the county and about 80 miles of graveled State and county roads. Roads follow practically all section lines.

Sioux Falls, Sioux City, Minneapolis, and St. Paul are the principal outside markets. The first two are the principal livestock markets and the last two the principal grain markets.

A good system of urban and rural schools prevails. A large number are South Dakota standard schools, and several are consolidated schools.

CLIMATE

The climate of Moody County is characterized by moderately long summer seasons, with hot days and comparatively cool nights, and rather long, severe winters, with temperatures well below freezing much of the time. Clear, crisp, cool days and cooler nights prevail during the fall months.

The records of the Weather Bureau station at Flandreau show a mean annual temperature of 43.8° F. The average date of the last killing frost is May 14 and that of the first killing frost is September 24. The average frost-free season of 132 days is sufficient for those varieties of crops which have been selected and bred for this locality. The latest killing frost recorded occurred on June 21 and the earliest on August 23, but such frosts are rare.

The mean annual rainfall is 23.71 inches. Most of this falls during the frost-free season, and when the soil is left saturated with moisture from melting snow in the spring this amount of rainfall proves sufficient. Hot south winds of from one to three days' duration sometimes occur during July and August. These affect the crops, especially if the soil has not been saturated with moisture from melting snows. The average depth of snowfall for the year is 27 inches. One-fourth of this total falls in March.

Table 1 gives the normal monthly, seasonal, and annual temperature and precipitation at Flandreau.

TABLE 1.—Normal monthly, seasonal, and annual temperature and precipitation at Flandreau

(Elevation, 1,565 feet)

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1894)	Total amount for the wettest year (1908)	Snow, average depth
	° F.	° F.	° F.	Inches	Inches	Inches	Inches
December.....	17.9	56	-35	0.59	0.35	0.73	4.3
January.....	14.0	60	-38	.44	.51	.10	4.7
February.....	15.4	64	-38	.52	Trace.	2.09	4.5
Winter.....	15.8	64	-38	1.55	.86	2.92	13.5
March.....	30.4	84	-20	1.06	1.02	1.52	7.0
April.....	45.4	94	6	2.52	2.43	3.08	2.9
May.....	57.3	95	20	3.85	.80	9.07	.3
Spring.....	44.4	95	-20	7.43	4.25	13.67	10.2
June.....	65.4	101	29	4.10	1.96	4.96	.0
July.....	70.0	103	38	2.89	1.04	4.47	.0
August.....	68.8	103	33	2.98	3.37	3.08	.0
Summer.....	68.1	103	29	9.97	6.37	12.51	.0
September.....	60.4	99	15	2.23	1.57	1.81	Trace.
October.....	49.0	94	4	1.59	2.43	2.14	1.1
November.....	32.5	79	-16	.94	.26	1.72	2.2
Fall.....	47.3	99	-16	4.76	4.26	5.67	3.3
Year.....	43.8	103	-38	23.71	15.74	34.77	27.0

AGRICULTURE

The earlier settlers of Moody County engaged only in wheat growing and cattle raising. Wheat production rapidly gained in importance until it became the principal farming industry. However, wheat was gradually replaced by corn, oats, and barley, and cattle, hogs, and sheep were raised more extensively. The area in wheat increased from 12,631 acres in 1879 to 87,243 in 1899, according to the United States census. Since then the number of acres has decreased, and only 6,999 acres were reported in 1919, and probably there was less than half this acreage in 1926. The average yield is about 10 or 11 bushels to the acre.

In 1919, oats occupied a larger acreage than any other crop. The number of acres planted to this crop rapidly and steadily increased until 1919, when 77,460 acres were reported. The census figures show an average yield of about 30 bushels to the acre, but over a term of years the average is probably nearer 35 or 40 bushels to the acre. The favorite early variety grown is the Sixty-Day, which is a small yellow oat with light straw. A later variety is grown on the lighter-textured soils. Oats having heavy straw are apt to lodge on the heavier soils.

The general trend is for some of the oats acreage to be replaced by corn, the acreage of which has increased rapidly from 8,642 acres in 1889 to 67,668 acres in 1919. The average yield has also increased gradually since 1899, and corn is no doubt gradually becoming by

far the most important crop in the county. Corn from a considerable acreage is used for filling silos. Hogs, sheep, or cattle are often turned in cornfields to fatten for the market, especially in seasons when the corn does not reach maturity. Cornfields are pastured after the corn has been gathered. The three principal varieties of corn grown in Moody County are Daily's White Dent, Wimple Yellow Dent, and Minnesota 13. According to the farmers through the county, Daily's White Dent is the heaviest-yielding variety. This variety has been adapted, selected, and bred locally and seldom fails to mature. Both the other varieties are yellow. Wimple Yellow Dent has a slightly larger ear and ordinarily yields well, but it sometimes fails to mature as it requires a slightly longer season than Minnesota 13 which always matures but which does not yield so well as the two other varieties. Corn yields average between 25 and 40 bushels to the acre, and yields of 60 bushels are not uncommon. The largest average yields are obtained on the bottom lands and in the southeastern part of the county.

Barley is a rather important crop. In 1909, 59,432 acres were reported, but only 16,232 acres were grown in 1919. The average yield is between 15 and 20 bushels to the acre. Less important small grains are rye, emmer, and spelt. Buckwheat and cane are often used to supplement crops that, for some reason, have failed to develop satisfactorily.

The acreage planted to potatoes is gradually increasing, but the acre yield is decreasing. The 1920 census reported 1,325 acres in potatoes in 1919, with an average yield of 52 bushels to the acre. One farmer who makes a practice of growing potatoes for the local market reported a yearly average yield of 150 bushels to the acre. One or two farmers near Flandreau make a specialty of growing cabbage.

The principal hay and forage crops are timothy, clover, alfalfa, and sweet clover. Timothy occupies the largest acreage and timothy and clover mixed follow closely. Each crop yields slightly more than 1 ton to the acre. Alfalfa yields from 1½ to more than 2 tons and is the principal legume hay crop. Some sweet clover is grown for hay, but most of it is grown for seed. It yields slightly more than red clover and produces from 5 to 8 bushels of seed to the acre. Most of the hay obtained is from native grasses which grow abundantly in the sloughs and wet areas. These sloughs dry sufficiently in the fall to allow the cutting of hay. In 1919 a total of 13,967 acres of native grasses were cut for hay, with an average yield of 1.16 tons to the acre. Millet and cane are sometimes planted for forage, and occasionally corn is drilled thick and close and cut green and cured for forage. Alfalfa and sweet clover will no doubt become the chief tame-hay crops.

Very few fruits are grown in the county, and as most of those produced are early varieties they do not keep well. In 1919, the 6,351 apple trees produced slightly more than 1 bushel each. The 3,171 plum trees produced 422 bushels of fruit. A few grapes are grown. Strawberries are practically the only small-fruit crop, 6 acres in 1919 yielding 5,660 quarts. Large quantities of various fruits are shipped into the county annually.

The total value of livestock in 1919, as reported by the 1920 census, was \$4,056,478. Hogs ranked first in numbers and value, but no particular breed predominated. Beef cattle ranked second, with

20,285 valued at \$1,000,872, dairy cattle third with 14,632 valued at \$763,633, and horses fourth with 10,634 valued at \$939,420. Dairying is rapidly increasing in importance, and dairy products are becoming an important source of income. Cream stations are located throughout the county, and a large, successful cooperative creamery is in Flandreau. Most of the dairy cattle are Holstein.

Some farmers keep small flocks of sheep, but probably most of the sheep are shipped in as lambs for fattening. In the fall many farmers buy western lambs and turn them in the stubble fields and cornfields to pasture and fatten. Most farmers who make a practice of feeding lambs sow rape in the stubble fields and cornfields for forage. The pigeon grass which grows in the stubble field makes good sheep pasture.

Poultry and eggs are also rather important sources of revenue. Most of the poultry are in farmyard flocks, very few commercial flocks being noticed. The value of poultry and eggs almost trebled between 1909 and 1919, and poultry raising is rapidly increasing in importance.

The 1920 census reported a total of 1,245 farms in the county with an average of 246.4 acres to the farm, of which 83.8 per cent or 206.4 acres was improved land. The same census reports the value of all property as \$52,855 a farm, of which 81.9 per cent represented land, 8.4 per cent buildings, 3.3 per cent implements, and 6.4 per cent domestic animals. The value of all farm property nearly trebled between 1910 and 1920, the greatest increase being in the value of the land.

The labor expense on 1,047 farms averaged \$664.53 to the farm, and that of feed \$379.15 a farm on 674 farms. The number of farms operated by owners has gradually decreased, with a corresponding increase in the number operated by tenants and managers. The 1920 census reported 54.1 per cent operated by tenants, 1.1 per cent by managers, and 44.8 per cent by owners. Most of the land is rented on a cash basis, but some is rented on a share basis.

