U. S. DEPARTMENT OF AGRICULTURE
BUREAU OF CHEMISTRY AND SOILS

IN COOPERATION WITH THE UNIVERSITY OF MINNESOTA
AGRICULTURAL EXPERIMENT STATION

SOIL SURVEY OF JACKSON COUNTY MINNESOTA

BY

M. W. BECK, IN CHARGE, AND J. AMBROSE ELWELL, U. S. DEPARTMENT OF AGRICULTURE, AND J. S. HALL AND G. B. BODMAN, UNIVERSITY OF MINNESOTA AGRICULTURAL EXPERIMENT STATION

[Advance Sheets—Field Operations of the Bureau of Soils, 1923]

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON
1928

BUREAU OF CHEMISTRY AND SOILS

C. A. BROWNE, *Acting Chief*
A. G. McCALL, *Chief, Soil Investigations*
WILBERT W. WEIR, *in Charge of Editorial Work*

SOIL SURVEY

CURTIS F. MARBUT, *in Charge*
T. D. RICE, *Inspector, District No. 3*

COOPERATION

UNIVERSITY OF MINNESOTA AGRICULTURAL EXPERIMENT STATION
W. C. COFFEY, *Director*
F. J. ALWAY, *in Charge of Soil Survey*

U. S. DEPARTMENT OF AGRICULTURE
BUREAU OF CHEMISTRY AND SOILS

IN COOPERATION WITH THE UNIVERSITY OF MINNESOTA
AGRICULTURAL EXPERIMENT STATION

SOIL SURVEY OF JACKSON COUNTY MINNESOTA

BY

M. W. BECK, IN CHARGE, AND J. AMBROSE ELWELL, U. S. DEPARTMENT OF AGRICULTURE, AND J. S. HALL AND G. B. BODMAN, UNIVERSITY OF MINNESOTA AGRICULTURAL EXPERIMENT STATION

[Advance Sheets—Field Operations of the Bureau of Soils, 1923]

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON
1928

[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.]

CONTENTS

ILLUSTRATIONS

FIGURE

MAP

SOIL SURVEY OF JACKSON COUNTY, MINN.

By M. W. BECK, in Charge, and J. AMBROSE ELWELL, United States Department of Agriculture, and J. S. HALL and G. B. BODMAN, University of Minnesota Agricultural Experiment Station

COUNTY SURVEYED

Jackson County, in the southern tier of counties in Minnesota, is the third east of the South Dakota line. It is rectangular, measures 30 miles east and west and 24 miles north and south, and has a land area of 704 square miles or 450,560 acres.

Jackson County is a part of a drift-covered plain, the undulating surface of which has been modified by erosion. A belt of somewhat rolling land extends from north to south through the center of the county and over the southern parts of Sioux Valley and Round Lake Townships. The valley of West Fork Des Moines River, which extends from the north-central part of the county to its southeastern corner, is from 100 to 150 feet deep and has a valley floor ranging from one-fourth to one-half mile in width.

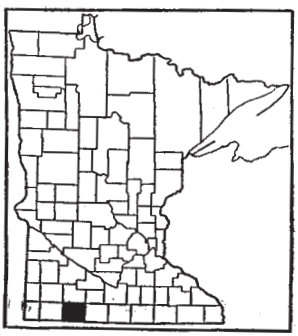


FIG. 27.—Sketch map showing location of Jackson County, Minn.

The largest smooth areas are in Wisconsin, Enterprise, and Kimball Townships, in the eastern part of the county. The area immediately southwest of Heron Lake is rather flat, and one in Middleton Township, about 1½ miles wide and 4 miles long, is decidedly flat and depressed below the surrounding undulating rolling lands. Steep slopes border the valley of West Fork Des Moines River and occur elsewhere to a very slight extent. In the central and southern parts of the county the slopes, seldom very steep, are steeper than elsewhere.

The surface of this county has a gradual ascent from east to west. The mean elevation is 1,430 feet above sea level; the lowest elevation of 1,250 feet is at the southern boundary where West Fork Des Moines River leaves the county; and the highest elevation of approximately 1,550 feet occurs in the central and extreme southwestern belts of rolling land.

West Fork Des Moines River drains the southeastern and central parts of the county. The uplands bordering it have good surface drainage, flat lands with poor drainage not occurring to any extent within 4 miles of the river.

The flow of the streams in the northwestern part of the county is sluggish, this area being the most poorly drained portion of the Des

Moines River watershed. West Fork Des Moines River has a rapid current, the average fall being 3½ feet to the mile. Water power has been developed at a few points but the volume of the stream is too irregular to furnish power the year around. Other drainage channels tributary to West Fork Des Moines River are very small and serve only a comparatively narrow watershed adjacent to the main river course.

The basin of Little Sioux River drains the greater part of the four southwestern townships of the county. In its upper parts, in Rost and Ewington Townships, the streams form shallow sloughlike depressions in the generally flat land, and are too few to provide satisfactory drainage. In the central and southern parts of the watershed, the stream dissection becomes somewhat greater, although the flow continues to be sluggish and the channels in many places are so restricted as to cause small swamps and ponds.

The third and smallest drainage basin is that of Elm Creek in the northeastern townships, Kimball and Enterprise, and in parts of Belmont, Wisconsin, and Christiana. Throughout most of this part of the county the streams do not afford adequate drainage facilities for the adjacent lands.

Besides Heron Lake, the largest, there are 24 or more small lakes, the largest of which covers 2 square miles. These lake depressions practically all occur along the belt of rolling land through the central and extreme southwestern parts of the county.

Jackson County was organized in 1857. Most of the early settlers came from Iowa, and in the early sixties Norwegians came in from Wisconsin. The Civil War retarded settlement and at two different times Indian massacres almost depopulated the county. Settlement was rapid for a few years after the Civil War, and when the railroad land grants were spread in 1884, settlement was even more rapid. Census figures give the population as 181 in 1860. The population increased steadily until about 1910, but little increase has taken place since that time. The 1920 census reports a population of 15,955, all of which is classed as rural, with a density of 22.7 persons to the square mile. The population is well distributed over the county. Among the foreign born, German and Norwegian predominate. Sioux Valley, Rost, and Heron Lake Townships have the largest number of Germans, and Belmont, Christiana, and Des Moines Townships the largest number of Norwegians.

Jackson, the county seat, is the largest town and in 1920 the population was 2,144. Other incorporated towns are Lakefield, 1,346; Heron Lake, 922; Alpha, 261; and Wilder, 91. Miloma and Okabena are unincorporated shipping points. Petersburg, Sioux Valley, and Bergen are trading centers.

There are three railways: Chicago, Milwaukee & St. Paul; Chicago, St. Paul, Minneapolis & Omaha; and Chicago, Rock Island & Pacific. A good system of dirt roads is maintained. During the last four years hard surfacing with gravel has been completed on 120 miles of road and road extensions are being made annually. Rural telephone and mail service reaches all parts of the county, and 5 consolidated schools and 93 rural schools furnish educational facilities.

Six incorporated towns, two shipping points, and three small trading centers are the local markets for produce; and Chicago is the principal outside market for fat cattle, corn, and oats. Milwaukee, Minneapolis, Duluth, and Cedar Rapids receive small shipments of corn, oats, and barley. Feeder cattle are obtained from Sioux City and St. Paul. Fat hogs are marketed principally at Austin and Albert Lea, smaller quantities going to Chicago.

CLIMATE

The climate of Jackson County is temperate, with warm summer months, cold winters, and changeable weather during the spring.

The usual frost-free season is from early May to early October, with moderate temperatures well into September. Moisture conditions favor rapid growth of spring plantings, and the well-distributed rainfall gradually decreases during the summer. Clear weather with mild days and frosty nights is common in the months of October and November. In winter the temperature is prevailingly cold, and the ground is usually covered with snow except during occasional thaws. The normal snowfall of 38.4 inches begins usually in October and covers the ground through April. This blanket of snow protects the pastures and fall seedings against excessive cold and serves as a source of moisture for spring plantings.

The data in the following table are taken from the records of the nearest Weather Bureau station at Fairmont, Martin County, 24 miles east of the county boundary.

