

SOIL SURVEY OF JEFFERSON COUNTY, NEBRASKA.

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DESCRIPTION OF THE AREA.

Jefferson County is situated in southeastern Nebraska, on the Kansas State line. Fairbury, in the central part of the county, is about 65 miles southwest of Lincoln. The county is square, each side being about 24 miles long. It comprises an area of 578 square miles, or 369,920 acres.

Jefferson County lies mostly within the glaciated-drift hill area of Nebraska, but also includes portions of the loess-plain area. Physiographically the region included within the county is an incompletely dissected plain sloping gradually toward the southeast, the initial surface of which consisted of an extremely smooth plain the surface of which was formed by a layer, several feet thick, of silty material designated by geologists as loess, resting on a layer of glacial drift, and this in turn upon sandstone, shale, and a few thin beds of limestone.

Throughout the northern half and a large area in the west-central part of the county, where the smooth loess mantle has been removed only along major drainage ways, the topography is that of a flat to gently undulating plain modified by an intricate system of broad and narrow V-shaped valleys. The uneroded remnants of the loess mantle lie at a uniform level. They are quite continuous, though very irregular in outline owing to the headward erosion of numerous small drainage ways. They occur upon the divides between major and minor stream valleys and occupy the highest positions in the county. The surface is generally flat, though locally modified by shallow swales and draws. The largest remnants are in the vicinity of Gladstone, Daykin, and Plymouth, in the west-central, northeastern, and northwestern parts of the county. Along the larger valleys, where erosion has cut through the loess mantle to the underlying drift, the surface of the slope land varies from gently undulating to rolling. The upper parts of the slopes bordering the edge of the loessial divides are usually gradual, owing to the downward slipping of the loose, siltlike mantle. They usually become steeper and more rolling toward the edge of the flat alluvial lands bordering the streams.

In the southeastern part of the county, east of the Little Blue River, most of the loessial mantle has been eroded away and the surface of the underlying Kansan drift has been carved into the typical drift-hill topography. It has a rolling to hilly relief and is composed of numerous ridges, hills, and valleys, locally modified by narrow, flat-topped divides where remnants of the original loess mantle have escaped erosion. Over most of the area the major slopes are moderate and the ridges well rounded. The smaller drainage

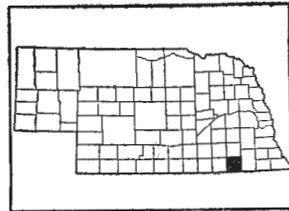


FIG. 48.—Sketch map showing location of the Jefferson County area, Nebraska.

¹Report written by F. A. Hayes.

ways are usually shallow, though frequently sharply cut, having short, steep grades. The slopes along the larger creeks are often quite abrupt immediately bordering the flood plains, but become gradual toward the crests of the divides, which lie from 30 to 70 feet above the stream channels. Throughout the rest of the uplands, including a large area in the southern and southwestern parts of the county, parts of the valley slopes bordering the Little Blue River, and a small area along Rock Creek northeast of Endicott, erosion has removed the loess and drift, exposing the sandstone, shale, and limestone rocks. In these localities the upland is characterized by steep slopes and a generally hilly to extremely rough and broken relief. In the southern and southwestern parts of the county the bedrock stands at a comparatively high level and is exposed along the edges of the valleys, where it produces steep to almost precipitous slopes. The ridges lie from 75 to 125 feet above the narrow valley floors. The soft sandstone has been eroded into an intricate system of deep V-shaped valleys separated by narrow though usually rounded divides. The roughest topography occurs along Rock Creek northeast of Endicott and on the slopes bordering the Little Blue River northwest of Steele City, where the Dakota sandstone is exposed over considerable areas and forms precipitous slopes along many of the drainage ways. West and southwest of Fairbury and in the extreme western part of the county, north of the Little Blue River, the valley slopes between the flood plains and the edge of the loess mantle are gradual, though rolling.

The terrace or second-bottom lands of Jefferson County are very inextensive. They are confined chiefly to a narrow continuous strip bordering Rose Creek in the southwestern part and to small independent bodies along the Little Blue River. The terraces stand from 12 to 20 feet above the present flood plains and are comparatively smooth. The descent to the bottom lands is usually marked by a short, steep slope, while the transition to the uplands is more often long and gradual. In many places, however, especially along Rose Creek, the slopes between the uplands and terrace also are steep to precipitous.

The first-bottom or flood-plain land is extensive in Jefferson County. It occurs as narrow continuous strips varying in width from a few rods to about one-half mile along most of the larger streams. The largest development lies along the Little Blue River, where it has an average width of about one-half mile across the county. The surface of the bottom land is generally flat, though locally modified by slight depressions and overflow channels. These areas are the lowest in the county and lie from 4 to 10 feet above the stream levels.

The average elevation of the county is about 1,320 feet above sea level. It ranges from about 1,255 feet where the Little Blue River crosses the southern county line to approximately 1,540 feet in the western part. The average elevation of the loessial uplands is about 1,400 feet and that of the bottom lands 1,300 feet above sea level. The general slope of the county is to the south and east.

The southwestern half of the county is drained by the Little Blue River and its tributaries, and the rest is drained by creeks leading to the Big Blue River in Saline and Gage Counties. The Little Blue River flows through the county in a southeast direction. Its principal tributaries are Rose Creek on the south, and Rock, Big Sandy, and Little Sandy Creeks on the north side. The southwestern and

south-central parts of the county drain directly into Rose Creek and its branches. The extreme northwestern part is drained by Big and Little Sandy Creeks. Swan, Cub, and Indian Creeks are tributaries of the Big Blue River and drain the north-central, central, east-central, and southeastern parts of the county.