The 1925 census reports a total of 1,340 farms with an average of 231.3 acres, an increase of nearly 100 farms and an average decrease of approximately 15 acres to the farm in a 5-year period. The same census reports the value of all farm property as \$26,460 a farm, the value of all livestock as \$2,561,874, and the value of all crops as \$3,101,040.

SOILS

Moody County lies in that belt of the United States where the influence of climate has been strongly impressed on the soils. The most important characteristics of the soils of the region result directly or indirectly from climatic influences, particularly those which determine the available supply of soil moisture. Climatic conditions, uniform for the entire area, have acted on variable materials and have developed soils remarkably uniform in appearance and composition. Minor soil variations have resulted from conditions or materials that retard soil development, such as differences in drainage and in the texture and chemical composition of the parent materials from which the soils have developed.

Certain characteristics tend to develop in all the soils of the well-drained uplands, where the soil-forming processes have acted with

full intensity for a long period of time. The most obvious and striking characteristic of these soils is the dark color of the surface layer. In well-drained soils this color is developed only where prairie conditions prevail. The comparatively low moisture supply of the region has not been sufficient to support a forest vegetation, but it is has been favorable to the growth of grasses. The black organic matter which imparts the dark color is incorporated in the soil by the decay of grass roots.

The second characteristic of the upland soils is the accumulation of carbonates, principally lime carbonate, in the lower part of the subsoil. This high content of carbonate is also a result of the low moisture supply which, although sufficient to favor the accumulation of large quantities of organic matter, is not sufficient to leach the soil to any great depth. The carbonates, therefore, occur in only small quantities in the surface soil but are so abundant between depths of 18 and 30 inches that an actual concentration is indicated.

The soils of the well-drained upland, where undisturbed by erosion, have reached a stage of development that may be regarded as mature for this climatic belt. The typical profile is characterized by three distinct layers or horizons which, for convenience, are given the designations A, B, and C. These major horizons may be subdivided according to local variations, but the three general divisions are everywhere present. The upper dark-colored part of the soil, or A horizon, varies in thickness from 12 to 20 inches. The upper layer of this horizon may be very finely granular, silty, or single grained. The granules are uniform in color, and the material does not change color when crushed. In virgin areas to a depth of one-half inch or 1 inch the material is loose silty mulch, and to a depth of 3 inches it is filled with grass roots forming a turf. The lower part of the A horizon, in most places below a depth of about 4 inches, is slightly more compact where undisturbed than is the upper part. When the material is broken, it falls apart into a mass of granules. This layer is the darkest one in the soil, being slightly darker than the layer above.

The next lower layer is the upper part of the B horizon. This is commonly heavier than the layer above. The color changes with depth from that of the surface soil to grayish yellow or grayish brown. The color, originally brown, is darkened by organic matter that has penetrated downward along cracks and worm and insect burrows and has formed a coating over the soil particles. The tongues of dark-colored material decrease with depth, and the lower part of the B horizon is uniformly grayish yellow or grayish brown. The material of the lower part of the subsoil is structureless and breaks up into soft clods. Lime is abundant, either as concretions or finely disseminated through the soil material. This is apparently a zone of lime accumulation, as it contains a higher percentage of carbonate than the A horizon and apparently contains more than the horizon below.

The underlying substratum or C horizon consists of the parent material which has been but little altered by weathering. The typical color is grayish yellow with a slight olive tinge. Lime carbonate is in most places uniformly distributed throughout the mass. The material is structureless and breaks into soft clods which are irregular in size and shape.

Uplands soils which have reached the stage of development just described are shown on the accompanying map as members of the Barnes, Moody, and Flandreau series. The Bearden soils on the higher terraces have characteristics similar to those described and belong in the same general group. The Flandreau soils on the upland and the Sioux soils on the terraces have loose, porous, sandy or gravelly subsoils, but in a broad classification they belong with this group of well-drained soils.

The soils occupying the river bottoms and depressions in the uplands have weathered under conditions of restricted drainage which have prevented the development of the normal profile of this region. These soils have black surface layers and gray or mottled subsoils. This group is represented by the Fargo soils of the poorly drained terraces and depressions and by Lamoure soils of the first bottoms. These soils have heavy-textured, highly calcareous subsoils. The Cass soils on the first bottom, which are poorly drained on account of their low position but which have sandy and gravelly subsoils, may also be placed with this group.

The soils of Moody County have been placed in groups on the basis of differences in soil characteristics such as color, structure, consistence, and the arrangement and thickness of the various layers. The larger groups are called the soil series. Under each series the soils are separated, according to the texture of their surface layers, into soil types, the unit of soil mapping. The series is given a place name and the texture is added to show the soil type. In the following pages of this report attention is also given to the source, character, and mode of accumulation of the parent material from which the soils were developed.

The unweathered loess, which comprises part of the surface material of the soils in Moody County, consists of light-brown or buff, uniformly fine-textured material of which the texture is predominantly silty but which contains some clay and a small percentage of sand. This layer does not show stratification but has a well-defined columnar structure and is sufficiently coherent to stand in deep vertical cuts. Loess is the parent material of the very extensive Moody soils. This material, removed and redeposited by water, enters into the composition of the alluvial soils, probably making up a large part of the Bearden soils and a smaller proportion of other alluvial soils.

Underlying the loess is material transported and deposited by the ice sheets. This glacial drift includes *débris* from many rock formations. It consists of an unstratified mixture of coarse and fine textured materials, gravel, and boulders. Drift is exposed in the western part of Moody County, and soils of the Barnes and Pierce series have developed there.

The alluvial soils occupy the terraces or benches and the flood plains or first bottoms along streams. The terraces lie well above overflow, but parts of the flood plains are subject to inundation during periods of high water. The terrace soils have been derived from assorted materials washed down from the upland and deposited at former flood stages of the streams. The fine-textured deposits are composed mainly of loess. Some of the coarser-gravel terraces may be glacial-outwash materials.

The soils of the Moody series have developed the typical regional profile, except that in them the columnar structure is not so defined. The surface soil is very dark grayish brown or almost black and consists of three typical layers, the thin surface mulch, a loose finely granular layer, and a firmer and more distinctly granular layer. Below this is a transitional layer through which the dark color gradually fades with depth and the granular structure disappears. The next layer is grayish-brown silty loam, streaked with lime. It has no definite structure and is the zone of lime accumulation. This layer is underlain by the parent loess, a loose, grayish-yellow, structureless, silty material. The silt loam and very fine sandy loam members of the Moody series and three phases of the silt loam have been mapped in this county.

The Barnes soils have dark grayish-brown or almost black surface soils. The lower part of the dark-colored surface soil is granular or cloddy. In the next lower layer the color changes with depth to brown or grayish brown. Below this layer, at a depth ranging from 18 to 24 inches, is a layer of lime accumulation which consists of grayish-yellow highly calcareous material containing white streaks and spots of lime. The parent till of grayish-yellow structureless silty clay loam underlies this layer. Lime is less abundant than in the layer above. Glacial gravel and boulders are scattered over the surface and throughout the soil. In many places, the brown subsoil layer has a columnar structure. Barnes loam, with a rolling phase, Barnes silt loam, and Barnes fine sandy loam have been mapped in Moody County.

The surface layers of soils of the Flandreau series are dark grayish brown or almost black. They have a finely granular or single-grained structure and are from 2 to 5 inches thick. Below this layer and continuing to a depth of 10 inches is a layer, similar to or slightly darker in color than the surface soil and distinctly granular. The next lower layer, which reaches a depth of 24 inches, is dark brown or grayish brown and is less granular than the layer above. This is underlain by a thin layer of grayish-brown, calcareous very fine sandy loam. Below a depth of 30 inches the color becomes grayish yellow and the mixture fine or medium sand. These soils differ from those of the Moody series chiefly in the sandy texture of the C horizon. Four members of the Flandreau series, the loam, silt loam, very fine sandy loam, and fine sandy loam, were mapped in Moody County.

The surface material of the Sioux soils is dark grayish brown or black and is rather friable. It is underlain by a slightly heavier layer which becomes brown with depth. This material, in most places, has a columnar structure. At a depth ranging from 18 to 30 inches the soil layers are underlain by loose sand and gravel. These soils occur on terraces and outwash plains. The loam, silt loam, and fine sandy loam members of the Sioux series, together with a deep phase of Sioux loamy sand, have been mapped in this county.

The surface soils of members of the Lamoure series are very dark grayish brown or black. The subsoils are heavier in texture and vary in color from grayish yellow to gray or mottled gray and brown. The subsoils and, in places, the surface soils are calcareous. These soils are formed over recent-alluvial deposits and occur on

flood plains subject to overflow. Three soil types, the loam, silt loam, and silty clay loam, represent the Lamoure series in this county.

The Bearden soils on terraces correspond to the Moody and Barnes soils of the upland. The surface soils are dark grayish brown or almost black and are rather friable. The subsurface material is lighter brown in color and slightly heavier in texture. The layer of lime accumulation is characteristic, but in this county it is, in some places, not strongly developed. The underlying parent material is grayish-yellow, friable, structureless material which may vary considerably in texture. The loam, silt loam, and fine sandy loam members of the Bearden series were mapped.