Normal monthly, seasonal, and annual temperature and precipitation at Fairmont, Martin County

[Elevation, 1,240 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1889)	Total amount for the wettest year (1905)	Snow, average depth
	°F.	°F.	°F.	Inches	Inches	Inches	Inches
December	20.2	56	−26	0.99	1.48	0.10	6.2
January	13.4	53	−35	.87	.92	.90	7.8
February	15.5	57	−33	1.02	.85	2.40	8.2
Winter	16.4	57	−35	2.88	3.25	3.40	22.2
March	29.7	77	−19	1.44	.55	2.15	7.3
April	45.6	86	10	2.70	1.55	2.34	3.0
May	57.1	96.	23	4.24	1.10	8.31	.1
Spring	44.1	96	−19	8.38	3.20	12.80	10.4
June	67.1	99	29	4.31	3.85	5.56	.0
July	71.8	101	40	3.56	1.65	4.02	.0
August	69.4	99	38	3.33	.59	2.28	.0
Summer	69.4	101	29	11.20	6.09	11.86	.0
September	61.2	99	18	3.11	.87	6.90	Trace.
October	48.7	88	8	1.70	Trace.	3.40	.8
November	32.7	76	−19	1.35	2.40	3.70	5.0
Fall	47.5	99	−19	6.16	3.27	14.00	5.8
Year	44.4	101	−35	28.62	15.81	42.06	38.4

This record covers a period of 36 years. The average length of the frost-free season is 152 days and extends from May 6 to October 5. The date of the latest killing frost in spring is May 31 and the earliest in fall is September 11. The grazing season usually extends from April 15 to November 1.

Variations from normal conditions sometimes cause harm to farming. Late dry springs retard germination of plantings; dry, warm weather during the first of July prevents the maturing of small grains; cold summers retard the growth of corn; protracted dry spells result in light pasturage and hay growth and, if too protracted, cause "firing" and stunted ear development of corn; but too much rain poorly distributed in the frost-free season is the more common cause of damage. Fall-seeded grains and hay meadows suffer from open, cold winters. Unusually early frosts seldom occasion damage except to late-planted crops or in slow-growing seasons. Damaging winds and hailstorms are of only occasional and local occurrence.

AGRICULTURE [1]

The first settlement in Jackson County was near the present site of Jackson. Unofficial reports state that in 1867 there were 400 acres under cultivation, cropped to wheat, hay, corn, oats, and potatoes. Settlement was then limited to the prairie lands adjacent to the southern half of the valley of West Fork Des Moines River. Two years later 2,549 acres were reported under cultivation.

Practically the only disastrous crop failures in the history of the county occurred between 1873 and 1878 when the grasshopper scourge checked settlement and even caused land abandonment and migration.

In 1880 the average size of the farms was 143 acres. This increased to 160 acres in 1890, and to 207 acres in 1900, the constant growth consisting largely in the breaking of virgin land. The greatest acreage then was in hay and the largest area of cultivated crops was in wheat. During this time diversified farming gained ground and the livestock industries, mainly hog and cattle raising, were receiving increasing attention. Land values increased steadily and doubled in the decades following 1900. Between 1910 and 1920 the average size of the farms decreased slightly, but an increasing percentage of improved land in farms indicated a trend toward better agriculture. The agricultural industries of the county are: The growing of corn, small grains, and hay; the raising and fattening of hogs and cattle; and the production of dairy and poultry products, which is of considerably less importance than the others. The largest acreage of any single crop is planted to corn. It is the leading cash grain crop as well as the leading feed crop. The Minnesota State agricultural census for 1923 reported a total of 120,125 acres in corn. About one-half of it is marketed and the rest, including the 30 per cent in silage, is used as feed on the farm. The well-drained first-bottom soils produce the highest yields, but the upland soils if not excessively drained are almost as productive. Home-grown mixed seed is mainly used. Yellow dent corn, of which Minnesota 13 is the favorite, is grown more than white dent, of which Silver King is the preferred variety. Corn is planted between May 1 and May 15, and replantings

[1] Federal Census Reports, beginning with 1880. ROSE, ARTHUR P., HISTORY OF JACKSON COUNTY.

because of insects or excessive rains and cold are seldom necessary. Where for any reason planting is delayed beyond June 1, the corn is used for silage or fodder, or as a short-season catch crop. Fodder or silage corn may be planted as late as July. Corn is the usual crop on newly plowed meadowland. On many farms small parts of the cornfields are left unharvested and "hogged down." Rape is sometimes broadcast at the last cultivation to furnish a supplementary forage for hogs and sheep. Silage corn is usually cut about the middle of September and fodder corn a trifle later or just before frost. The stalks are used for fall and winter pasturage.

Second in acreage is the oats crop. Of late years the trend has been and is now toward a decreased oat acreage and a correspondingly increased corn acreage. The Minnesota State agricultural census of 1923 reported 104,055 acres in oats. The highest yields are commonly obtained upon the well-drained areas of Wabash soils. The value of oats as a follow crop for corn and as a feed crop is responsible for the large acreages devoted to it. Nearly half of the oats produced is marketed, but it is not considered a very profitable cash crop. Home-grown seed of mixed varieties is commonly used, the early maturing strains of the Kherson type, locally called "June" and "Fourth of July," being the favorites. A common practice, however, is to grow both early and late maturing varieties so as to divide the labor of harvesting more equally. Of the late varieties, Green Russian, a medium late variety, is most commonly grown.

Hay and forage crops rank third in acreage. The Minnesota State agricultural census of 1923 reported 51,288 acres of hay, about half of which was wild hay. The wild-hay acreage is steadily decreasing because of the improvement of land for cultivated crops. Timothy and clover mixed is the cultivated hay most commonly grown. It is recognized as an admirable follow crop for small grains, a practice which is slowly increasing in favor. If a hay crop of timothy and clover is sown with the small grain, light pasturage is sometimes afforded in late summer and fall. Two cuttings of hay and light fall pasturage are usually obtained the following year. If it is retained as a hay meadow, clover is reseeded every third year and timothy every fourth year. The total acreage in timothy and clover grown separately and mixed was 22,384 acres in 1923.

Alfalfa although grown on a very small acreage has had a steady increase and in 1923 was grown on 1,260 acres. Millet is the only other hay grass of importance and it is used as a short-season catch crop. Most of these hay crops are grown from seed obtained from outside markets, and medium red clover is the variety most commonly used. Excepting small quantities marketed locally, hay and forage is fed on the farm.

Permanent pastures covered 55,078 acres in 1923. Bluegrass is the most common and best-established pasture grass.

Rye was cropped on 8,310 acres and the yield was from 10 to 15 bushels an acre. It is a hardy, dependable, fall-seeded small grain having a feed value particularly for hogs. It is seeded the last of September, sometimes affording light fall pasturage. It is harvested about July 10.

Flax was grown on 7,755 acres. Market conditions during the previous two or three years were largely responsible for a doubling

of acreage in this crop. Yields vary from 6 to 8 bushels an acre. Flax is planted between April 1 and April 15 and is harvested between September 15 and October 15.

In 1923 barley covered 5,374 acres, and the average yield was about 18 bushels an acre. There were 963 acres in wheat, two-thirds in spring wheat and one-third in winter wheat. The harvest date of spring-seeded wheat, like that of oats and barley, is between July 10 and July 25. Sugar-beet production had a small beginning recently.

Small fruits and garden crops are raised to a small extent for home use and local marketing. Potatoes were grown on 738 acres. Sweet corn and pop corn are the only other garden crops marketed locally. Strawberries, raspberries, and blackberries are the principal small fruits.

Orcharding receives little attention. Apples are the principal fruit, the Oldenburg (Duchess of Oldenburg) and Wealthy varieties being the most common. Plums and cherries are practically the only other fruits grown.

The raising and fattening of hogs is the most important branch of the livestock industry. The number of hogs trebled in the period of 1910–1920, there being 67,447 hogs on the farms of the county January 1, 1920. Most of the herds are of mixed breeds.

The raising of beef cattle is second in importance in the livestock industry. The 1920 census reports 29,663 of the 51,512 head in the county as beef cattle. Very few of these are feeder stock. Most of the livestock is home raised, mixed breeds constituting about 97 per cent of it. Of purebred livestock, Hereford and Shorthorn are equally popular.