The drainage is good throughout the county, except in places upon the broader loessial divides, where run-off is rather slow. There are numerous small, shallow ponds throughout the more level uplands, which, like most of the creeks, are intermittently wet and dry. Parts of the flood plains along the Little Blue River and the larger creeks are subject to overflow during periods of heavy rainfall, but the water seldom remains on the land longer than a few hours. All the creeks and smaller drainage ways are swift-flowing and are deepening their channels, especially in their upper courses. The Little Blue River, however, is approaching base level and in a few places is building up its flood plain. Water power is developed from this stream to run the flour mill at Fairbury.

The boundaries of the area included in Jefferson County were established by the Territorial Legislature in 1856 under the name Jones County. During the same year a county to the west was established as Jefferson County. In 1867 the two counties were united. In 1871 they were again separated, and that part lying east of the sixth principal meridian was named Jefferson County.

The first settlement in the area was made in 1854. The earliest settlers were of Russian and German descent and came from southern Russia. Later settlers came largely from eastern States and included the Swedish, Danish, English, Irish, and French nationalities. According to the 1920 census, the population of the county is 16,140, of which 68.6 per cent is classed as rural. The density of the rural population is 20 persons per square mile, but is greatest in the vicinity of the towns. The more sparsely settled sections are in the rougher regions in the southern and southwestern parts of the county. Over half of the inhabitants are native-born Americans; the rest are of foreign birth or mixed parentage.

Fairbury, the county seat, situated in the central part of the area, has a population of 5,454, and is a small manufacturing center and railroad division point. Plymouth, with 453 inhabitants, is located in the northeastern part of the county. Diller, in the east-central part, has a population of 418. Steele City, with 300 inhabitants, is in the southeastern part. The population of Jansen is 258, Reynolds 208, Daykin 204, Endicott 197, and Harbine 107. Powell, Helvey, Gladstone, Thompson, Shea, and Kesterson are small hamlets and sidings having less than 100 inhabitants each. These towns, villages, and hamlets are local distributing centers and markets for farm produce, implements, and supplies.

The transportation facilities of Jefferson County are good. Several railroads, including main and branch lines of the Chicago, Rock Island & Pacific, St. Joseph & Grand Island, and Chicago, Burlington & Quincy systems traverse the county in many directions. These roads furnish good connections with Lincoln, Omaha, St. Joseph, and Kansas City. No point is over 10 miles from a railroad.

Most of the wagon roads follow section or land lines regardless of topography. All are dirt roads. Several marked highways cross the area. The more important roads, including the highways and those

between the several towns, are kept in excellent condition. Little attention is given the minor roads. There are 12 bridges across the Little Blue River within the county, and cement culverts and bridges are common, even on the minor roads.

Rural free delivery routes reach all sections of the county, except a small area in the southern part. Telephones are in general use.

The direct railroad connections with large cities furnish the county with good outside markets. In Lincoln and Beatrice there is a steady demand for the surplus dairy and poultry products. The livestock is shipped to Omaha, St. Joseph, Kansas City, or Chicago. Most of the surplus grain is sold in the local elevators and later shipped to eastern markets. The flour mill at Fairbury furnishes a local market for wheat.

CLIMATE.

The climate of Jefferson County is marked by wide seasonal variations. The winters are usually long and cold and the summers warm. The spring is generally rather cool with considerable precipitation. The fall season has a moderate temperature and only occasional periods of rainy weather. The low temperature sometimes occurring in winter is not usually destructive to winter-grown crops, owing to the protection of snow. There is not sufficient variation in topography to cause any appreciable differences in climate within the county.

The table below, compiled from the records of the Weather Bureau station at Fairbury, gives the normal monthly, seasonal, and annual temperature and precipitation.

Normal monthly, seasonal, and annual temperature and precipitation at Fairbury.

(Elevation, 1,316 feet.)

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1887).	Total amount for the wettest year (1902).	Snow, average depth.
	° F.	° F.	° F.	Inches.	Inches.	Inches.	Inches.
December	28.5	70	-20	0.79	0.70	0.89	4.7
January	26.1	70	-25	.71	.30	1.14	5.3
February	27.4	76	-38	1.01	.45	.27	6.8
Winter	27.3	76	-38	2.51	1.45	2.30	16.8
March	40.1	93	-12	1.49	.65	.42	5.5
April	51.8	103	14	2.83	1.70	.83	2.8
May	62.4	99	25	4.74	3.90	5.04	.3
Spring	51.4	103	-12	9.06	6.25	6.29	8.6
June	72.2	111	38	4.57	2.82	12.59	.0
July	77.7	112	42	4.29	2.99	9.33	.0
August	76.1	112	39	3.18	1.35	7.72	.0
Summer	75.3	112	38	12.04	7.16	29.64	.0
September	68.0	105	23	2.85	1.35	4.33	.0
October	55.1	94	13	2.16	.57	3.25	.5
November	40.8	84	-8	.99	.50	1.36	2.5
Fall	54.6	105	-8	6.00	2.42	8.94	3.0
Year	52.2	112	-38	29.61	17.28	47.17	28.4

The mean annual precipitation is 29.61 inches. Over 75 per cent falls during the growing season from April to September, inclusive. About 47 per cent falls during May, June, and July, with the maximum in May. December and January are the driest months. The precipitation for the driest year on record (1887) was 17.28 inches, and that for the wettest year (1902), 47.17 inches.