The Fargo soils have very dark grayish-brown or black surface layers and heavier brown, dark-drab, gray, or mottled subsoils. These soils occur on poorly drained terraces or in old lake beds. They have a high lime content, particularly in the subsoils. Fargo clay and Fargo silty clay loam, with a poorly drained phase, have been mapped in this county.

The surface layers of the Pierce soils are dark grayish brown. The subsurface materials are slightly heavier in texture than the surface layers. The deeper subsoil layers consist of stratified sand and gravel. A thin layer of yellow or brown calcareous loam may occur between the black surface soil and the gravelly subsoil. The thickness of the combined soil layers above the gravel layer may range from 12 to 24 inches. The soil occupies kames and eskers of glacial deposition. Pierce loam was mapped.

Cass loam, the only member of the Cass series mapped in Moody County, somewhat resembles the Sioux soils but is not droughty. The subsoil is gravelly and is coarser textured than the surface soil. It occurs in the river flood plains in association with the Lamoure soils.

One miscellaneous class of material, rough stony land, was mapped. This material includes areas of Barnes, Moody, and Pierce soils which are too rough or stony to be cultivated.

In the following pages of this report the soils are described in full and their agricultural importance is discussed; the accompanying soil map shows their distribution; and Table 2 gives their acreage and proportionate extent.

TABLE 2.—Acreage and proportionate extent of the soils mapped in Moody County, S. Dak.

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Moody silt loam.....	115,328	50.3	Sioux silt loam.....	4,416	1.3
Poorly drained phase.....	9,792		Sioux loam.....	4,608	1.4
Terrace phase.....	5,632		Sioux fine sandy loam.....	3,072	.9
Shallow phase.....	35,008		Sioux loamy sand, deep phase.....	3,328	1.0
Moody very fine sandy loam.....	7,616	2.3	Lamoure silt loam.....	21,504	6.5
Barnes silt loam.....	6,016	1.8	Lamoure loam.....	5,312	1.6
Barnes loam.....	31,744	16.6	Lamoure silty clay loam.....	2,176	.7
Rolling phase.....	22,656		Fargo silty clay loam.....	4,032	2.2
Barnes fine sandy loam.....	9,216		2.8	Poorly drained phase.....	3,200
Flandreau silt loam.....	1,984	.6	Fargo clay.....	3,264	
Flandreau loam.....	5,376	1.6	Cass loam.....	2,688	.8
Flandreau very fine sandy loam.....	2,624	.8	Pierce loam.....	1,728	.5
Flandreau fine sandy loam.....	7,040	2.1	Rough stony land.....	4,416	1.3
Bearden silt loam.....	3,776	1.2			
Bearden loam.....	1,152	.4			
Bearden fine sandy loam.....	896	.3			
			Total.....	329,600	-----

MOODY SILT LOAM

The surface covering of Moody silt loam is dark grayish-brown, loose mulchlike silt loam from one-half to 1 inch thick. This material has evidently been worked by the wind. Grass roots are abundant in the uncultivated soil. The underlying layer, which continues to a depth varying from 6 to 12 inches, is very dark grayish-brown silt loam. In places, this material is indistinctly granular; in others it is loose, silty, or single grained. In virgin areas the abundant grass roots form a turf. The third layer, which reaches a depth ranging from 10 to 18 inches, is very dark grayish brown or almost black and is the darkest layer of horizon A. The undisturbed material is slightly firmer than that of the other layers. It breaks up to a mass of granules ranging in diameter from one-eighth to one-fourth inch. When the granules are crushed the resulting material is very slightly lighter in color than the unbroken surface.

The fourth layer is noncalcareous silt loam or heavy silt loam, as a rule slightly heavier than the layers above, which ranges in color from dark grayish brown in the upper part to grayish brown in the lower. On close examination, the color of the material does not appear solid, but the original brown color of the loess has been darkened by indistinct tongues of material that has seeped down along cracks, root holes, and worm and insect burrows. The organic matter has not discolored the soil mass throughout but forms a coating over the surfaces of the soil particles. Toward the lower part of this layer the organic-matter coating becomes thinner and gradually disappears. The numerous worm casts, some of which are well formed and others hardly recognizable, may be either lighter or darker than the surrounding soil and in some places apparently compose this layer. Below this layer is, in places, grayish-yellow structureless silt loam which contains few if any dark infiltrations. Below a depth ranging from 30 to 40 inches is the zone of lime accumulation, where the material consists of grayish-yellow structureless silt loam containing large quantities of lime in the form of white powder disseminated through the material or as concretions or spots of soft lime. Beneath this layer the material is similar in color and structure but the lime, though abundant, is not so concentrated as in the layer above.

Moody silt loam is derived from the weathering of loess overlying glacial drift. The loess covering averages about 5 feet in thickness but in some places continues to a depth of 7 feet. It rests on brown and gray mottled clay glacial till.

This soil occurs throughout the loess-covered part of the county and is the dominant soil except in the extreme western side. It occupies most of Lone Rock, Alliance, Clare, and Enterprise Townships, the eastern half of Grovener, Blinsmon, and Lynn Townships, the southern half of Riverview Township, and a large part of Egan Township. Large areas are also mapped in the four northeast townships. This soil is probably most typically developed in the large area southeast of Flandreau, between Brook and Flandreau Creeks, and in the northern part of Clare Township. The surface soil in these two areas is more level, heavier textured, deeper, and darker than in other areas. Along the west side of Brook Creek the soil is slightly lighter textured as it grades into the lighter-textured soils to the west.

Areas of this soil vary from flat or smooth to rolling. The more rolling areas border Sioux River and its larger tributaries, but most of the land is undulating. Disconnected flat strips varying from one-fourth to one-half mile in width are mapped along Pipestone Creek, Brook Creek, and Slip Up Slough. Most of these strips have a slightly heavier, deeper, and darker surface soil and are said to be slightly more productive than typical areas.

The surface soil in the more undulating areas is slightly lighter textured, shallower, and lighter colored than elsewhere. Small patches south of Bachelor Creek have slightly reddish-brown surface and subsurface soils. In the extremely rolling areas along Sioux River the surface soil is dark brown when dry and is only 5 or 6 inches thick, and the loessial covering also is slightly shallower. In sections 35 and 36 of Riverview Township, sections 1 and 2 of Clare Township, and in a large area east of Pipestone Creek yellow fine sand occurs in many places at a depth of about 38 or 40 inches. The areas mapped north of Sioux River and Flandreau Creek include small spots in which the till in some places lies within 3 feet of the surface.

This soil mapped north of Lone Rock Township and in the northern row of sections of Lone Rock Township is spotted with a number of small areas which have a decidedly heavier zone in the black horizon and some gypsum in the lower part of the soil. The soil in this locality closely resembles Moody silt loam, poorly drained phase, but most of it was included with Moody silt loam because the drainage seemed more nearly typical of that soil.

Moody silt loam is the most highly prized soil in the county and is a nearly perfect soil. Its structure gives it maximum water-holding and drought-resisting properties and allows good soil aeration. The soil is uniform, easy to cultivate, and fertile. These features, together with the favorable relief, favor the most economical cultural methods. Corn and oats are the chief crops. Corn yields average between 35 and 40 bushels to the acre, but yields of 60 bushels are not uncommon. Oats produce slightly more. Alfalfa and sweet clover are well adapted to this soil and produce yields ranging from $1\frac{1}{2}$ to $2\frac{1}{2}$ tons to the acre.

During heavy winds in extremely dry seasons this soil is apt to drift, especially in the lighter-textured areas. Heavy sudden rainfalls do some slight damage on the more rolling areas. However, thus far such damage has not been severe and can be easily eliminated. Rotation of crops is practiced to some extent. The rotation usually consists of corn, oats, and legumes. This soil is naturally fertile, and with care and proper soil management should retain its maximum fertility for years. The farms are well improved and vary in value from slightly less than \$100 to more than \$150 an acre.

Moody silt loam, poorly drained phase.—Moody silt loam, poorly drained phase, differs but slightly from typical Moody silt loam. The black and brown horizons extend to a greater depth and the upper part of the black zone is slightly heavier than the corresponding zone in Moody silt loam. The chief difference between these soils is the drainage conditions. The poorly drained phase occupies flats and slightly depressed areas along and at the head of small indistinct drainage ways, and during seasons of continued rainfall

these areas are apt to suffer from too much moisture. Some farmers have found tile drainage profitable. Gypsum is present in many places in the lower part of the soil, especially in areas bordering the Barnes soils in the western part of the county. The best crop yields are obtained during the normal or drier years.

In a few small spots there is a decidedly heavy compact layer in the subsoil. This layer varies from 6 to 12 inches in thickness and is commonly black or drab. When dry it is almost impenetrable with the soil auger. Crops suffer on such spots during periods of excessive drought or heavy rainfall. Such patches occur in sections 14, 23, 24, and 26 of Blinmon Township. Smaller spots occur throughout the soil.