The remaining 21,849 head of cattle were classed as dairy stock. Of the purebreds, Holstein are preferred, but there are many Guernsey, Brown Swiss, Ayrshire, and Jersey. Farm dairy products support 11 creameries and 4 ice-cream factories in the county, and 1,356,409 pounds of butter were manufactured for marketing in the East. Skimmed milk from the cream separators is used for feeding hogs. Dairying is recognized as a profitable side line and a few farmers are engaging in it on a larger scale.

The 1920 census reports 15,755 horses and 420 mules. Colt production supplies local demands for work animals and a small surplus for outside markets.

In the 1920 census a total of 5,027 sheep was reported, of which 4,077 were shorn, giving a production of 31,109 pounds of wool. Wool production, however, has since decreased very much, and a few sheep are fattened for market. Shropshire is the most popular breed.

Chickens are generally raised, and there are a few flocks of geese, ducks, and turkeys.

The soils of Jackson County are adapted to diversified farming. There are small areas too steep for use except as pasture and some so steep as to be waste land. On the other hand, flat, depressed areas of very poorly drained heavy-textured soils are used for wild hay until the provision of drainage will allow the use of the land for tilled crops. A large acreage produces well in normal seasons, but is not sufficiently well drained for the growing of small grains in wet seasons. On areas of light-textured soil protracted dry spells occasion loss in all crops from drought.

Although farms in this county are usually well equipped in the matter of buildings, they lack storage cribs for unusually large grain yields, and the mow space is inadequate for the hay produced. They are well supplied with farming implements. Practically all fields are fenced with barbed or woven wire. Good well water may be obtained almost anywhere reasonably near the surface. Windmills and engine pumps are in common use.

The only fertilizer used is manure produced on the farm, and that is used most commonly on hay meadows or small-grain stubble preparatory to plowing for corn or as a top-dressing for pastures and meadows.

Continuous cropping to corn and small grains, with only occasional seedings to clover and timothy, is the general farm practice. Once seeded to clover and timothy, the field may be retained in meadow and pasture from three to five years before reverting to plowland.

The labor supply is usually adequate except during small-grain harvest and corn picking. All labor employed is white and mostly native born. During the year 1922 the average wage was $40 per month with board, room, and laundry furnished. Harvest hands received from $3 to $3.50 a day and corn pickers from 5 to 8 cents a bushel.

With the steady increase in land values, tenancy also has increased steadily until 42.6 per cent of the farms are rented (1920 census). The prevailing basis of tenancy is a share rent for crop land and cash rent for hay and pasture lands. The most common share contracts are two-fifths share to the owner if the renter furnishes everything, or a half-and-half share if the landlord furnishes the seed and half the implements. Hay and pasture lands at the present time have a rental value of $5 or $6 an acre.

The only poor crop yields in Jackson County, other than those during the grasshopper scourge between 1873 and 1878, have been in years of excessive rains. The first drainage project was started in 1908, and at present a watershed of approximately 250 square miles is served by artificial drainage projects. About 220 square miles are still in need of drainage, and about 50 square miles of this are used only for wild hay production or pasture, but the remaining 170 square miles are cultivable if adequately drained. The largest bodies of these lands lie in La Crosse, Weimer, Sioux Valley, Rost, and Minneota Townships.

Petersburg and Belmont Townships are well drained naturally. Drainage improvement has been most active in Heron Lake, Middleton, Ewington, and West Heron Lake Townships. The providing of outlets in many cases requires the construction and maintenance of open ditches of which there are about 75 miles. A drainage project has been proposed for the land west of Heron Lake.

SOILS

Jackson County is in the prairie region of the United States where a temperate climate, a smooth surface, and a moderate moisture supply have favored a luxuriant growth of grasses, so that all the soils of the area have developed under prairie conditions. The parent material which originally covered the county and from which all the soils have developed, was highly calcareous drift laid down by the

last of the great ice sheets, and therefore it has been exposed to weathering for a comparatively short time. Climatic conditions are believed to have affected the development of the soils even more than the parent material from which they have developed. The mean annual rainfall, which is less than 29 inches, has not leached the lime from any except porous soils to a depth of more than 3 feet.

The most striking characteristic of the surface soils of this area is their dark color, which is imparted by finely divided carbonaceous material derived from grass roots, partly decayed and intimately mixed with the mineral constituents. The percentage of organic matter and the depth to which it has affected the color and other physical properties of the soil is determined very largely by drainage conditions. On flats and sloughs the black organic matter extends to depths varying from 20 to 30 inches, whereas on the better-drained ridges it does not affect the soil below a depth of 10 inches.

Jackson County is in the section of Minnesota covered by the Wisconsin glaciation, and the parent material of the soils is glacial till, a mixture of yellowish-brown or gray clay, sand, and gravel.

UPLAND SOILS

The upland soils that have developed on the glacial till plain have been grouped into four series, the thoroughly leached Dickinson soils, the moderately leached Clarion and Lakeville soils, and the more poorly drained unleached Webster soils. In a general way, the texture of these soils seems to vary with the texture of the parent materials and with their position. Thus, the Dickinson and Lakeville soils, with coarse-textured permeable subsoils, have fine sandy loam or loam topsoils; and Clarion and Webster soils, with heavier less permeable subsoils, have clay loam or silty clay topsoils. Heavier silty clay topsoil occurs on the flattest areas of Webster soils and a silty clay loam on the more undulating land. Clarion clay loam occurs on somewhat more rolling land than does Webster silty clay loam, and consequently has a better-leached subsoil and little or no coarser-textured topsoil.

ALLUVIAL SOILS

Alluvial deposits in Jackson County are divided into two main groups on the basis of their age and position, one being on the older high stream terraces and the other on the more recent first bottoms.

Terrace soils of the county are entirely of glacial-water deposition and occur high above possible levels of deposition by the streams which now occupy the valleys. They are for the most part associated with glacial-water channels or pockets now entirely separated from streams. West Fork Des Moines River is the only stream in the county sufficiently developed to affect to any marked degree the original till plain, and the only one whose flood deposits are above overflow level and are exposed to active aeration. Its narrow, deep valley prevents the deposition of materials on the valley floor above overflow. These terrace soils are differentiated according to the kind of subsoil. The Estherville soils have gravelly subsoils and the Fargo and Bremer soils have heavy-textured subsoils, the Bremer differing from the Fargo in having less lime.

First-bottom soils are heavy-textured deposits in shallow valleys and flood plains of sluggish streams. West Fork Des Moines River has deposited coarser loam and fine sandy loam materials only in narrow strips along its channel. Bottom lands of the river valley and other locations where aeration and oxidation have been more favored comprise the Wabash soils. Unleached bottom-land soils are classed as the Lamoure soils.

WELL-DRAINED SOILS

Some of the soils of the country have developed under good drainage conditions brought about by the rolling surface features which facilitate rapid disposal of the rain water by run-off, by the open nature of the substrata that facilitates the percolation of water through the soils, or by a combination of both these conditions. This transportation of the finer soil particles by subsurface drainage has resulted in coarse-textured topsoils. Plant growth has not been abundant, and organic matter has not been incorporated to any great extent. Aeration, oxidation, and leaching have been very active, resulting in well-oxidized, friable soils, low in lime and leached to a depth of 6 feet and sometimes more. The Dickinson soils belong to this group of well-drained soils.

Dickinson soils.—The topsoils of the Dickinson soils are dark brown, comparatively shallow and are underlain by brown or yellowish-brown subsoils of the same or lighter texture. The lower portion of the subsoil is loose, porous, and somewhat droughty. Both topsoil and subsoil are low in lime. These soils have developed on wind-deposited sand.

MODERATELY WELL DRAINED SOILS

Most of the soils of the county have developed under conditions of moderate drainage. In the development of these soils, which are intermediate between the calcareous soils formed under optimum moisture conditions and the less calcareous soils formed under low moisture conditions, drainage and moisture conditions have been moderately favorable to leaching and aeration. The result is black topsoils, deeper than those of the Dickinson soils. The upper part of the subsoil is well oxidized and slightly calcareous, and the lower part is gray, mottled, calcareous material which is more oxidized than the practically unleached subsoils of the poorly drained Webster soils, but which is still high in lime. To this group belong the Clarion and Lakeville soils of the uplands. The development of Lakeville soils has been similar to that of the Dickinson soils, except that the former have not been leached below a depth of 3 feet. The Estherville soils, on the terraces, are similar to the Lakeville soils.