The summer rainfall usually occurs as heavy local thundershowers of short duration. The rainfall in May and June is usually well distributed, and droughts are practically unknown in these months. In July the distribution is less favorable, though on the average rain falls at least once each week during May, June, and July. In August and September the precipitation is lighter and frequent short droughts occur, sometimes causing reduced grain yields. Total crop failures are practically unknown, as most of the soils are quite retentive of moisture. The annual snowfall varies from a few inches to several feet.

The mean annual temperature is 52.2° F. January is the coldest month with a mean of 26.1° F., and July the warmest with a mean of 77.7° F. This gives a range of 51.6° F. between the means of the coldest and warmest months. The lowest temperature recorded is -38° F. in February, and the highest, 112° F., occurring in both July and August.

The average date of the last killing frost in spring is April 28, and of the earliest in the fall, October 9. This gives an average growing season of 163 days, which is ample for the maturing of all farm crops common to the region. Killing frost has been recorded as late as May 27 and as early as September 11.

From April to October the prevailing winds are from a southerly direction and during the rest of the year from the northwest. The average wind velocity at Lincoln, about 65 miles northeast of Fairbury, is 11 miles an hour. A velocity of 70 to 80 miles has been recorded for short periods during severe storms. Tornadoes are rare.

The relative humidity is quite regularly near 70 per cent. About half the days are clear and sunny.

AGRICULTURE.

The earliest settlers in Jefferson County established themselves along the Oregon Trail, which followed the valley of the Little Blue River diagonally across the area. They confined themselves chiefly to the raising of corn and vegetables for home consumption and for sale to the overland emigrants. Wild game was depended upon to furnish the meat supply. Later settlers established themselves along the creek valleys and throughout the uplands, where they grew spring wheat, rye, oats, buckwheat, and flax in addition to corn and garden vegetables. The Federal census reports 24,692 acres in corn, 28,711 acres in wheat, and a production of 1,642 bushels of flaxseed in 1879. About 1885 wheat growing was practically abandoned, owing to the decreased yields and low prices, and the corn and oats acreage increased. The census reports 104,165 acres devoted to corn, 27,526 to oats, and only 6,192 to wheat in 1889. About this time a variety called "Grass" wheat was found to yield exceptionally well when planted in the fall, and since then winter wheat has gradually increased in acreage. Its production has been stimulated further by

the introduction of Turkey wheat, a hardy variety commonly grown in the area at present.

Rye, barley, buckwheat, potatoes, and sorghum have been grown as minor crops since the early settlement of the county. Between 1880 and 1890 native hay became an important crop and has remained so since that time.

With the exception of the "grasshopper year" (1874) and the three years of protracted drought (1890, 1894, and 1901), agricultural progress has been steady. In 1913 the corn crop was practically a failure throughout the county, the average yield being slightly over 5 bushels per acre, although winter wheat made a fair yield.

The present agriculture of the county consists of diversified farming, including grain and hay production and the raising of hogs. Dairying and the raising of cattle and other livestock are practiced less extensively. Of the farm crops, corn, wheat, oats, alfalfa, wild hay, and coarse forage are the most important, ranking in acreage in the order named.

Corn is the main crop and about 30 per cent of the improved farm land is devoted to its production. In 1909, 2,270,602 bushels were produced on 108,720 acres. The present acreage is considerably lower. According to the 1920 census, 85,760 acres were devoted to corn in 1919, yielding 1,101,854 bushels. During July and August hot winds sometimes cause considerable damage to corn, but with plentiful rainfall throughout the growing season the crop does well, yielding from 30 to 45 bushels per acre. Reid Yellow Dent, Iowa Silvermine, and Leaming Improved are the most popular varieties. On tenant farms most of the corn is sold, while on farms operated by owners a large part is fed to hogs and other livestock. It is a common practice to husk the corn from the standing stalks and pasture cattle and horses in the field during the winter. Some farmers cut a little corn for winter roughage. A few farmers have silos and usually cut 10 to 15 acres for silage.

At present wheat ranks second to corn in acreage, the ratio being approximately 2 acres of wheat to 2½ acres of corn. In 1909, 941,168 bushels of wheat were produced from 47,842 acres. The acreage of wheat has increased considerably since 1909, at the expense of the corn acreage. The 1920 census reports 68,832 acres in 1919, producing 1,020,142 bushels. Turkey wheat is grown almost exclusively at present. This variety yields better than spring wheat, can be sown in the fall at a time when the farm work is light, and matures before the dry weather and hot winds occur. The Hessian fly, black rust, and loose smut occasionally cause damage, although loss from these causes seldom runs high. A new variety, Kanred, is being introduced. This strain is rather hardy and not affected to any great extent by leaf or stem rust. During average years the returns from this variety are slightly larger than from Turkey, while in unfavorable years the yield is decidedly greater. Wheat is strictly a cash crop, and most of it is sold direct from the threshing machine.