This soil occurs most extensively in irregular-shaped areas extending from the vicinity of Chamberlin School to the northwest corner of Clare Township. A large number of smaller areas are mapped in Lynn Township, in the four southeast townships, and throughout areas of typical Moody silt loam. Early settlers report that at one time these areas were covered with water for considerable periods during rainy seasons. As a whole Moody silt loam, poorly drained phase, has a slightly lower agricultural value than typical Moody silt loam, but the same crops are grown and about the same yields are obtained in favorable seasons.

Moody silt loam, terrace phase.—Moody silt loam, terrace phase, does not differ materially from typical Moody silt loam except in topographic position and surface features. It occupies high terraces along the west side of Sioux River and along Bachelor Creek and Squaw Creek. Small areas are mapped along Spring, Mud, Brook, and Pipestone Creeks. In road cuts along the edges of the terrace bedded gravel and sand may be seen at a depth of 4 or more feet. However, the coarser layer lies much deeper in areas back from the edge of the terrace and does not affect the productivity of the soil. The surface is flat or slightly sloping toward the streams. The land is planted to the same crops as typical Moody silt loam, and farmers report as good average yields. It is also held at about the same price as typical Moody silt loam.

Moody silt loam, shallow phase.—Moody silt loam, shallow phase, includes two soils which differ in some respects. The areas mapped north of Flandreau Creek and east of Sioux River differ from those in other parts of the county but were included with Moody silt loam, shallow phase, because of their uniformly fine-grained texture and freedom from boulders or gritty material to a depth of 2 feet. There is a sharp transition between the smooth stone-free upper material and the gravelly stony till subsoil.

The surface soil is dark grayish-brown friable silt loam which is slightly heavier than the surface soil of typical Moody silt loam. It is possible that it is alluvial in origin. At a depth varying from 10 to 14 inches, the surface soil is underlain by brown, friable, medium granular silt loam. This layer corresponds to the brown layer of typical Moody silt loam and is darkened by the same dark-colored streaks. At a depth ranging from 16 to 20 inches the brown layer gives way to brownish-yellow or yellow friable silt loam. Between depths of 22 and 29 inches this grades rapidly into grayish-yellow calcareous clay loam containing some fine gravel, bluish-gray spots, and

rust-brown specks. At a depth of about 36 inches this layer passes into grayish-yellow clay till containing yellowish-brown and bluish-gray spots and lime concretions. Glacial till may be present at a depth of about 22 inches, but the average depth is probably 25 inches.

A few patches of Barnes silt loam, too small to map separately, are included with this soil. Areas mapped on the western slopes of Sioux River, along Squaw Creek, Bachelor Creek, and other small streams, the area just northwest of Flandreau, and the area in section 3 of Blinsmon Township have developed on loess with till subsoils within 3 feet of the surface. These areas have lighter-textured and sandier surface soils than typical Moody silt loam. The dark surface soil is from 6 to 10 inches thick and is underlain by the brown layer to a depth ranging from 14 to 18 inches, at which depth the yellow or yellowish-brown friable silt loam occurs. Below a depth ranging from 20 inches to 4 feet is drab and brown mottled clay till. In the western part of the county this soil occupies a position between the Moody and Barnes soils and includes small areas of Barnes soils. Knolls of Barnes silt loam, many of which have gravel and boulders on the surface, are scattered over areas of this soil. The loess seems thickest in the swales and on slopes. This shallow soil is not so highly prized as typical Moody silt loam and, according to information gathered from farmers, the yields of corn and oats, the principal crops, are from 5 to 10 bushels less to the acre than on that soil.

MOODY VERY FINE SANDY LOAM

The surface soil of Moody very fine sandy loam is very dark grayish-brown fine sandy loam. In its characteristics other than the texture of the surface soil and other layers to a depth of 3 or more feet, this soil closely resembles Moody silt loam. Below a depth ranging from 36 to 40 inches the material is yellowish-brown silt or silty very fine sand splotched with gray and some brown and containing rust-brown iron pipelike concretions. At a depth of 43 inches the gray color becomes more pronounced, the brown appearing as splotches. Lime and iron concretions are also present. At a depth of 50 inches the material is gray very fine sand containing a large number of iron concretions. Moody very fine sandy loam varies rather widely, ranging from almost a silt loam to a fine sandy loam. The subsoil to a depth of 30 inches is uniform fine sandy loam but below this it varies from very fine sandy loam to silt loam similar to the corresponding layer of Moody silt loam.

A part of the area of this soil mapped in sections 16 and 22 of Blinsmon Township is rather coarse, approaching fine sandy loam in texture. The area in the eastern part of section 32 of Grovena Township approaches silt loam in texture. Here the boundary between Moody silt loam and Moody very fine sandy loam is arbitrary, as the two blend into each other almost imperceptibly.

Moody very fine sandy loam is not considered so desirable a soil as Moody silt loam, as it produces slightly lower yields of crops. It blows somewhat during dry years and during heavy winds, especially if it is left exposed after plowing. Corn and oats are the chief crops grown, and sweet clover and alfalfa yield well.

BARNES SILT LOAM

In virgin areas the surface layer of Barnes silt loam, to a depth ranging from 1 to 3 inches, is dark grayish-brown very fine sandy loam containing considerable silt. This layer is no doubt modified by wind-blown material. Abundant grass roots bind the soil into a turf. Small boulders and gravel are scattered over the surface in many places. The next lower layer, which continues to a depth of 8 inches below the surface, is very dark grayish-brown or almost black silt loam. In some places this material is indistinctly granular, but in other places it is laminated and breaks into flat blocks. When these blocks are crushed, the resulting material is somewhat browner than the broken surface. Worm casts are in most places distinguishable throughout this layer, and here and there boulders and gravel are present. The third layer, which is commonly heavier in texture than the layer above, is a transitional zone which reaches a depth from 18 to 24 inches below the surface. The color changes downward from the dark color of the layer above to brown, and streaks and tongues of dark-colored material, containing organic matter which has seeped from the surface layers, project downward. The dark-colored material forms a coating over the soil particles. The next lower layer, which continues to a depth ranging from 40 to 60 inches, is highly calcareous grayish-yellow silty clay loam having an orange tinge. The lime is disseminated through the soil mass and segregated in concretions ranging from very small to one-half inch in diameter and in streaks and spots. This is the zone of lime accumulation. The material is structureless, but it breaks up into soft irregular clods. The next lower layer is silty clay loam, slightly more yellow than the layer above as it is not whitened by such large quantities of lime. The material has no definite structure. Below a depth of 60 inches, the lime concretions generally disappear and red and yellow iron stains discolor the material, and, in places, iron concretions are abundant. This is the glacial-drift parent material from which the Barnes soils have developed and is little changed by weathering. Glacial gravel and boulders are more or less numerous in all layers of the soil but are commonly more abundant below a depth of 60 inches. They also occur here and there on the surface. They are very abundant on some knolls.

The surface of this soil is undulating but is slightly more level than that of Barnes loam. The soil is mapped in the western part of the county, mainly in the western edges of Fremont and Jefferson Townships and in the northwest corner of Lynn Township.

Barnes silt loam is not considered quite so good a soil as Moody silt loam because it is more broken by poorly drained areas and in places a small quantity of stone detracts slightly from its value. Corn and oats are the principal crops, and the yields are said to be slightly lower than on Moody silt loam. Alfalfa and sweet clover are the chief legume and hay crops.

BARNES LOAM

Barnes loam as mapped in Moody County has practically the same color and structure characteristics as Barnes silt loam. However, the black and brown layers may be, on the average, slightly thinner. Lime occurs at about the same depth and in the same form in the two

soils, but in some places where the loam has a heavy clay subsoil the lime appears to follow natural cracks between clods. Barnes loam is coarser textured than Barnes silt loam, especially in the more undulating and gravelly or stony areas. In the smoother and less stony areas the constituents are mostly silt and very fine sand and, in places, the soil resembles Barnes silt loam. This is especially noticeable in the two northwest townships. The subsoil varies considerably but ordinarily it is slightly heavier in texture than that of Barnes silt loam and it contains decidedly more gravel, stone, and shale fragments. Some of the more rolling areas, at a depth ranging from 36 to 48 inches, have subsoils of clay loam or clay which breaks into rectangular and cubical fragments under pressure. At a depth between about 5 and 6 feet the material becomes more friable. The heavier subsoil seems to contain a larger percentage of gray material than does the lighter-textured subsoil.

This soil is mapped principally in the four western townships. Some small areas are mapped northeast of Flandreau, and a small area is in section 9 of Blinsmon Township. More gravel and stone are scattered over the surface and throughout the soil than occur in Barnes silt loam. The areas mapped in the two northern townships are not so stony.

Some areas of this soil are spotted by a large number of low poorly drained patches. Some of these patches are rather large and have well-defined shore lines. The larger ones may contain water for all or a part of the year and are known as sloughs. Most of them are shown on the map by swamp symbols and are mapped as Fargo soils; other areas are simply flats and shallow depressions. These low areas with the intervening knolls give the surface a choppy or billowy appearance.