Clarion soils.—Clarion soils have dark-brown or black topsoils, underlain by silty clay loam or heavy clay loam subsoils which are yellowish brown in the upper part, and dark gray and calcareous in the lower.

Lakeville soils.—Lakeville soils have comparatively shallow dark-brown topsoils which are underlain by brown or yellowish-brown subsoils of the same or lighter texture. At lower depths the subsoils in places show some stratification or bedding, and are high in lime.

Lakeville soils differ from Dickinson soils in containing more lime and more coarse sand and gravel.

Estherville soils.—Estherville soils have dark-brown or black topsoils underlain by subsoils of sandy and gravelly loam material, loose and incoherent in the deeper part of the subsoil and with poorly defined stratification. The subsoils are unleached. These soils occur on terraces of former glacial streams and lakes.

POORLY DRAINED SOILS

Other soils of the county have developed under poor drainage conditions on flat areas where the moisture supply is high and the ground-water level remains near the surface. The abundance of decayed organic matter which was added developed a deep black soil. The material underlying this dark-colored layer has remained practically unaltered, so that gray or mottled calcareous subsoils have resulted. Under such conditions, the Webster soils have developed on the flatter uplands, the Bremer soils in depressions on the uplands, the Fargo soils on the poorer-drained terraces or former lake-bed depressions, and the Lamoure and Wabash soils on first bottoms. These poorly drained soils include shallow muck, from 12 to 20 inches deep, in which the abundance of plant growth has as yet but partly disintegrated and is not fully incorporated with the mineral soil material.

Webster soils.—Webster soils have almost black, moderately heavy topsoils, generally rich in organic matter, underlain by subsoils of plastic, compact, and poorly oxidized silty clay loam material or clay, dark yellowish brown in color, with mottlings of gray, rust-brown, and yellow. The subsoils contain gray calcareous material and some concretionary lime carbonate. Coarser sand and gravel occur throughout the soil, the larger quantities being in the subsoil.

Bremer soils.—Bremer soils have almost black topsoils, high in organic matter. The underlying heavier subsoils are dark gray or black in the lower part with mottlings of gray, yellow, and rust-brown. Both topsoil and subsoil contain little lime carbonate. Bremer soils are typical terrace soils, but these soils mapped in the county occur largely in depressions within the areas of upland glacial soils.

Fargo soils.—Soils of the Fargo series have almost black topsoils, high in organic matter, and subsoils of silty clay loam material or clay, dark gray or brown, mottled with gray, and contain much lime carbonate. They are sedimentary soils deposited in depressed, poorly drained areas formerly glacial lakes or stream beds.

Lamoure soils.—The topsoils of Lamoure soils are almost black, underlain by heavier dark-brown subsoils which have gray and yellow mottlings and a high content of lime carbonate. These soils are similar to the Wabash soils.

Wabash soils.—Wabash soils have almost black, mellow topsoils and heavier dark-brown faintly mottled subsoils which contain a small percentage of lime carbonate. They comprise the first-bottom lands along the streams, having originated from sediments deposited by the streams.

Muck.—Muck consists of the remains of vegetation weathered and in so advanced a state of decomposition that the original plant forms

have been lost, so that the mass consists of finely divided carbonaceous particles with just enough intermixed mineral particles to give it coherence and body. The material is black and usually light and fluffy. It occurs on beds of former glacial lakes or ponds.

In the following pages the various soils are described in detail. The following table gives the proportionate extent of the soils mapped in the county:

Acreage and proportionate extent of the soils mapped in Jackson County, Minn.

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Clarion clay loam	238, 720	54. 3	Fargo silty clay	9, 792	2. 2
Steep phase	5, 824		Bremer silty clay	42, 048	9. 3
Webster silty clay	45, 184	10. 0	Estherville fine sandy loam	2, 176	. 5
Webster silty clay loam	73, 856	16. 4	Wabash silty clay loam	7, 232	1. 6
Dickinson fine sandy loam	4, 736	1. 0	Lamoure silty clay loam	4, 544	1. 0
Lakeville fine sandy loam	3, 008	. 7	Muck, shallow phase	9, 984	2. 2
Fargo silty clay loam	3, 456	. 8	Total	450, 560	------

CLARION CLAY LOAM

The surface soil of Clarion clay loam to a depth of about 8 inches is very dark grayish-brown or almost black clay loam. It has a finely granular structure and is loose and friable. The next layer, about 10 inches in thickness, is grayish-brown silty clay loam streaked and splotched so abundantly with darker material from the surface layer that the color is in general dark; but these dark streaks or tongues decrease in size as the depth increases. The structure is distinctly granular, the granules being somewhat larger than those in the surface layer. A few glacial bowlders of granite and gneiss are present. The upper part of the next lower layer differs from the second very little in appearance, but there is a gradual change with increasing depth. The brown color becomes prominent and the dark-colored streaks decrease in size and finally disappear. Granulation also decreases and disappears. There is not sufficient lime in this third layer to cause effervescence with acid. At a depth of about 28 inches and extending to a depth of about 48 inches a grayish-yellow, friable silty clay loam material occurs. Specks and streaks of lime and fragments of rotten limestone are abundant. This material represents the parent drift and its structure gives no evidence of weathering. Below a depth of 4 feet the color in some places is olive-drab or has a bluish cast.

Clarion clay loam comprises slightly more than one-half of the total area of the county, and is the predominating soil except on the flatter drift plains west of Heron Lake and those east of West Fork Des Moines River. This is practically the only upland soil on the rolling area extending from Delafield Township south to Minneota and thence west through Sioux Valley and Round Lake Townships. As a whole it contains slightly more sand in the topsoil and sand and gravel in the subsoil than it does in other positions.

Areas of this soil are prevailingly undulating or gently rolling. Where near or within bodies of flatter drift plains it occurs on rolling surfaces slightly elevated above the general plain. Here the soil

shows a deeper black surface soil and a subsoil not so well oxidized nor so deeply leached of lime as on the more gently rolling land, whereas in the bodies throughout the rolling belt and in areas adjacent to West Fork Des Moines River the black topsoil is shallower and the subsoil is oxidized and leached of lime to a greater depth. Skirting the river bluffs here and there are narrow strips from one-fourth to three-fourths of a mile wide, practically level but having very deeply leached soil because of its proximity to the river bluff, with its better drainage. Level areas with deeply leached subsoils occur to a small extent in regions of poor natural surface drainage, such areas having a loose porous deep subsoil or substratum which facilitates leaching.

Natural drainage of Clarion clay loam is well established except over its flatter or gently undulating areas, and erosion occurs only on the bluff lands of West Fork Des Moines River.

Practically all Clarion clay loam is under cultivation, and is admirably suited to the production of corn and small grains, the principal crops grown on it. Wet years do not occasion great losses in production because of the good natural drainage. Probably a greater proportion of this soil than of any other is tilled. Tame grasses grow on practically all the meadows.

Corn yields on this land average about 38 bushels an acre, ranging from 25 to 75 bushels, and yields of silage corn range from 10 to 12 tons an acre. Oats average 35 bushels an acre; barley, from 15 to 35 bushels; wheat, from 12 to 20 bushels; flax, from 3 to 20 bushels; timothy and clover mixed, from 1½ to 2 tons of hay; timothy alone, from 1 to 1½ tons; clover alone, about 2 tons; and alfalfa, from 3 to 4 tons.

Ordinarily Clarion clay loam is maintained in good tilth without great difficulty. The organic matter plowed under usually consists of corn, small-grain, and hay stubble, and manure. Fall plowing is generally considered best. Continuous cropping to corn and small grains for 7 or 8 years, followed by tame hay for 2, 3, or 4 years before reverting to grain, is the usual practice on this soil. Only occasionally are systematic rotations with the cultivated grasses followed.

Farms on Clarion clay loam are well improved. They are well stocked with hogs, cattle, horses, and sheep, ranking in number in the order named. The values of these farms vary with the state of improvement and nearness to markets, as well as with the productivity of the soil. Land transfers during 1923 showed a price range from $100 to $225 an acre, but prices during this period were considered below normal.