The area devoted to oats is about one-half that used for wheat production. According to the 1920 census there were 29,693 acres in oats in 1919, with a total yield of 939,336 bushels. Kherson is the leading variety. This strain is especially well adapted to the bottom-land soils of the county on account of its short stiff stem which minimizes the danger of lodging. The acreage in oats has

decreased materially during the last few years, due principally to the larger returns obtained from wheat and corn. At present oats are grown almost entirely as a step in the rotation between corn and wheat or alfalfa. Most of the crop is fed to work stock. Very little effort is made to control rust and smut, although yields are often reduced as much as one-sixth by these diseases. The average yield fluctuates considerably on the different farms. Maximum yields of 75 to 80 bushels have been obtained during favorable seasons on well prepared land. On most farms, however, 25 to 30 bushels is considered a good yield. Among the grain crops barley ranks next to oats in acreage. It is grown on a few farms for hog feed. The 1920 census reports 3,501 acres devoted to barley in 1919, yielding 70,853 bushels.

Of the minor crops, rye, emmer (or spelt), millet, sorghum, kafir, and potatoes are grown in small patches by many farmers for feed and home consumption. Kafir and other grain sorghums ordinarily yield 3 to 4 tons of fodder per acre and 20 to 30 bushels of seed. They are excellent feed for work stock and cattle. Some farmers thresh the crop and feed the seed to chickens and pigs. Sorgo (saccharine sorghum) does well, yielding an average of 3 to 4 tons of fodder. Very little sorgo is grown for sirup.

The hay crop has been of considerable importance since the early settlement of the county. The acreage of wild hay has gradually decreased with the increase in grain production. At present alfalfa is the leading hay crop. According to the census, 23,502 acres were devoted to alfalfa in 1919, with a total yield of 31,801 tons. This crop is increasing in importance each year, owing to its high feeding value. It is grown on all the soils of the county, except the more poorly drained parts of the bottom land. Most of the crop is fed to horses and cattle on the farms where produced, although some is annually baled and shipped to outside markets. The yield ranges from 2 to 4 tons per acre, depending largely upon the rainfall. The crop is usually cut three times, though in exceptional seasons a fourth cutting is obtained.

Native hay ranks next to alfalfa in acreage. The 1920 census reports 13,664 acres in virgin hay land in Jefferson County, yielding 12,739 tons. The principal hay grasses are big and little bluestem, grama grass, buffalo grass, blue grass, and bunch grass, together with small quantities of marsh and swamp grasses. These grasses will support from 32 to 40 head of cattle per quarter section when grazed during the summer season, June to October, or when cut for hay will yield from three-fourths ton to one and one-half tons per acre, depending upon the rainfall. The larger yields are obtained only in the most favorably situated locations and during seasons of exceptional rainfall.

Sweet clover is adapted to the climatic conditions and does well during average years. A few of the progressive farmers use the crop as a step in the rotation preceding alfalfa, as it inoculates the land and leaves the soil in a favorable condition for obtaining a good stand of the latter crop. On some farms it is used for pasture the first year, and the second year it is allowed to mature and reseed itself. A few farmers thresh the seed for market.

Not much attention is given to fruit production. There are no commercial orchards in the county, although most farms have a few

apple, cherry, plum, or pear trees to supply fruit for home consumption. The farm orchards are given very little attention and a large percentage of the trees have died during recent years. Some grapes, strawberries, blackberries, and raspberries are produced. Practically all the fruit is consumed locally and considerable quantities are shipped into the county. The 1920 census reports 6,506 apple trees, 5,288 cherry trees, 695 plum trees, 982 pear trees, and 7,131 grapevines in the county.

Some attention is given to the raising of beef cattle. Many farmers fatten four to six head for sale when prices are most favorable and a few ship in one or two carloads for winter feeding. The animals are fattened on corn and alfalfa for a period of about 90 days and shipped to outside markets. Most of the beef cattle are grade Hereford or Shorthorn, although a few farmers have purebred Hereford herds. The census reports 28,736 cattle valued at \$1,452,683 in the county in 1920; 14,096 of these were beef cattle.

Dairying is practiced on a small scale and there are a few purebred Holstein herds within the county. Nearly every farmer keeps from 4 to 6 milk cows in addition to young stock. The larger dairy herds seldom exceed 12 to 15 cows and are usually located near the large towns. On most farms a small surplus of cream or butter is sold. The cream is usually separated on the farm and hauled to the cream stations for shipment to centralized creameries at Fairbury, Beatrice, or Lincoln. On the average farm little attention is given to the proper feeding or housing of the dairy cattle. The value of all dairy products, excluding milk and cream for home consumption, was \$496,409 in 1919.

The raising of hogs is the most important branch of the livestock industry. Ordinarily from 20 to 30 hogs per farm, and sometimes as many as 200, are fattened each year for market in addition to those slaughtered for home use. Most of the hogs, as well as other livestock, are kept on the farms operated by owners. Practically all the animals are raised and fattened on the same farms. In a few cases, however, stock is shipped in for fattening. On some farms all the corn grown is fed to the hogs, and as a rule this practice is profitable. The Duroc-Jersey, Chester White, and Hampshire are the principal breeds. Very few of the animals are purebred, although the quality of the stock in general is high. A few farmers practice cross-breeding, the result being a very inferior animal after the first generation. In general, the breeding of hogs is along constructive lines and the crossing of breeds is resorted to only for the purpose of obtaining certain market types. Considerable losses are suffered in some years from hog cholera. The outbreaks of this disease, however, rarely result in as great losses as in former years on account of the increased attention being given to sanitation and vaccination. The census reports 38,913 hogs, valued at \$797,454, in Jefferson County in 1920.