Except for the more stony areas, Barnes loam is considered about equal in value to Barnes silt loam. The same crops are grown and about the same yields are obtained.

Barnes loam, rolling phase.—Barnes loam, rolling phase, has practically the same profile characteristics as typical Barnes loam, except that the surface soil may average slightly shallower and may contain more coarse sand. The subsoil is uniformly heavier but contains spots with sandy or loamy subsoils. As a whole this soil has a more rugged or rolling surface and contains more stones and gravel. The large area mapped east of Sioux River in Riverview and Spring Creek Townships is more level than other areas of this soil, except those along the river. The surface soil is shallower, and both surface soil and subsoil contain more clay than most of the soil. Most of the areas mapped along Flandreau Creek approach fine sandy loam in texture. The continuous area extending through Fremont Township has a uniform and smoother surface, contains less rock than most of the soil, and more nearly resembles the typical soil.

BARNES FINE SANDY LOAM

The surface soil of Barnes fine sandy loam, to a depth of 4 or 5 inches, is dark grayish-brown friable finely granular fine sandy loam, underlain by a 3 or 4 inch layer of black, finely granular, friable fine sandy loam which is decidedly brown when crushed. Below a depth of 8 or 10 inches the soil is friable brown fine sandy loam

or loam with medium-sized granules and containing burrows filled with black material, common in Moody silt loam and Barnes silt loam. When crushed the brown granules show light-brown or yellowish-brown colors. Below a depth ranging from about 14 to 16 inches is yellow loam containing some gravel and sufficient clay to form a ball when rubbed between the fingers. Fewer black streaks are present. At a depth varying from 18 to 22 inches is the customary zone of lime concentration which is described under the other silt loam soils. The lime content decreases rapidly below a depth of 4 feet. Below the 20-inch depth the color is olive green with yellow splotches and here and there red or reddish-brown iron specks. Between depths of 44 and 48 inches heavy olive-drab clay, containing small brown or reddish-brown concretions, is present.

Barnes fine sandy loam varies widely in soil characteristics. In some small spots the fine sandy loam continues to a depth below 3 feet. Borings in sections 9, 16, 17, and 21 of Blinsmon Township and in a few places in Egan and Enterprise Townships showed yellow fine sandy loam below a depth of 18 inches. Some borings along the slopes to Sioux River and some road cuts exposed the clay subsoil within 12 or 14 inches of the surface.

Most of this soil occurs on the east side of Sioux River in a belt averaging $1\frac{1}{2}$ miles wide and extending from 2 miles south of Egan to the county line. A small area is mapped in section 11 of River-view Township.

This soil is not so desirable as Barnes loam and Barnes silt loam, as some of the sandier spots are affected by drought. Rocks and gravel occur in varying quantities and some low knolls are very gravelly. The surface is undulating and slopes gradually toward the river. Drainage is well established and dissection is complete but not excessive. Few sloughs occur within areas of this soil. Corn and oats are the chief crops.

FLANDREAU SILT LOAM

The surface layer of Flandreau silt loam is friable, finely granular, very dark grayish-brown loam from 6 to 8 inches thick. The plowed soil shows a grayish cast. The subsurface layer is brown friable silt loam in which the granules are slightly coarser. The size of the granules gradually increases with depth. When crushed they assume a lighter shade. This layer contains the characteristic animal burrows and worm casts present in other upland soils. The transition from the dark surface soil to the brown subsurface soil is rapid, but from the subsurface layer to the subsoil the color change is more gradual. Below a depth ranging from 24 to 30 inches is the yellow or brownish-yellow, friable, almost structureless, calcareous subsoil. The lime occurs as concretions and in finely divided form. At a depth varying from 28 to 34 inches this layer is abruptly underlain by yellow loose fine or medium sand. The sand may effervesce when tested with hydrochloric acid, but in most places it does not. The sandy layer may continue for 2 or more feet or it may be underlain by a silty layer at a depth of about 4 feet. Flandreau silt loam is similar to Moody silt loam above the deep sandy subsoil.

Most of this soil occurs along the stream slopes and ridges bordering the larger streams. It is transitional between Moody silt loam

and other Flandreau soils. The largest area is in the southwest corner of Spring Creek Township. Other areas are west of Ward, in the eastern part of Union Township, in the southeast corner of Riverview Township, and in the northwest corner of Enterprise Township. Some smaller areas are in Blinsmon and Alliance Townships. Small areas of Flandreau silt loam are included with Moody silt loam because they were too small to be accurately mapped.

This soil is well drained and, except in extremely dry years, is not droughty except in a few small spots where the sand is near the surface. Corn, oats, and legumes are the chief crops, and the yields compare favorably with those obtained on Moody silt loam.

FLANDREAU LOAM

The surface soil of Flandreau loam is friable, structureless, very dark grayish-brown loam, silt loam, or very fine sandy loam, 3 or 4 inches thick, underlain to a depth of 8 or 10 inches by dark grayish-brown loam of granular structure. The material is browner when pulverized. The next lower layer is brown loam containing the dark-colored worm or insect burrows common to all the upland soils of this county. The soil granules are slightly larger than in the layer above, and they increase in size toward the lower part of this layer. This part of the soil, when dry, shows a columnar structure. The color gradually becomes lighter, and at a depth of 16 or 18 inches the material is yellowish brown. Below a depth of 20 inches is yellow structureless loam or silt loam. Lime carbonate occurs at a depth of about 24 inches and continues to a depth of 28 or 30 inches. Yellow or brownish-yellow fine sand, resembling the sand which is present in Flandreau silt loam but in many places more calcareous, underlies the layer of lime accumulation. The sand continues to a depth of 4 or more feet and is underlain by gray or bluish-gray silt loam mottled with brown or reddish brown. A few gray mottles or splotches may also be seen in the lower 10 inches of the sandy layer.

This soil occurs near the Moody soils and differs from them in having a sandy subsoil within a depth of about 30 inches. The surface is uniformly undulating but smooth. The largest areas are in Riverview Township north of Meadow Creek. Most of the soil is mapped in a broken belt between this large area and Ward. Other areas are in section 25 of Riverview Township, section 7 of Enterprise Township, section 32 of Lynn Township, sections 20 and 29 of Alliance Township, and section 35 of Blinsmon Township. Practically all of the land is in cultivation. It gives fair yields, but crops suffer somewhat from drought during extremely dry years. Corn and oats are the principal crops.

FLANDREAU VERY FINE SANDY LOAM

The surface soil of Flandreau very fine sandy loam is very dark grayish-brown, loose, friable material from 6 to 12 inches thick. The virgin soil has a darker appearance than the plowed soil and is finely granular. The dark-colored surface soil is underlain by brown slightly heavier, medium granular material, which is lighter brown

or yellowish brown when the granules are powdered. Worm and insect burrows occur in this layer, particularly in the upper half. At a depth of 16 or 18 inches this layer in turn is underlain by yellow friable very fine sandy loam or loam and at a depth ranging from 22 to 30 inches yellow or brownish-yellow loose fine sand or medium sand is present. This layer continues to various depths, but most of it is calcareous below a depth of 40 inches. In places the very fine sandy loam extends from the surface to the sandy subsoil, whereas in other places a heavier or silty material intervenes.

It was difficult to determine the origin of the parent material of Flandreau very fine sandy loam. The soil may be wind-laid and from the same source as the parent material of the Moody soils, or it may be outwash material from which the loess has been partly removed. This soil is mapped along the larger streams and borders Moody silt loam. A few rocks may be found on the surface in places. The surface is gently undulating. The largest areas are mapped in sections 4, 12, 18, 33, and 34 of Spring Creek Township, sections 3, 4, 9, and 10 of Flandreau Township, and sections 21, 22, and 32 of Union Township. The crops common to the region are grown. Yields are cut short to some extent by droughts during dry seasons.

FLANDREAU FINE SANDY LOAM

The surface layer of virgin Flandreau fine sandy loam, to a depth ranging from 11 to 18 inches, is very dark grayish-brown practically structureless material about 3 inches thick. The subsurface layers break up into medium-sized indistinct granules. Below the surface soil the darker-colored material gives way to brown structureless fine sandy loam, which continues to a depth of 24 or 26 inches, where it grades into brownish-yellow or grayish-yellow friable silt loam. Lime concretions, many of them having cherty centers, occur in this layer. Lime also covers chert gravel. Below a depth varying from 31 to 43 inches is brown or yellow fine sand containing a high percentage of lime carbonate. Streaks of the heavier soil protrude downward into the sandy subsoil layer, giving it an uneven appearance. Below a depth of 4 feet another silt or till layer, which in most places is gray with brown splotches, may be present. The lime concretions in this layer also are soft, and they lack the hard cherty centers of the concretions in the overlying material. In places the fine sandy loam continues below a depth of 3 feet and is underlain by till. Some areas of Barnes fine sandy loam, too small to be mapped separately, are included with mapped areas of this soil.