Clarion clay loam, steep phase.—Although aggregating only a small acreage in the county, Clarion clay loam on steep slopes skirting the valley of West Fork Des Moines River and its deepest-cut tributaries is differentiated as a steep phase on account of the surface features of those areas. Erosion on the slopes has resulted in a wide variation in the color and texture of the surface soil. Where erosion has not exposed the substratum there may be 10 inches of dark-brown or black clay loam or silty clay loam. Where erosion has been severe and has removed the dark topsoils the lighter-colored subsoils are exposed.

The areas along the valley of West Fork Des Moines River rise from 100 to 150 feet above the floor of the valley, and the height of the terraces along South Fork Elm Creek is about 50 feet. Erosion of the slopes is difficult to check. Grass in times of heavy rainfall suffers from soil washing and from lack of moisture during dry periods. Most of this soil originally supported, and much of it still supports, a good growth of trees, which assists in the preservation of the soil mantle. The steep phase is suited only for grazing or forestry.

WEBSTER SILTY CLAY

The surface soil of Webster silty clay to a depth of about 12 inches is black silty clay, high in organic matter, sticky when wet, and granular and crumbly when dry. Below this to a depth of about 20 inches the material is grayish-brown silty clay or clay with mottlings of lighter gray. To depths ranging from 36 to 40 inches the material is light-gray or grayish-brown clay with yellow and lighter-gray mottlings, very compact when dry and very plastic when wet. Lime is generally present at a depth of 15 inches. Appreciable quantities of sand and gravel occur, especially in the subsoil; but the content of coarse particles is in a few places sufficient to greatly change the texture and structure.

Extensive areas of this soil are mapped throughout the western part of the county, the largest body occurring in West Heron Lake Township. Areas of this soil are comparatively flat and usually somewhat depressed. The restricted drainage of these flat, depressed areas has resulted in a greater quantity of moisture in the soil, so that grass grew more abundantly and the consequent incorporation of organic matter has affected this soil to greater depths than in the silty clay loam. In small patches in the most depressed areas the surface material consists of a thin layer of muck.

In places the texture of the surface soil varies from silty clay loam to clay. The silty clay loam may be about 3 or 4 inches deep and is underlain by heavier silty clay or clay; but when mixed by the plow, the surface layer to a depth of 6 inches is silty clay or clay. The areas having silty clay loam topsoils usually occur in association with Clarion clay loam, and in many places the upper part of the subsoil is better oxidized than in the typical soil. Some areas of this soil are adjacent to and north of Jack Creek. The subsoils of the silty clay areas are tighter, more compact when dry, and more plastic when wet, than the subsoils of silty clay loam areas. Also, they contain smaller proportions of sand and gravel, and fewer areas contain coarser particles in sufficient quantity to change the texture to sandy clay or gravelly clay.

By reason of its position in depressions, this soil receives much run-off water from adjacent higher lands. Drainage ways have cut very shallow channels, and periods of high rainfall are followed by short periods of inundation. The infrequent overflows of greater duration come only when Heron Lake basin is filled and the discharge through its outlet does not keep pace with the rate of inflow from its watershed to the west. The conditions of excessive moisture prevailing in the normal season, however, are not good for best crop production, thus artificial drainage is essential.

Webster silty clay covers an area of 70.6 square miles in the county. Its largest crop acreage is in corn, followed by oats, clover and timothy, pasturage, rye, barley, flax, and wheat. There is a greater acreage of pasture and hay land on Webster silty clay than on Webster silty clay loam, corn is more continuously cropped, and small grains are not grown so extensively. The acreage in timothy and clover is greater than that in wild hay. Crop yields, except in dry seasons or on well-drained areas, average a little lower than the yields on silty clay loam owing to the lack of adequate drainage and moisture control. Corn yields average about 30 bushels an acre, oats about 25 bushels, and timothy and clover from 2 to 2½ tons of hay.

The farms are not so well stocked as those on Webster silty clay loam and Clarion clay loam. Hog raising is the most important livestock industry.

The soil is known to be productive when properly drained. It is considered too rich for the growing of small grains; therefore manuring is not given so much attention as on Clarion clay loam.

At present farms comprising Webster silty clay do not bring so high a price as those located on the better-drained Webster silty clay loam. Current land values range from $100 to $130 an acre.

WEBSTER SILTY CLAY LOAM

The surface soil of Webster silty clay loam to a depth of 12 or 14 inches is almost black silty clay loam. As indicated by its color, this soil is high in organic matter. The structure is finely granular, so that the topsoil is loose and mellow when dry and very plastic when wet. The underlying material to a depth of about 24 inches is dark grayish-brown silty clay loam material or silty clay which is slightly mottled with gray in its lower part. The next lower layer to a depth of 36 or 40 inches is very dark grayish-brown, plastic silty clay or silty clay loam material with gray and yellow mottlings and containing varying quantities of lime carbonate. Drift sand and gravel are present in the soil mainly below a depth of 3 feet, but are in few places sufficiently concentrated to destroy entirely the tenacious consistence of the subsoil. A few bowlders are present on the surface and throughout the soil.

The most extensive areas are flat or very gently undulating and have a slight slope to the east. They occur on the table-lands east of West Fork Des Moines River. Areas of the soil in Christiana and Kimball Townships and in other parts of the county west of West Fork Des Moines River, may be somewhat depressed or flat and have neither the elevation nor the drainage that characterize the larger areas. The surface soil is somewhat higher in organic matter and the subsoil has a higher lime content and in many places contains sand and gravel sufficient to make the subsoil a gravelly sandy clay.

In Christiana, Belmont, Des Moines, and Petersburg Townships, and east of West Fork Des Moines River areas of this soil resemble high terraces which are bordered on the east by areas of higher-lying Clarion soils and on the west, along the river, by belts of Clarion soils. In these localities, the Webster silty clay loam is more thoroughly leached than in areas where drainage conditions are not so well developed. The tract just north of Petersburg is leached of lime almost to a depth of 4 feet. Where these bodies are bordered by

marked slopes the surface soil has been modified by deposits of fine-textured materials washed from the slopes.

The natural drainage developed on areas of this soil is inadequate. The flat or gently undulating surface is practically undissected by drainage ways of any size or depth, and the subsurface drainage through the tough and plastic subsoil and substratum is usually sluggish.

Webster silty clay loam has a total area of about 115 square miles. It is considered one of the most productive soils in the county, and all the crops common to the county are grown on it. On those tracts having fair or good drainage, crops rank in acreage as follows: Corn, oats, timothy and clover, rye, flax, and pasturage; but on the more poorly drained areas wild hay and pasturage cover a larger acreage than timothy and clover. In pastures bluegrass usually maintains an excellent stand. Short-season hay and forage crops such as millet, sorghum, rape, and buckwheat, are grown.

Crop yields vary widely with the drainage and the seasonal rains. Yields of the major crops are: Corn, 35 bushels an acre; oats, 30 bushels; timothy alone, from 1½ to 2 tons; clover and timothy, from 1½ to 2½ tons; and wild hay, from 1½ to 1¾ tons.

Inadequate drainage is the limiting factor in crop production, so that tiling is essential for the establishment of adequate drainage. Continuous cropping to corn is more prevalent on Webster silty clay loam, as a rule, than on Clarion clay loam. More thorough cultivation, fall plowing, and the turning under of organic matter in moderate quantities will tend to improve the tilth of this soil. The land is not regularly fertilized with manure.

Recent transfers of these lands have been at prices ranging from $100 to $200 an acre, but these prices are considered below normal.

DICKINSON FINE SANDY LOAM

The surface soil of Dickinson fine sandy loam is about 15 inches deep and consists of dark grayish-brown fine sandy loam, with a moderately loose structure but containing sufficient fine material to provide fair moisture-holding capacity. Below the surface layer, to a depth of about 26 inches, the soil material maintains practically the same fine sandy loam texture, but through lack of organic matter the dark color changes to a brown or yellowish brown. The sand content increases with depth, so that below 30 inches the material is yellowish-brown fine sand with varying quantities of coarser sand and gravel. The material in this lower layer is loose and porous, but when it remains extremely dry for any length of time it becomes somewhat indurated. Leaching has carried the lime to a depth of 6 or more feet.