The raising of horses consists chiefly in the breeding of work mares. Most of the farmers raise 1 or 2 colts a year and sometimes as many as 6. The stallions are mainly of the Percheron and Belgian breeds, and the work stock is generally good. A comparatively large number of mules are being raised, especially in the southern part of the county. These find a ready market within the county. There were 11,328 horses valued at \$886,427, and 1,480 mules valued at \$174,461, in the county in 1920.

Poultry is raised on all farms and constitutes an important source of farm income. There is a good local demand for poultry products and in general more attention is being given the industry, although there are no specialized poultry farms. The Leghorn, Plymouth Rock, Rhode Island Red, and Orpington are raised chiefly. Geese, ducks, or turkeys are kept on many farms. With the present high prices of eggs and poultry the industry is very profitable. The 1920 census reports the total value of all poultry products in Jefferson County in 1919 as \$508,195.

The adaptation of certain soils to particular crops is observed to some extent by the farmers. It is recognized that the Grundy and Carrington silt loams are best suited to all crops common to the region, but that the highest yields of most crops are obtained on the terrace and the better drained bottom soils. The eroded areas of the Shelby and Lancaster soils are best suited to grazing and hay production, as are the more poorly drained parts of the bottom lands. The heavy well-drained bottom-land soils of the Wabash series are better adapted to corn than to small grains, as the latter often produce a rank vegetative growth at the expense of the grain and sometimes lodge. The highly calcareous soils of the Sogn series are recognized as being well suited to alfalfa. The more sandy members of the Shelby, Genesee, and Cass series are well adapted to the production of melons, as they are among the first soils to warm up in the spring. There is not enough variation in the adaptation of the soils to cause specialized farming in any part of the county.

There is no definite system of crop rotation commonly practiced in the county, although many farmers have evolved more or less indefinite systems which they employ on their farms. Corn is usually followed with small grain. The general tendency is to grow corn from two to four years, oats one year, and wheat three to four years, when the field is returned to corn. Frequently wheat is grown continuously on the same land for six years or longer. When grown year after year, the crop yields noticeably decrease. Oats are seldom grown more than one year in the same field, the crop being used chiefly as a step in the rotation between corn and some other small grain or alfalfa. Stubble ground is often seeded to alfalfa and the stand allowed to remain six to seven years before again planting to grain crops. A rotation which seems well adapted to most of the soils of Jefferson County is two years of corn, one year of oats, and two years of wheat, followed occasionally by alfalfa or some other leguminous crop.

Stubble and sod land is plowed in the fall if time permits. Where corn follows wheat or a hay crop, it is either listed or checkrowed on plowed and disked land. When land is plowed in the spring, the corn is more often listed. When corn follows corn the land is usually disked two or three times before the seed is listed. Many farmers cut the stalks with a stalk cutter before listing. Subsequent to the planting it is considered good practice to harrow the corn a few times before it is large enough to cultivate in order to keep down the weeds and conserve soil moisture. Small grain is usually sown with a press drill on well-prepared corn or stubble ground. Some farmers disk the corn land a number of times, harrow the fields, and then seed with a press drill. Wheat is sometimes sown between the corn rows in the fall. When alfalfa sod is broken, the land is usually used for corn two years

before small grain is planted. Corn is probably better adapted to recently broken alfalfa ground than small grains on account of its deeper rooting system, but even corn is subject to drought in dry seasons, as the alfalfa plant requires considerable moisture and leaves the ground in a comparatively dry condition.

Alfalfa requires a smooth, mellow seed bed and is usually sown after wheat or oats. The seed is generally sown broadcast and harrowed in, although a few farmers prefer seeding with a press drill on account of the more even stand obtained. Alfalfa does best when sown immediately after the first heavy rain in August. From 12 to 15 pounds of seed per acre are considered sufficient. Some alfalfa is planted with barley, wheat, or oats as a nurse crop.

As a rule the farms are well improved. Those operated by owners are usually kept in much better condition than the tenant farms. The houses and barns are generally painted and kept in good repair. The county has a general appearance of prosperity. The farms are fenced and cross-fenced with barbed wire, and most farmers have considerable woven-wire fencing around their hog lots. Modern labor-saving devices are in general use. Most farms are equipped with mowers, binders, rakes, harrows, disks, grain drills, riding cultivators, and plows, while a few farmers have in addition corn binders and tractors. There is a general effort to economize on manual labor by the increased use of machinery. Automobiles are in common use on most farms.

Not much attention is given to the use of commercial fertilizers. Some of the Lancaster, Carrington, and Shelby soils could be improved by the addition of ground limestone, such as could be found locally. Green crops are seldom turned under. Barnyard manure is applied to the land where available, but the supply is usually insufficient for best results. It is hauled in the spring or fall when farm work is light, and spread over the corn and wheat land. On the tenant farms most of the manure is applied on fields near the buildings.

The county is fairly well supplied with farm labor. Most of the work is done by farmers and their families. Farm laborers receive from \$30 to \$40 per month when hired by the year. The daily wage ranges from \$2.50 to \$4, and during harvest as high as \$5 per day, with room and board, has been paid. Corn shuckers receive three to four cents per bushel. During the last year (1921) wheat was threshed for seven cents per bushel and oats for three to four cents, depending upon whether threshed from the stack or from the shock. Many farmers hire labor by the year and thus guard against a labor shortage.