Flandreau fine sandy loam occurs on slopes or flats along the streams. Most of the areas mapped in Blinsmon Township, the eastern part of Egan and Enterprise Townships, and the northern parts of Riverview, Spring Creek, and Ward Townships occupy such positions. The areas mapped in the southern part of Union and Flandreau Townships closely resemble the Pierce or Moody soils. A narrow low ridge extends through the area southeast of Flandreau, and both the surface soil and subsoil are coarser textured, resembling the Pierce soils. This soil also occurs in saddle-like depressions on ridges composed of the Barnes soils.

The surface of this soil is undulating or gently sloping. Here and there a stone may be found on the surface where the soil borders or includes areas of the Barnes soils.

Nearly all the Flandreau fine sandy loam is under cultivation, principally to corn. Oats, sweet clover, and alfalfa are also grown. During dry years drought greatly reduces crop yields. This soil is best suited to intertilled crops which conserve moisture.

BEARDEN SILT LOAM

The surface soil of Bearden silt loam is very dark grayish-brown friable finely granular silt loam from 5 to 8 inches thick. The granules are about the same size and shape as those in the corresponding layer of Barnes silt loam. The surface soil grades into the brown friable silt loam subsurface soil which may be heavier than the surface soil. The upper part of this layer has the same granular structure as the surface soil, and the granules gradually increase in size with depth, but at a depth of about 2 feet they disappear. This layer also is streaked with worm burrows similar to those occurring in corresponding layers in the Barnes and Moody soils. The brown subsurface soil gradually changes to yellow more friable silt loam at a depth ranging from about 18 to 22 inches, and the granular structure of the layer above gradually disappears. Between depths of 39 and 48 inches bedded sand and gravel are present. A layer of grayish-yellow highly calcareous structureless silt, from 2 to 6 inches thick and containing numerous lime concretions, occurs just above the gravel. However, some small local areas do not have the gravelly substratum. Most of this soil does not show any decided zone of lime accumulation within a depth of 3 feet.

This soil is mapped along the various streams of the county, but the larger areas are along Sioux River north of Egan, west of Trent, and in the southeast corner of Enterprise Township. Gravel underlies these areas at a depth varying from 39 to 48 inches, and the soil resembles the Moody soils but is uniformly heavier. Most of the terraces occupied by this soil lie from 10 to 15 feet above the river bottom, but the areas 2 miles southwest of Egan and in the center of Riverview Township occupy the slightly higher and better-drained parts of the Sioux River bottom. The surface is flat or gently sloping.

Bearden silt loam gives good yields and the gravel substratum is said to have no deleterious effect on production. Corn and oats are the chief crops, and the yields compare favorably with those obtained on the Barnes soils.

BEARDEN LOAM

Bearden loam very closely resembles Bearden silt loam except in texture. The deep gravelly subsoil is lacking in most areas. The surface soil, to a depth varying from 6 to 10 inches, is friable dark grayish-brown or black loam. The subsurface layer is brown loam continuous to a depth ranging from 18 to 24 inches, where it is underlain by yellow loam or silt loam. Lime carbonate may be present in sufficient amounts, within 3 feet of the surface, to cause the material to effervesce when treated with hydrochloric acid. In

many places lighter-textured material occurs below a depth of 30 inches.

This soil occurs, mainly in small areas, on stream terraces in the northeast corner of the county. The largest area is west of Flandreau. The area west of Trent approaches very fine sandy loam in texture. Bearden loam is considered a good farming soil comparing favorably in production with the better Moody and Barnes soils.

BEARDEN FINE SANDY LOAM

Bearden fine sandy loam has the color and structure characteristic of the other Bearden soils, but it has a fine sandy loam surface soil which continues to a depth ranging from 6 to 12 inches. The brown friable fine sandy loam subsurface soil extends to a depth varying from 18 to 24 inches, where it grades into yellow or grayish-yellow loam. This may reach a depth of 3 feet below the surface or it may grade into grayish-yellow silt loam at a depth of about 30 inches.

This soil is mapped on low stream terraces, mainly in the western part of Blinmon Township and in the vicinity of Flandreau. Smaller areas are in sections 16, 17, and 22 of Riverview Township. Most of the soil is in cultivation to corn and oats, which give average yields.

SIoux SILT LOAM

The surface layer of Sioux silt loam consists of brown structureless silt loam 1 or 2 inches thick. The next layer, which reaches a depth ranging from 4 to 8 inches, is very dark grayish-brown, finely granular silt loam. The darker material grades into brown, friable, medium-granular silt which contains the characteristic dark-colored insect burrows. At a depth varying from 14 to 18 inches the color becomes brownish yellow or olive drab and the material is slightly heavier in texture than the layer above and is cloddy rather than granular. The columnar structure common to the soils of eastern South Dakota occurs in these three layers but disappears in the lower part of the yellow layer. Below a depth ranging from 24 to 30 inches are calcareous, stratified sand and gravel, which vary from gray to yellow, brown, and reddish brown. Gray or grayish-yellow calcareous silt or loam an inch or two thick occurs in most places just above the gravel. Some small areas having a surface soil approaching very fine sandy loam in texture are included with this soil on account of their small size. Such areas are in sections 7, 18, and 33 of Lynn Township and section 3 of Enterprise Township. On the outer edges of the terraces the materials are generally lighter textured.

Sioux silt loam has developed on stream and lake terraces and outwash plains. Most of the soil along the larger streams lies from 10 to 20 feet above the stream bottoms. The surface is flat or gently sloping toward the stream or lakes. The largest area lies along the county line in the northern part of Ward Township. Other areas are in section 34 of Lone Rock Township, in sections 14, 15, 22, and 23 of Spring Creek Township, in section 6 of Grovena Township, and scattered throughout the county. The area mapped northwest of Trent closely resembles Moody silt loam, terrace phase, in the upper layers, but it has a gravelly subsoil at a depth of about 30 inches.

This area is not so seriously affected by drought as is most of this soil. Corn and oats are the principal crops grown.

SIoux LOAM

Sioux loam differs from Sioux silt loam only in the texture of the surface layer. It has a black friable loam surface soil from 7 to 10 inches thick, underlain by a brown loam or clay loam subsurface layer. This, in turn, is underlain, at a depth ranging from 18 to 24 inches, by brownish-yellow or yellow stratified sand and gravel. No yellow layer is developed in areas in which the gravel bed is shallow. A thin layer of calcareous soil occurs, in places, just above the gravel. The gravel subsoil occurs at an average depth of about 24 inches, but in some places it lies almost 3 feet below the surface, as in the area just east of Lake Campbell, the one in sections 22 and 26 of Jefferson Township, and the one in section 33 of Spring Creek Township.

This soil is mapped on lake and stream terraces scattered throughout the county. Most of it occurs along Sioux River and other streams in the western and northeastern parts. It lies at an elevation ranging from 10 to 20 feet above the flood plains. Areas mapped within the Sioux River bottoms lie slightly higher than the surrounding Lamoure and Cass soils. Some of these areas approach Sioux fine sandy loam in texture.

Sioux loam is not an extensive soil in Moody County. Corn is the principal crop grown. Crops yield best during the wetter years, and yields are greatly reduced during the very dry years.

SIoux FINE SANDY LOAM

The surface soil of Sioux fine sandy loam varies rather widely in texture from rather coarse fine sandy loam to loam. The dark grayish-brown surface soil is friable and loose and is from about 5 to 8 inches thick. It is underlain by the subsurface soil of brown friable loam or sandy loam, which, in places, is reddish brown. The subsurface soil varies from slightly lighter to heavier in texture than the surface soil. Below a depth ranging from 18 to 24 inches stratified gray, brown, and yellow calcareous sand and gravel is present. Calcareous soil an inch or two thick ordinarily occurs above the gravel. On some small areas the texture changes gradually downward from the fine sandy loam surface soil to a coarse sandy subsoil.

Most of this soil is mapped along Sioux River on high terraces bordering the bottom land or on low terraces within the bottom-land areas. The largest areas are in the northern part of Riverview Township and in the vicinity of Flandreau and Trent.

This soil differs from Sioux loam in being sandier both in the surface and subsurface layers. Also the gravelly subsoil is, in most places, nearer the surface. Crops are damaged by drought during dry years. Corn is the chief crop grown.

SIoux LOAMY SAND, DEEP PHASE

Sioux loamy sand, deep phase, is loose loamy fine sand to a depth of 4 or more feet, where it is underlain by coarse sand or gravel. The dark-colored surface layer is from 6 to 9 inches thick and the brown subsurface layer continues to a depth ranging from 20 to 30

inches, where the color changes to yellow. In few places is lime present in sufficient quantities above the gravelly subsoil to effervesce when the soil is treated with hydrochloric acid. A layer of loam or fine sandy loam may occur below a depth of 3 feet and may vary from a few inches to more than a foot in thickness.

This soil occurs on slopes and stream terraces at various elevations. The principal areas are southwest of Flandreau, in sections 23, 26, and 35 of Egan Township, and in sections 7, 18, and 19 of Blinsmon Township. The area in Blinsmon Township lies within the river bottom and slopes gently toward the river. Other small areas are mapped along Sioux River and Flandreau Creek.