The largest and most uniform body of this soil is in the northwestern part of Christiana Township just east of where West Fork Des Moines River enters the county and at the eastern edge of the belt of rolling land. The rolling surface is the result of dissection by minor tributary drainage ways of West Fork Des Moines River, which are still more or less actively eroding and lowering the surface.

This soil is rather widely distributed in the county in small tracts, most numerous in the rolling sections through the center of the

county. Where the soil on upland levels is not affected by drainage channels, the land is generally more elevated and more rolling than the adjacent lands.

Variations in the soil are largely determined by its occurrence on divides and slopes, and have been brought about principally by the processes of soil washing, soil leaching, and dissection by drainage ways. On the divides there is little variation in soil material; but on the upper slopes the surface mantle has been washed to the lower elevations, leaving a thin subsurface layer of different texture near the surface. The soil of the lower slopes has been deepened by the deposit of material washed from higher areas, so that usually it is uniform fine sandy loam. The only other noteworthy variations in areas of this soil are a few small gravelly kamelike knolls on the crown of the river bluff.

This soil has good natural surface drainage. The subsurface drainage is good, and in periods of dry weather the moisture retained is insufficient for crop needs.

Dickinson fine sandy loam has a total acreage equivalent to about 7 square miles. Because of its lower content of organic matter, its shallower topsoil, and more porous, droughty subsoil which allows excessive drainage, it is less productive than the heavy upland soils, although in wet seasons crop yields are very good. Corn and small grains are not grown so continuously and a comparatively greater acreage is seeded to pasture and hay meadows. The soil will not long endure continuous cropping, so that rotation, including grass, is necessary for the maintenance of fertility.

On this kind of land rye is the most productive of the small grains, and timothy is the most satisfactory of the cultivated grasses. Corn yields average about 25 bushels an acre; oats, 25 bushels; rye, between 15 and 20 bushels; and timothy, about 1½ tons.

The current market value of this kind of land can not be accurately determined on account of its inextensive occurrence, but its presence on a farm detracts somewhat from the value of the farm.

LAKEVILLE FINE SANDY LOAM

The surface soil of Lakeville fine sandy loam is dark-brown or dark grayish-brown fine sandy loam to a depth of 10 or 12 inches. Below this to a depth of about 24 inches the material may be light-brown or yellowish-brown fine sandy loam or sandy loam. Underlying this there is loose, porous sand and gravel carrying small quantities of clay and silt particles. The material above the gravelly subsoil is low in lime carbonate, but the gravel stratum is still unleached of lime. Bowlders occur on the surface and to some extent throughout the soil. Lakeville fine sandy loam is widely distributed over the county in small tracts. About one-half of it occurs on kames and ridges in the rolling region along the valley of West Fork Des Moines River, and much of the surface soil has been removed by erosion.

A comparatively small part of the soil occurs on small ridges in the flatter part of the drift plain. Drainage is excessive and vegetation suffers during periods of low rainfall. The soil materials are so heterogeneous that many of the individual bodies present textures and structures very different from those of the typical soil, but the main variation seems to be in the depths of the gravelly subsoil.

The soil is mapped in Des Moines, Middleton, Petersburg, Belmont, Minneota, Heron Lake, Delafield, and Kimball Townships. Nearly all of this land is pastured. The gravelly shallow topsoil and droughty subsoil make it ill suited to cropping, and only on small areas surrounded by better, cultivable soils are crops grown. Pastures suffer during dry periods, and manuring, frequent reseeding, and regulated light pasturing is necessary to maintain them. Erosion is so active that control is possible only by maintaining tree growth.

FARGO SILTY CLAY LOAM

The surface soil of Fargo silty clay loam is black silty clay loam, plastic when wet and crumbly when dry, and rich in organic matter. At depths ranging from 12 to 16 inches the material is dark-gray or grayish-brown plastic silty clay or clay in texture, and at a depth of about 22 inches the clay is lighter gray and mottled. Appreciable quantities of calcareous material are usually present at a depth of about 14 inches.

Small patches have a shallow covering of muck. The depth to which organic matter is incorporated in the soil varies widely. The drainage ways have deeper black soil, and deeper leaching of lime. Where deposition by slope waters is more active, the texture of the surface soil varies from fine sandy loam to loam. The deeper portion of the subsoil of Fargo silty clay loam contains thin layers of loose sandy or gravelly material in some places. Associated with these subsoil variations are variations in the surface soil, from fine sandy loam to loam. These surface-soil variations occur on the edges of lake-bed depressions where the more active water movement has deposited coarser sediments.

Fargo silty clay loam occurs in sluggish swampy drainage ways rather than in lake beds entirely restricted in drainage. Where it occurs in former lake beds it is usually associated with Fargo silty clay. The areas vary from almost level to very gently undulating, and natural drainage is poor. Except where artificially drained, the soil remains saturated for some time after rains.

Fargo silty clay loam in the county has an aggregate acreage equivalent to about 5 square miles. More than half of the acreage is used for hay land and pasture. Crop yields are similar to those on Webster silty clay or Webster silty clay loam where drainage and moisture conditions are similar.

The methods of management and improvement are the same as for Fargo silty clay.

FARGO SILTY CLAY

The surface soil of Fargo silty clay to a depth of about 12 inches is silty clay which is almost black because of its high content of organic matter. When wet it is very plastic and when dry, crumbly. The surface soil is underlain to a depth of about 20 inches by dark-gray plastic clay, and below this the clay is dark gray with yellow, bluish-gray and light-gray mottlings. Small quantities of sand are present throughout the soil. Lime is present in the topsoil in places and the subsoil is high in lime.

In the large body in the Heron Lake bed, this soil resembles muck to a depth of 3 or 4 feet. An analysis by the division of soils of

the State University of Minnesota showed this material to contain 14.99 per cent of volatile matter to a depth of 6 inches, and 9.85 per cent in the layer between depths of 6 and 12 inches. The surface soil is plastic and sticky when wet, but cracks and becomes granular when dry.

Fargo silty clay occurs on beds of former glacial lakes. An area of about 5 square miles in Middleton Township is the most typical of this type of soil. It is entirely surrounded by higher uplands, those to the east having the greatest elevation and forming an almost unbroken divide, with the exception of one drainage outlet to West Fork Des Moines River. The surface of this area ranges from flat to very gently undulating. Small bodies have a thin covering of muck, but such patches are too small to indicate on the soil map. In places the quantity of coarser sand particles in the subsoil is sufficient to impart a sandy clay or, in places, a loose sandy gravelly loam texture, and the shallow surface soils vary from very fine sandy loam to loam. A stratum of loose sand and gravel underlies an area in the northeastern corner of La Crosse Township at depths ranging from 3 to 6 feet. This area is flat and almost level and is slightly lower than the surrounding upland.

Drainage is deficient on areas of this soil, and small quantities of alkali are present in a number of localities. Where artificial drainage has not been provided, the soil is excessively wet most of the year, in a few places being swampy. Tile drainage has been effective and has made the utilization of a considerable acreage of the soil possible for the production of flax, corn, and small grains.

Owing to the greater utilization of this soil for growing hay and pasturage, cattle and hog raising are important industries. Fall plowing for spring seed-bed preparation is the usual practice. It is not possible to work the soils under a wide range of soil-moisture conditions. Improved drainage by tiling is important to control the moisture conditions and to assist in the removal of alkali. Current prices for this soil will probably range from $75 to $125 an acre.

BREMER SILTY CLAY

The surface soil of Bremer silty clay is black silty clay, 15 or 16 inches deep, which is plastic when wet and crumbly when dry. Continuing to a depth of about 25 inches, the soil material is dark grayish-brown silty clay, heavier in texture and lower in organic matter. Below this material, the lower part of the subsoil is gray, yellow, or bluish-gray mottled clay, which is very tenacious and plastic. All the soil material is uniformly fine textured and contains very small quantities of coarser material. Changes in soil material from topsoil to subsoil are very gradual. The soil is low in lime carbonate to a depth of 4 feet, although the subsoil in some areas may contain more.

Bremer silty clay occurs mostly in depressed, poorly drained areas on uplands at the heads of sluggish drainage ways and in many places on flat divides between drainage ways. Along Jack Creek it occurs in broad, flat, very gently sloping depressions on uplands bordering low first-bottom lands.