The farms vary considerably in size, ranging from a few acres to over 1,000. The average is about 190 acres. The census reports 1,827 farms in Jefferson County in 1920, of which 987 were operated by owners, 822 by tenants, and 18 by managers. On the tenant farms both the cash and share rental systems, or sometimes a combination of the two, are followed. The share system is the more common, being prevalent throughout the county, while the cash system is followed only occasionally, in connection with small plots of land used for truck farming. In the eastern and northern parts of the county, where the best farming land is located, the landlord receives two-fifths of the corn and one-third of the small grain delivered in town or to the nearest elevator. Alfalfa and other hay lands rent for half the

crop left in the stack. In the southwestern and southern parts of the county, where the land is generally rough and not very productive, one-third of the grain crop is delivered to the landlord. Pasture land rents for cash, rentals ranging from \$5 per acre in the northern and eastern parts of the county to \$2 in the rougher and drier southern and southwestern parts.

The value of farm land in Jefferson County ranges from \$30 to \$175 an acre, depending upon the topography, character of the soils, the improvements, and the location. The level to gently rolling table-land comprising the northeastern half of the county and the west-central part has a market value of about \$175 an acre. The rougher sections on the south side of Rose Creek are of little value, except for grazing land, and sell for \$25 to \$35 an acre. The terraces and the better drained parts of the bottom lands command about the same price as the better sections of the upland.

SOILS.

The soils of Jefferson County have been differentiated in this report into a number of series and types on the basis of their most obvious physical characteristics and their chemical constituents so far as these could be readily determined in the field. The characteristics of the soils of any region are the results of two factors. First, the character of the parent rock from which the soils are formed, and, second, the processes of soil formation, including weathering, leaching, aeration, and oxidation, to which the soils have been subjected during their development. The soil-forming processes, which are controlled to a large extent by climatic conditions, are believed to have been of greater influence in fixing the present character of the soils of this area than the composition of the parent rocks. Climatic conditions and topographic features of the area, with their resulting soil differences, have combined to prevent the growth of trees and to favor a dense growth of short grasses. The soils of the county have, therefore, been developed under a grass vegetation and have those characteristics which are everywhere impressed upon a true prairie soil.

The most obvious characteristic of the surface soils, and one that is common to prairie soils developed under the influence of a moderate supply of water, is their dark color. This color is imparted by finely divided organic matter derived from the decay of grass roots and intimately mixed with the constituents of the soil. All the soils of the county, with exception of small outcrops of material recently exposed to weathering, have dark surface soils varying in color, according to locality, topography, and type, from a dark grayish brown to almost black. The dark-colored soils fall into two groups whose differentiation is based on drainage conditions of soil or subsoil, or both, during their development.

The soils of one of these groups were developed under conditions of good soil and subsoil drainage. The typical profile has a surface layer of dark-brown color and finely granular structure ranging in depth from 8 to 15 inches. This is underlain by a transitional layer, usually very thin or a few inches in thickness, which changes in color gradually downward from dark brown to brown. The next lower layer has a brown or yellowish-brown color, a heavier texture than the two upper layers, and a coarse granular structure. At depths

ranging from 24 to 30 inches below the surface a yellowish-brown more friable material is encountered, which approaches the parent material in character. To this group belong the soils of the Carrington, Shelby, and Lancaster series on the upland and the Waukeshu series on the higher terraces. The Crawford and Sogn soils, derived from recently exposed materials, may be regarded as immature members of this group.

A second group of dark prairie soils were developed under conditions of somewhat restricted drainage of the subsoil or both soil and subsoil. They have surface soils of dark grayish brown or almost black color and a fine granular structure. These are underlain by gray or mottled grayish-yellow and brown subsoils, heavier as a rule than the surface soil. The details of the profiles of these soils vary considerably, depending upon the degree and manner in which oxidation, leaching, and other processes have acted. In the Grundy and Summit series of the upland a dark-brown intermediate layer usually exists between the black surface soil and the mottled horizon and generally where this transition layer is present the lower part of the 3-foot section is lighter in color and more friable and approaches in character more nearly the parent material. With this general group may be placed the soils of the Grundy and Summit series on the upland and the Wabash and Cass series on the poorly drained bottoms.

The only extensive light-colored soils which occur in this area belong to the Genesee series of the first bottoms. These soils have been developed on recently deposited alluvium made up mainly of sediment derived from light-colored geological formations and does not contain any great proportion of the black organic matter.

The principal characteristics which have been mentioned above are those imparted to the soil by the soil-forming processes, such as leaching, oxidation, and the accumulation of organic matter. It is believed that these forces have been predominant in fixing the most important characteristics of the soils. In the differentiation into series, however, account has been taken of the sources and processes of accumulation of the material from which the soils have developed.

The soils of Jefferson County may be divided, with respect to the origin of their parent materials, into four groups, loessial, glacial, residual, and alluvial.

The entire surface of the county was originally covered with a layer of plains loess. The soils derived from loess constitute the most extensive types of the area, but the deposit has been entirely removed in valleys and on steep slopes where erosion has been active, and remains only on the flat tops of the stream divides. These loess-covered areas, which make up a large proportion of the surface, except in the southern quarter of the county, are coextensive with the areas shown on the map as Grundy silt loam, this being the only soil type derived entirely from loess.