This soil yields best during wet years. During dry years crops suffer from lack of moisture, as the open porous subsoil does not retain sufficient moisture to carry the crops during periods of drought. Corn is the principal crop, and some oats and barley are grown.

LAMOURE SILT LOAM

The surface soil of virgin Lamoure silt loam is friable loose structureless silt, 1 or 2 inches thick, underlain by black medium-granular silt loam. The structure and the black color disappear with depth. At a depth ranging from 14 to 18 inches dark-brown or brown silt or silty clay is present, and at a depth varying from 24 to 30 inches, this material gives way to a gray, drab, or yellowish-gray silty clay or clay layer which seems more friable and contains a high percentage of lime carbonate as concretions disseminated in fine particles throughout. Some borings showed the black noncalcareous soil to extend below a depth of 3 feet, whereas in other borings a decided yellow color, similar to that of Bearden silt loam was noticed. Such variations in color occurred within a few rods of each other. That soil having the lighter-colored and lighter-textured subsoil generally occupied a slightly higher position.

The surface texture approaches very fine sandy loam in spots and in others it approaches silty clay loam. Layers of sand are not uncommon throughout the soil. Lamoure silt loam is a variable soil, as it occupies the stream bottoms where it is deposited from successive overflows.

Lamoure silt loam is mapped along most of the streams. The largest areas are along Sioux River and Pipestone Creek. The area along Pipestone Creek is probably the most uniform in texture in the county. This soil mapped south of Flandreau along Sioux River is seldom overflowed except in a few low spots, but north of Flandreau, especially in Riverview Township, the land is subject to inundation. Areas along the smaller streams vary widely in texture and profile.

This soil is naturally fertile and highly productive. The chief crops are corn and oats. From a small percentage of the land, particularly from those areas most subject to overflow and those along the smaller streams, hay is cut. The heavier phases of this soil require careful handling. In favorable years yields on Lamoure silt loam compare favorably with those on the Moody and Barnes soils.

LAMOURE LOAM

Lamoure loam occupies the lower positions along the streams, and most of it is subject to frequent overflows. Consequently it is very variable. The surface soil is black or very dark grayish-brown friable loam or fine sandy loam from 5 to 16 inches thick. In most places it is finely granular to a depth of a few inches, but the granules gradually increase in size with depth until the soil mass shows no structure. The subsurface soil is brown friable loam to a depth ranging from 28 to 32 inches, at which depth it is underlain by gray or yellowish-gray loam or clay loam containing some brown iron stains and lime carbonate. In some spots a black heavy clay subsoil occurs between depths varying from 18 to 36 inches; in others the subsoil may be dark gray or drab in the lower part. In places the soil is decidedly sandy throughout, and in other places only the subsoil is sandy.

Most of this soil is mapped along Slip Up Slough, Flandreau Creek, and Spring Creek, and small areas lie along Sioux River. Only a small part of the land is in cultivation. Most of it is used for the cutting of hay and for pasture. When cropped it gives fair yields in favorable years.

LAMOURE SILTY CLAY LOAM

The surface soil of Lamoure silty clay loam is black, sticky, plastic silty clay loam from 6 to 10 inches thick. The material when dry breaks into particles which are rectangular or cubical in shape. The subsurface soil is black clay having the same breakage when dry but when wet being sticky and plastic. This black clay may continue to a depth of 3 feet or it may grade into brown clay at a depth of 18 inches. Most of the material, however, grades into dark-drab or gray sticky plastic clay at a depth ranging from 18 to 30 inches. It contains a high percentage of lime carbonate, in the form of both stains and concretions. The granular structure disappears in most places at a depth of about 14 or 16 inches. In some local spots sufficient lime is present in the surface soil to cause effervescence when treated with hydrochloric acid. Red or brownish-red iron specks are not uncommon in the lower part of the soil. Streaks and thin layers of sand are present in the lower part of many areas. This soil is locally known as gumbo.

Most of this soil is mapped in Riverview Township in the Sioux River bottoms. It occupies the lower positions on the stream flood plains. Most of the land is under cultivation and gives excellent yields. Because of the heaviness and stickiness of the soil it must be handled with care. Corn and oats are the chief crops.

FARGO SILTY CLAY LOAM

The surface soil of Fargo silty clay loam is black, sticky, plastic silty clay loam from 5 to 10 inches thick. When dry it breaks or crumbles into small, sharp-edged cubical or rectangular granules, from one-sixteenth to one-eighth inch in diameter. This layer is underlain by tough, sticky, plastic black clay having the same structure as the layer above. When dry these clay particles break or crush

only with difficulty. At a depth ranging from 16 to 24 inches the black clay grades into dark-brown or drab, sticky, plastic, calcareous clay, mottled with some brown or gray or both below a depth of 30 inches. In some local areas the soil is black throughout, and in others a pronounced gray, highly calcareous clay subsoil is present. Lime appears both as concretions and disseminated through the soil. In many places glacial drift or loessial material is present within 3 feet of the surface. The depth of till or parent material depends on the quantity of lacustrine material that has collected.

Most of this soil is mapped in the western part of the county in association with the Barnes soils, but a few areas are in other parts of the county. The largest areas are in Colman, Lynn, Fremont, and Jefferson Townships. Many of these areas are less than 10 acres in extent. Numerous small spots are included with mapped areas of Barnes soils.

This soil occupies flat areas and depressions that are sufficiently well drained to produce crops in average years. Some spots are artificially drained. Crops are damaged during years of excessive rain. During average or drier years Fargo silty clay loam exceeds the surrounding upland soils in production. Corn and oats are the principal crops, and some barley is grown.

Fargo silty clay loam, poorly drained phase.—The soil material of the poorly drained phase of Fargo silty clay loam is the same as that of Fargo silty clay loam, but areas of the poorly drained phase occur in the deeper lakelike depressions and a thin covering of semidecomposed organic matter lies over them. Some areas of this phase are more deeply covered and remain under water longer than others. Some dry up sufficiently to allow the cutting of grasses for hay, others do not, and still others do not support grasses fit for hay. The wetter areas are indicated on the map by swamp symbols. Included with this soil are some poorly drained seepy places along the northern part of Spring Creek. Most of the land is used for pasture.

FARGO CLAY

On most areas of Fargo clay there is a covering, from 1 to 4 inches thick, of loose brown semidecomposed vegetable matter. Below this is black silty clay loam, 2 or 3 inches thick, overlying heavy black clay. The silty clay loam layer may be lacking. The material breaks up into small, sharp-edged, square or rectangular particles, which are very difficult to crush when dry. In most places, at a depth ranging from about 18 to 24 inches this black layer grades into drab or gray, sticky, plastic clay which continues to a depth of 3 feet. In some places brown or yellowish mottles may be seen below a depth of 30 inches, and in other places till or loessial material may be present within 36 inches. The black or dark-brown color may continue to a depth of 36 inches, but below a depth ranging from 18 to 24 inches, the material is sticky, plastic clay.

Fargo clay ordinarily has a high lime content below a depth of 18 or 20 inches. In places lime may also occur on the surface and throughout the soil to a depth of 18 inches or a zone of lime accumulation, from 6 to 12 inches thick, may be found above a depth of 18 inches. The lime appears as small, soft, immature lime concretions. Some alkali is present throughout most of this soil.

Fargo clay occupies sloughs and depressions. These areas usually contain considerable water and support a heavy growth of water-loving plants which provide an abundant supply of organic matter. These areas receive drainage water and surface wash from the areas surrounding them.

This soil is mapped chiefly in Jefferson, Colman, and Lynn Townships, in association with the Barnes soils. Most of the areas are covered with water a large part of the year, but a few are sufficiently drained to be cultivated during the drier years, and a few are artificially drained. Such areas are in sections 4, 5, 12, 15, 20, 21, and 32 of Jefferson Township and section 8 of Lynn Township. Some parts of the depressions are sufficiently dry in the fall to allow the cutting of grass for hay, but most of this soil is used for pasture. Most of it can be cultivated only after draining, and it is doubtful whether the expenses of draining would be warranted at present. The wetter areas are indicated on the map by swamp symbols.

Two areas of Lamoure clay are included with Fargo clay because of their similarity and small extent. One such area lies along Battle Creek just south of Lake Campbell, and the other is 2 miles southwest of Egan in the Sioux River bottoms.

CASS LOAM

The surface soil of Cass loam is black friable loam from 10 to 14 inches thick. This is underlain by brown friable loam, clay loam, or silt loam, below which, at a depth varying from 26 to 30 inches, is brown and gray mottled or gray sandy clay or clay. This layer, in places, becomes more sandy within a depth of 3 feet. Lime is abundant in the lighter-colored subsoil.