In small tracts of very restricted drainage, as in former lake beds, a covering of muck from 2 to 10 inches deep is present, and the incorporation of organic matter has modified the soil to a depth as great as 36 inches. Drainage is very poor and sluggish. During periods of rainfall saturation usually results and frequently water stands for some time. Swamp symbols on the map indicate areas where swampy conditions prevail practically the year round. The total acreage of Bremer silty clay in the county is 65.7 square miles, and it is well distributed. Practically all this soil is of agricultural value. Only a comparatively small acreage of swamp is waste land, and even this can be utilized for light pasturage, the native vegetation on these areas consisting of wild slough grasses. About one-half the area is used solely for permanent pasture, perhaps one-third for wild hay, and the remainder for cultivated hay and grain crops. Most of the land cropped to grain is on the smaller tracts included in fields of better-drained soils. Very little of this soil is adequately drained to insure desirable crop returns with the normal seasonal rainfall.

Corn is the leading crop. Small grains have a tendency to grow rank and lodge and produce light yields. Flax is sometimes grown with moderate success. It is a favorite first-year crop on newly broken land, mainly because of the resulting improvement in the tilth of the soil. Timothy and clover are the leading hay grasses. Short-season forage and hay crops like millet, sorghum, and rape are grown to a small extent. Wild hay yields about 1½ tons an acre. Pasture growth is easily maintained, even through the drier periods of the grazing season. Where this soil constitutes a large part of a farm much livestock is kept to utilize the pasturage.

Little improvement has been made in the drainage of this soil, except improving the surface drainage for adjacent uplands. As the soil in its present condition is best suited for pasture, little effort is made to improve it for cultivation, except where its acreage on a farm is large and a sufficient acreage of better-drained land is not available for cultivation. When drained and under cultivation this soil is treated in much the same manner as Webster silty clay, but it can not be worked under so wide a range of moisture conditions.

A rough appraisal of this land would place upon it a current value ranging from $75 to $100 an acre, depending largely on drainage conditions and the state of cultivation.

ESTHERVILLE FINE SANDY LOAM

The surface soil of Estherville fine sandy loam consists of dark-brown or black mellow fine sandy loam, underlain at a depth of about 12 inches by an 8-inch or 16-inch layer of light-brown or yellowish-brown sandy clay loam or clay loam material. Below this is the subsoil of loose sandy gravelly material which contains small quantities of clay and silt. This gravelly layer is partly assorted and faintly stratified. Lime carbonate usually in limestone gravel is present below a depth of about 20 inches. In places the subsoil is less gravelly, and is uniform sandy loam, which, however, is usually underlain by a coarser gravelly layer at depths of several feet, and in such places the lime has been leached to greater depths than in the typical soil. In other places the quantity of gravel is greater

than in typical Estherville fine sandy loam, and in small patches the topsoil and subsoil are gravelly.

Three-fourths of the area of Estherville fine sandy loam in the county is on high outwash terraces bordering West Fork Des Moines River, and the remainder occurs near lakes and minor stream ways. Where entirely surrounded by Fargo soils Estherville fine sandy loam occurs on terrace remnants at moderate elevations above areas of Fargo soils. Such areas are nearly level, but the terraces along West Fork Des Moines River have their original level surfaces somewhat modified by dissecting tributaries. Drainage is thoroughly established, and during periods of dry weather the moisture retained is insufficient to supply crop needs.

Estherville fine sandy loam comprises a total area of 3.4 square miles, and is not an important soil agriculturally. It is inferior to Clarion clay loam and similar to the Dickinson and Lakeville upland soils in productiveness. Most of it is used for pasture and hay land. Tame-hay grasses are grown to the exclusion of practically all the wild prairie grasses.

Corn is the leading grain crop, and small grains are second in importance, but they are not grown so continuously as on the heavier soils. Liberal quantities of manure are applied to maintain the supply of organic matter. Crop yields are about the same as those on the Dickinson soils. The present value of this land is difficult to determine because of its small extent, but estimates are similar to those made for the Dickinson and Lakeville soils.

The improvement of this soil lies mainly in liberal applications of manure or other forms of organic matter and in deeper and more thorough cultivation.

WABASH SILTY CLAY LOAM

The surface soil of Wabash silty clay loam is black silty clay loam rich in organic matter, moderately plastic when wet, but finely granular when dry and mellow under cultivation. At a depth of about 15 inches it is underlain by dark-brown silty clay loam or silty clay, which, between depths of 30 and 40 inches, in many places shows faint mottlings and rust-brown iron stains. Although this mottled lower part of the subsoil is very plastic when wet and but slightly compact when dry, the upper part of the subsoil is only slightly less friable than the topsoil when dry and slightly more plastic when wet. Small quantities of sand are well distributed throughout the soil, and the entire soil section is low in lime carbonate, which constitutes the principal difference between this soil and Lamoure silty clay loam.

Wabash silty clay loam comprises the first-bottom lands along the larger streams. Two-thirds of this soil in the county occurs along West Fork Des Moines River. The periods of overflow are not sufficiently long in normal seasons to cause damage. Tributaries are usually small and their drainage waters, as well as those from the valley slopes, flow to the river channel without inundating the first-bottom lands for any length of time. The coarser sediments washed from the slopes and the material forming the natural levees bordering the river channel occasionally are loamy in texture and are usually nearly as coarse as fine sandy loam or sandy loam.

Drainage is good under conditions of normal rainfall.

The first bottoms of Jack Creek and Okabena Creek comprise about one-third of the total area of Wabash silty clay loam. The soil here is higher in organic matter, is more plastic than typical Wabash silty clay loam when wet and less friable when dry, and the lower subsoil is more compact. These first-bottom lands are very little below the level of the uplands, and the creek channels are narrow and cut to depths ranging from 10 to 15 feet. Overflows are common during rainy periods, but are seldom of great duration. The surfaces are level and are cut by few tributary channels. Wabash silty clay loam also occurs along two branches of Little Sioux River in Round Lake, Rost, and Sioux Valley Townships. The valleys are similar to those of Jack and Okabena Creeks, and in places the material washed from the slopes has modified the surface soil immediately at the foot of the slopes.

Wabash silty clay loam in the county covers an area of 11.3 square miles. Most of it is used for pasture and hay land. Bluegrass maintains an excellent growth and the length of the grazing period is not greatly shortened during dry seasons. Wild prairie and slough grasses constitute the vegetation of the larger part of the hay lands but on better-drained areas protected from overflow, tame-hay grasses yield abundantly. Cropping to grain is uncertain except on the better-drained parts of bottoms. The soil in the valley of West Fork Des Moines River affords a large acreage suitable for cropping in all except seasons of very heavy rainfall. Small grains have a tendency to rank, late-maturing growth and light production. When not damaged by overflow, corn on this soil yields from 35 to 45 bushels an acre; oats, from 25 to 35 bushels; timothy and clover, from 2 to 2½ tons; and wild hay, from 1½ to 2 tons. Where the pasture acreage is large, livestock is kept in greater numbers.

Wabash silty clay loam can be cultivated under a slightly wider range of moisture conditions than Webster silty clay loam. Very little manure is applied to cultivated land. Moisture conditions can be improved by tile drainage.

Transfers of this land during 1923 were made at prices ranging from $50 to $100 an acre. Land suited only to hay and pasturage commands lower prices ordinarily than that under cultivation.

LAMOURE SILTY CLAY LOAM

Lamoure silty clay loam has black silty clay loam surface soil which is high in organic matter, plastic when wet, and crumbly when dry. At a depth of about 18 inches the heavier material is dark grayish-brown or almost black poorly oxidized silty clay or clay. Mottlings of dull gray may be present in the deeper part of the subsoil. The upper part of the soil is leached of lime, but lime is abundant below a depth of 14 inches.

Lamoure silty clay loam occurs as first bottoms of smaller streams. The largest body is along Little Sioux River and there are smaller tracts along Elm Creek. The land is very poorly drained. Periods of saturation are of long duration and it is only in the more protracted dry spells that the water table is lowered and the surface soil becomes dry. In places shallow muck covers the surface.

The bottoms comprising Lamoure silty clay loam are level, and here and there local backwater depressions and narrow foot slopes of colluvial material occur along the borders of steep hillsides.