Below the loess lies the Kansan drift sheet. The upper weathered zone of this drift is silty, and in places it is difficult to distinguish the soils which it produces from the loess soils. The lower part or Kansan drift proper is a heterogeneous mass of clay, silt, sand, gravel, and boulders. The upper oxidized zone varies in color from yellowish brown to brown or reddish brown. The lower less oxidized drift is light gray or pale yellow, with numerous iron stains, and may con-

tain lime in the form of concretions, seams, and marly pockets. On the upper slopes, immediately below the loess soils, occurs the Carrington silt loam, which has weathered mainly from this drift, with some addition of loess in the surface soil. On slopes subjected to severe erosion the silty material has been entirely removed and the Shelby soil types have been developed on the Kansan drift proper.

The bedrock formations exposed in Jefferson County are the Dakota formation and the Graneros, Greenhorn, and Carlisle members of the Benton formation. The Dakota sandstone has produced the soils of the Lancaster series, which occur in the southern part of the county. The limestone and shales of the Benton formation are the parent material of the Crawford, Sogn, and Summit soils of the southern part of the area.

In the system of mapping employed by the Bureau of Soils, the soils are grouped in soil series on the basis of common characteristics of color, structure and origin. The series are divided into types on the basis of texture or the relative proportion of different-sized mineral particles. Eleven series, represented by 19 soil types and one phase, are recognized in Jefferson County. In addition to the above, Rough broken land is mapped.

The soils of the Grundy series are dark brown to black. The lower part of the soil or surface layer is lighter in color than the upper part, giving a suggestion of a subsurface gray layer. The upper subsoil is mottled, heavy, and rather plastic when wet or hard when dry, the mottling consisting of dark drab and yellowish brown. This passes gradually into a layer of somewhat lighter color and texture. In this county the subsoil below 30 inches is light colored and floury and usually calcareous. The topography is flat to gently rolling. The derivation is from silty material overlying the Kansan drift in Missouri, Kansas, Nebraska, and Iowa. The Grundy silt loam has been mapped in this county.

The soils of the types in the Carrington series are dark brown and the subsoil is yellowish brown to brown. These soils have developed upon glacial till, but the silty members are modified to some extent by loess. The topography is gently undulating to rolling and drainage is always good. The lime has been largely removed to depths of more than three feet. The series is represented here by the Carrington silt loam.

The Shelby series includes types with dark-brown and usually rather shallow soils. The subsoil is composed of brown or reddish-brown, sticky sandy clay, containing in many places coarse sand and gravel. Lime concretions and streaks of calcareous material are numerous in the lower subsoil. The Shelby types in this area are derived from the sandy Kansan drift. The topography ranges from gently to sharply rolling.

Types included in the Crawford series consist of dark-brown surface soils over a dark reddish brown to brown subsoil. These are prairie soils derived from limestone but the lime is largely leached to 3 feet or more.

The soils of the types grouped with the Summit series are dark brown to almost black, and the subsoil mottled yellow and gray. The types occupy smooth and nearly flat to sharply rolling prairies.

They are of residual origin and derived from calcareous shales associated with thick interbedded layers of limestone. The soils contain much organic matter. Drainage is usually established.

In the Sogn series are placed types with dark-colored surface soils underlain by a grayish-yellow, light-gray, or almost white floury subsoil, normally high in lime. The Sogn silt loam is an immature soil weathered from recently exposed limestone.

The soils of the types of the Lancaster series are brown to dark brown and the subsoil is light brown to light grayish brown. Both soils and subsoil have an open porous structure, and the more sandy types are rather droughty. The topography is rolling to hilly and the surface and internal drainage are good. The types are residual, being derived from sandstone.

The surface soils of types in the Waukesha series are dark brown and the subsoil is yellowish brown to brown. These soils usually occur in areas of deep glacial drift. They are derived from water-assorted glacial debris and loess deposited on broad filled-in valleys, outwash plains, and terraces. The topography is flat to undulating. Drainage is always good.

The Wabash series includes types with dark brown to black surface soils, and a gray or mottled subsoil. The soils are formed of recent-alluvial material derived principally from the loess and associated soils of the region.

In the Cass series are grouped types whose surface soils are dark brown to black. The subsoil, while variable, is lighter in color and texture than the soils. The lower subsoil usually consists of loose sand and gravel. These types occur on the lower bottoms and are subject to overflow.

The Genesee series includes types with light-colored surface soils underlain by a light-colored subsoil which may be of similar texture or heavier than the surface soil. In this area the series is developed from recently deposited sediments. The soils occur on the lower bottoms and are subject to frequent floodings.

In subsequent pages of this report the soils of Jefferson County are described in detail. Their distribution is shown on the accompanying map. The table below gives the actual and relative extent of each soil type.

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Grundy silt loam.....	138, 688	37. 5	Lancaster fine sandy loam.....	5, 504	1. 5
Carrington silt loam.....	78, 080	21. 1	Rough broken land.....	5, 312	1. 4
Shelby loam.....	24, 384	6. 6	Waukesha silt loam.....	3, 456	. 9
Wabash silt loam.....	21, 952	5. 9	Genesee very fine sandy loam.....	2, 880	. 8
Sogn silt loam.....	13, 888	4. 9	Summit silt loam.....	2, 432	. 7
Stony phase.....	4, 160		Waukesha very fine sandy loam.....	2, 304	. 6
Lancaster very fine sandy loam...	14, 656	4. 0	Crawford silty clay loam.....	1, 600	. 4
Wabash very fine sandy loam.....	13, 696	3. 7	Cass very fine sandy loam.....	1, 408	. 4
Crawford silt loam.....	13, 568	3. 7	Cass fine sandy loam.....	1, 408	. 4
Shelby very fine sandy loam.....	13, 440	3. 6	Genesee fine sandy loam.....	1, 152	. 3
Shelby gravelly sandy loam.....	5, 952	1. 6			
			Total.....	369, 920	-----

GRUNDY SILT LOAM.