In some small areas the subsurface layer is black heavy clay and is underlain by brown and drab mottled, or drab clay, which may grade into sand or sandy clay. A few included areas have clay loam surface soils. One such area extends through the middle of section 2 of Enterprise Township and similar areas are in Riverview Township. A few spots of Lamoure soils, too small to be mapped separately, are included with mapped areas of this soil.

Cass loam occurs in the Sioux River bottoms in association with the Sioux and Lamoure soils, but it probably lies at a slightly lower level. During periods of excessive rains it is apt to be flooded from small streams which spread out over the bottoms. The principal areas are in Riverview, Egan, Blinsmon, and Enterprise Townships. There are a few small droughty areas, but as a whole this soil showed no ill effects from drought during the dry year of 1926. Most of the land is in cultivation, chiefly to corn. Good yields are obtained.

PIERCE LOAM

The surface soil of Pierce loam is very dark grayish-brown friable loam from 6 to 10 inches thick. It is underlain by a brown transitional layer that is slightly heavier than the surface soil in most places. This layer is ordinarily underlain by a layer of grayish-yellow loam, from 2 to 4 inches thick, most of which is calcareous in the lower part. At a depth ranging from 12 to 24 inches beds of stratified and banded sand and gravel are present. The yellow layer

is lacking in many of those areas containing the least gravel. The gravel and sand layer, which is everywhere calcareous, varies in color from gray to yellow and brown. The columnar structure of the eastern South Dakota soils was more noticeable in this soil than in the Moody and heavier Barnes soils.

The surface of Pierce loam is rolling, and the soil occupies ridges and knolls in association with the Barnes soils. The largest areas are south of Lake Campbell, at the junction of sections 32 and 33 of Spring Creek Township and sections 4 and 5 of Flandreau Township, east of Colman, and in sections 6, 7, and 18 of Lynn Township. The large area mapped 4 miles north of Flandreau occupies what is apparently an old high terrace between Spring Creek and Sioux River and has a smoother surface than most of this soil. Included with mapped areas of Pierce loam are some small spots of very fine sandy loam or silt loam.

Most of the Pierce loam is in cultivation. Corn and oats with some legumes are the chief crops. Crops are apt to suffer from drought during the drier years, as the open, porous gravelly subsoil does not retain moisture well. Frequent rains are necessary for good crop yields. Because of its openness this soil warms up earlier than the heavier soils and allows earlier seeding. Intertilled and early crops do best. Early truck crops should do well. This soil is not so highly prized as are the other upland soils. The gravel substratum makes excellent road-building material.

ROUGH STONY LAND

Rough stony land includes all areas that are too rough or too stony to be cleared or cultivated economically, but it may also include a few small cultivable areas. The texture, soil materials, and topographic features of areas of this miscellaneous material vary considerably. The surface soil of those areas mapped in the western part of the county in association with the Barnes soils is loam. Such areas resemble the Barnes soils and as a rule are low stony ridges or strips of broken land bordering the streams. However, some flat stony areas are also included. Most of the narrow strip of this material bordering the Sioux River bottoms resembles the Moody soils in surface features and has glacial drift outcrops on the lower slopes. The texture of the surface soil here approaches very fine sandy loam. Some of the areas east of Flandreau resemble the Barnes soils, whereas others along Flandreau, Mud, and Spring Creeks resemble the Pierce soils but were included with rough stony land because of their surface configuration. This land is utilized chiefly as pasture land.

SUMMARY

Moody County is in the extreme east-central part of South Dakota and has a land area of 515 square miles or 329,600 acres.

The average elevation ranges between 1,550 and 1,700 feet above sea level. The surface relief is undulating, rolling, or choppy. In most of Moody County surface drainage is good and, except in the four extreme western townships, the area is well dissected by streams.

Moody County was organized in 1873, and it had a population of 9,742 in 1920. Most of the inhabitants are of Norwegian, German, Swedish, Indian, and Scotch descent.

Roads are good throughout most of the county, and most farms are reasonably close to railroad shipping points. Sioux Falls, Sioux City, Minneapolis, and St. Paul are the chief markets for produce from this county.

Most farmers are engaged in grain growing supplemented by the raising of some livestock. Corn and oats are the chief grain crops, and some barley is grown. Alfalfa and sweet clover are the principal legumes. About half the hay is from native grasses cut from sloughs. The raising of swine and cattle is the chief livestock industry. Lambs are shipped into the county and fattened in grain-stubble and cornstalk fields in the fall. The poultry and dairy industries are rapidly growing in importance. Very little fruit is grown.

Typically the well-drained upland soils of Moody County have dark-brown or black friable finely granular surface soils, with brown, friable, medium-granular subsurface soils, and gray, yellow, or yellowish-gray friable, highly calcareous subsoils.

The Moody soils are derived from loess and are of a uniformly smooth fine texture; the Barnes soils are derived from glacial drift and contain more coarser material, some gravel, and rocks. The Bearden soils are terrace soils having the same general soil characteristics as the Moody and Barnes soils.

The Sioux soils are terrace soils which have gravelly subsoils and are subject to drought. The Pierce are upland soils which closely resemble the Sioux soils.

The Flandreau soils are upland soils in which the subsoils are sandier textured than the surface soils.

The Fargo soils occur in the poorly drained areas and sloughs. They have heavy black surface soils and heavier-textured but lighter-colored calcareous subsoils. The Lamoure are bottom-land soils similar to the Fargo. The Cass soils are bottom-land soils having subsoils which are lighter textured than the surface soils.

Rough stony land is a miscellaneous classification including areas which are too stony or rough to be profitably tilled and which are valuable chiefly as pasture.



[PUBLIC RESOLUTION—No. 9]

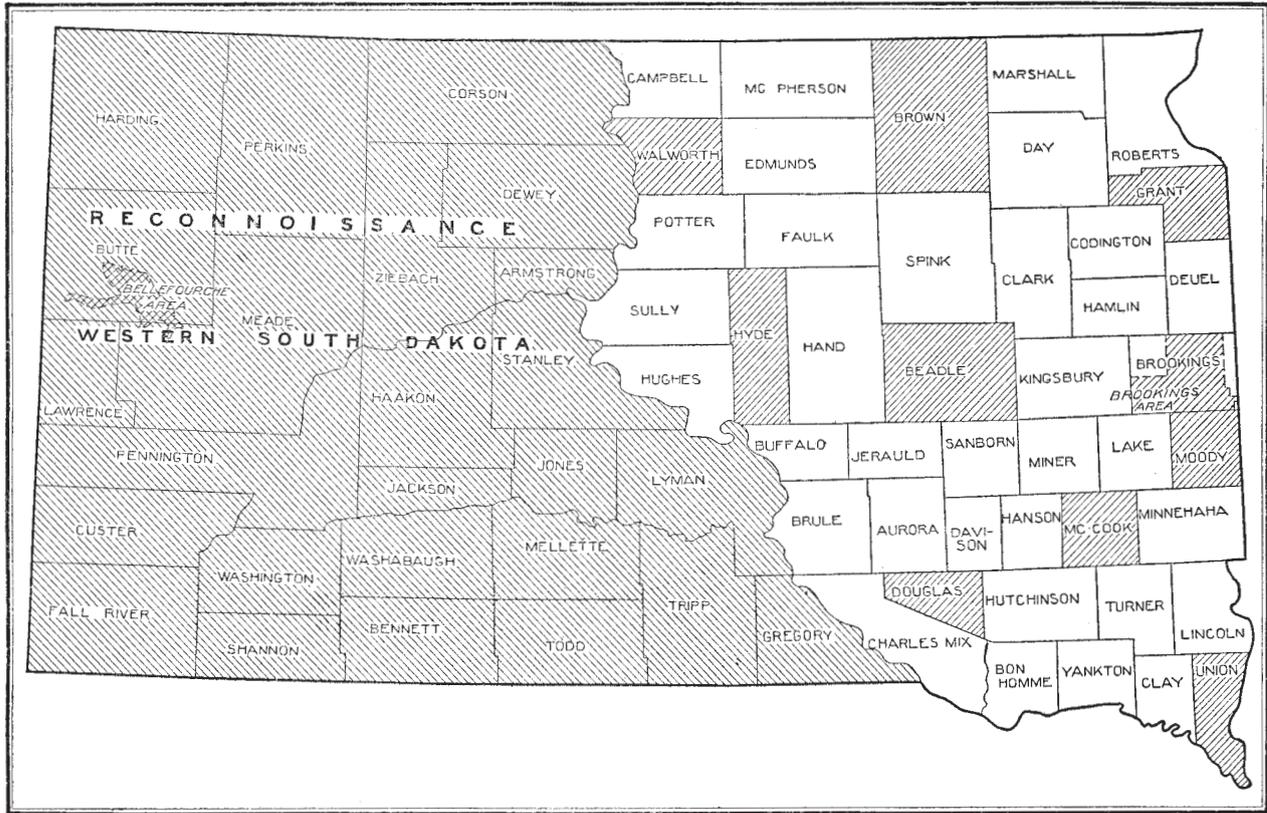
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

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

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

Approved, March 14, 1904.

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



Areas surveyed in South Dakota, shown by shading

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