The total area of Lamoure silty clay loam in the county is 7.1 square miles. Because of its present drainage it is utilized almost entirely as pasture and hay land. The most poorly drained areas support a growth of wild prairie and slough grass and in patches rush grasses of rank growth. The better-drained tracts have been seeded to tame hay and pasture grasses. Livestock is kept to utilize the pasturage and hay produced. Only a few small bodies are sufficiently well drained to assure fairly certain crops of grain, and such areas are recognized as very productive for corn which is grown almost to the exclusion of small grain. Farming practices and crop yields on this soil are similar to those on the Webster and Fargo soils which have similar moisture conditions.

The current value of Lamoure silty clay loam in its present state of cultivation averages less than that of the Wabash soil.

Drainage and subsequent improvement of the structure of the surface soil are necessary to give this soil good tilth. Drainage improvement in most cases can be accomplished only by straightening and deepening the stream channels, but this would not be practicable for the improvement of the Lamoure soils alone. Such improvement has been contemplated for the bottoms of Little Sioux River, rather with the object of benefiting the entire watershed by furnishing a more efficient outlet for drainage waters than for the improvement of the bottom lands.

MUCK, SHALLOW PHASE

The surface material of shallow muck consists of a black mass of decomposed and rather thoroughly disintegrated vegetable remains and fine-textured mineral matter. The surface soil is light in weight and somewhat spongy in nature. It is moderately plastic when wet and mellow when dry. The mineral matter in the soil increases with depth, so that at depths ranging from 24 to 30 inches the material is black silty clay or silty clay loam in texture and free from organic matter. At a depth of about 3 feet, coarse sand and gravel may be present in sufficient quantity to impart a sandy clay texture. The subsoil color may be bluish gray, or dark gray with faint mottlings of yellow, light gray, or brown. The soil contains calcareous material in varying quantities at various depths, and the subsoil is high in lime. Shell fragments and lacustrine lime concretions occur in many places.

Shallow muck has accumulated in former lake beds or sloughs which have been partly drained. Although drainage is usually cut off from surface outlets, more or less seepage takes place through the subsoil. The bodies are of wide distribution throughout the county, but they are more numerous in the more uneven or rolling sections. The largest area occurs west of Lakefield on the western edge of this rolling belt in a section of flat or undulating land.

Muck, shallow phase, covers 15.6 square miles of the county. The land is used principally for growing wild hay and for pasture. Land improved by drainage is cropped usually to corn, potatoes, and flax.

Crops specially adapted to muck, such as onions, celery, and sugar beets, are given little attention, largely because such crops compete with the ordinary field crops in their labor requirement. Corn yields well on the better-drained areas of muck, save where alkali salts are present in the surface soil. Early fall frosts sometimes damage crops, but as a rule only when the crop is unusually late in maturing.

Unless drainage conditions are improved, this soil must be utilized for hay or pasture land. Wild hay and slough grasses make up the larger part of the vegetation. Owing to the high percentage of organic matter, good tilth is more easily maintained than on the Bremer, Fargo, and Lamoure soils under similar drainage conditions.

An appraisement of the value of this land is difficult. Where drainage conditions are unimproved the value of some tracts would be very low, whereas improved bodies command prices as high as $125 an acre.

Greater utilization of this soil can be made possible through drainage, and then by pasturing to compact the surface soil. Drainage will also result in the removal of alkali.

SUMMARY

Jackson County is in the southwestern part of Minnesota. Its area is 704 square miles or 450,560 acres. It comprises an undulating or moderately rolling drift plain having a very gentle ascent from east to west. In most prominent relief, a more rolling, knolly belt of higher elevation extends north and south through the center of the county and over the southern portions of Sioux Valley and Round Lake Townships. Upland elevations range from 1,350 to 1,550 feet above sea level.

West Fork Des Moines River, together with its Heron Lake basin tributary drainage, forms the principal drainage system of the county. Little Sioux River is the only other stream of importance. About one third of the county is well drained naturally, another third is artificially improved, and the remainder is still in need of drainage improvement.

Jackson County was organized in 1857. The population is predominantly native American. The largest town is Jackson, the county seat. Three railroads cross the county.

The average frost-free period is 152 days. The mean annual precipitation is 28.62 inches and usually it is well distributed. The mean annual temperature is 44.4° F.

The farms of Jackson County average 191.5 acres in size. They are well improved as a whole and well equipped. A combined grain and livestock farming system prevails. Corn, oats, rye, flax, barley, and wheat are the grain crops grown and rank in the order named. Timothy, timothy and clover mixed, clover, and alfalfa are the tame-hay grasses grown, and are named in order of acreage. The raising of hogs and beef cattle are the principal livestock industries.

Corn and small grains hold first place in the cropping systems. Definite systems of crop rotation are seldom followed. Manure is the only fertilizer used.

A little less than half of the farms are rented. The labor supply is adequate except during harvest periods.

The market values of the farms of the county during 1923 ranged from $125 to $175 an acre.

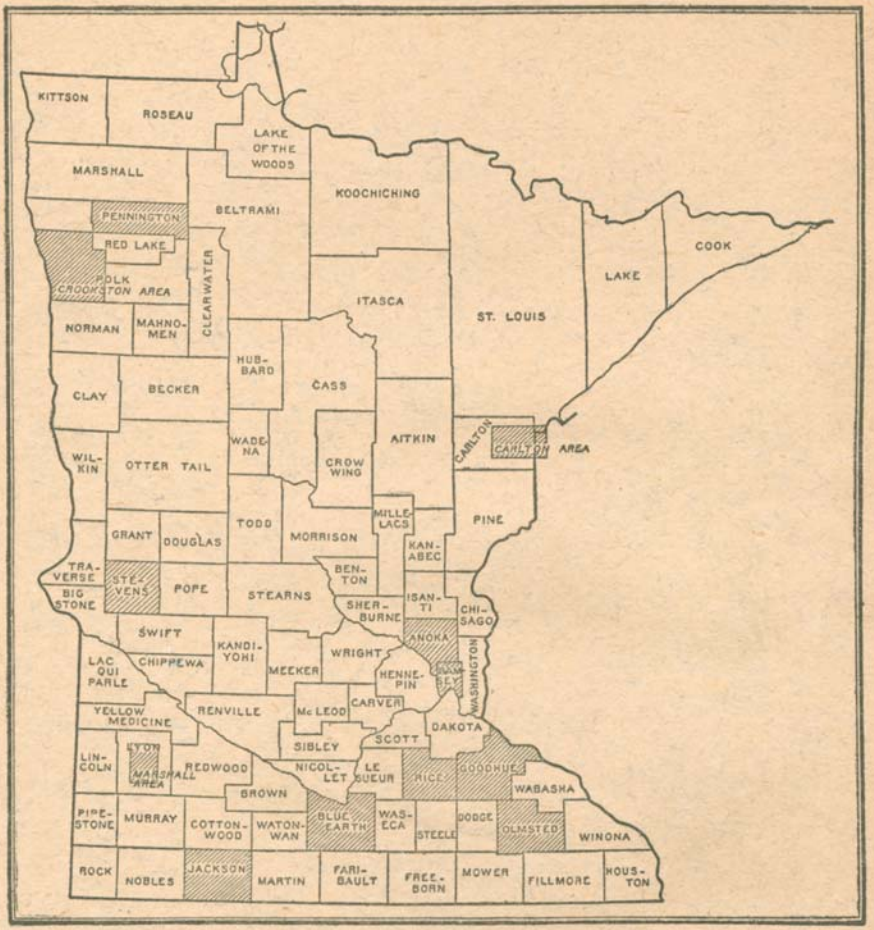
The soils of Jackson County have developed from glacial material and are not related to the deeply underlying rock formations.

Upland soils comprise about six-sevenths of the area of the county. Clarion and Webster soils are the most extensive upland soils and Dickinson and Lakeville soils less extensive upland soils.

The terrace soils of outwash glacial or lacustrine origin are classed as Bremer, Fargo, and Estherville soils. The terrace soils have a total area of about 90 square miles.

The first-bottom lands comprise the Wabash and Lamoure soils and cover a total of about 18 square miles. Nearly 16 square miles of the shallow muck occur in the county.

○



Areas surveyed in Minnesota, shown by shading

Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410, or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.