The surface soil of the Grundy silt loam, as it occurs in this county, is typically a dark-brown to nearly black heavy silt loam 10 to 15 inches deep, with an average depth of about 12 inches. It is high in organic matter and friable, breaking down into a fine powder. The upper subsoil consists of dark-brown or dark-gray to nearly black, heavy and compact silty clay to clay. This material may extend to below the 3-foot section, though usually it passes at 28 to 32 inches into a yellowish-brown or pale-yellow silty clay loam of more friable and less compact structure than the upper subsoil. The substratum below 36 to 40 inches generally grades into the loose, floury, light-gray silt of the parent loess, and has an open and columnar structure. The material is usually calcareous below 30 inches, the lime existing chiefly in the form of small angular concretions from one-sixteenth to one-eighth inch in diameter. The heavy upper subsoil layer is stiff and plastic when wet and becomes hard, tough, and almost impervious upon drying. It is locally referred to as "hardpan" by the farmers and where exposed is called "gumbo." The transition between the soil and upper subsoil is very gradual both in color and structure, while that between the two subsoil horizons is abrupt.

A few variations occur. Locally where erosion has greatly thinned the loessial mantle, small scattering pebbles are occasionally found on the surface. The type includes small areas in which the hardpan layer is not developed and the upper subsoil is only slightly more compact than the surface soil. In these localities the surface soil is a dark-brown heavy silt loam about 15 inches deep, and the subsoil is a light-brown slightly compact silty clay loam, which at about 30 inches changes to a yellowish-gray silt loam or silty clay loam having a loose floury structure. This variation is similar to the Grundy silt loam as mapped in parts of Seward and Gage Counties. It occurs in the more rolling parts of the type and along the edges of draws where the type gives way to the Carrington silt loam. In a few places along shallow valleys the surface and upper subsoil layers have been entirely removed, exposing the light-colored highly calcareous subsoil.

The Grundy silt loam is the most extensive soil in Jefferson County. It occupies the table-lands and broader divides throughout the northern half of the county. It is also extensively developed throughout the uplands in the vicinity of Gladstone, north of Reynolds and Thompson, and west of Fairbury. In the southeastern part of the county the type occurs only upon the higher divides.

The type represents weathered remnants of the original loessial mantle which have escaped destructive erosion. The heavy compact nature of the upper subsoil is due to the downward leaching of the finer soil particles from the surface soil and their concentration in the lower strata. The soil occupies the highest positions in the county, occurring on the flat to gently undulating and in places slightly rolling tablelike areas between drainage channels. Around the margins of the type where it gives way to lower lying areas of other soils, the headward erosion of small intermittent drainage ways has created rather deep U-shaped valleys, producing a gently rolling relief.

Drainage over most of the type is good. It is usually sufficient even on the flat areas during normal seasons. In wet years the surface drainage is in places inadequate and the heavy, compact subsoil retards underdrainage. In local depressions water accumulates and remains on the surface for periods of a few days to several weeks after heavy rains. The total area of poorly drained land is very small, however, even during seasons of excessive precipitation. In dry years crops sometimes suffer from lack of moisture, as the compact subsoil prevents a sufficiently free upward movement of capillary water to supply their growing needs during periods of high temperature and hot winds.

The Grundy silt loam is the most important agricultural soil in Jefferson County. Its large extent, high organic matter content, and level topography tend to make it the leading soil for general farming. It was originally covered with a heavy growth of prairie grasses, but the native sod has practically all been broken for the production of grain and cultivated hay crops. Corn occupies the largest acreage, followed by wheat, oats, and alfalfa, ranking in acreage in the order named. Rye, barley, Sudan grass, and sorghums are grown for feed on many farms. Wheat is the chief cash crop and is usually sold in the local elevators soon after threshing. The raising of hogs is an important industry and many farms have large herds. Cattle feeding is practiced as extensively on this type as on any soil in the county, but it is of secondary importance, as most of the farmers are engaged in grain production and hog raising. Many farmers fatten three or four cows or steers for market each winter and a few feed a carload or two. Most of the corn, oats, and alfalfa is fed on the farms where produced.

Crop yields vary widely, depending upon the seasons and the care taken in handling the land. In normal years corn yields 30 to 35 bushels per acre, although yields of 50 and 60 bushels are common on well-managed fields in favorable seasons. In exceptionally dry seasons the yields are often very low, as the soil does not withstand droughts so well as the types having less compact subsoils. The average yield of wheat is about 18 bushels and of oats about 25 bushels per acre. These crops suffer less from drought than corn, as they usually mature before the dry weather and hot winds occur. Oats are not considered as profitable as either corn or wheat but are valuable as a step in the rotation between the two. Barley is sometimes substituted for oats in the rotation. The yield ranges from 20 to 25 bushels per acre. Alfalfa is the principal hay crop. It is usually cut three times, though during long seasons a fourth cutting is sometimes obtained. The yield ranges from 2 to 4 tons per acre, depending upon the rainfall. Millet yields from 1½ to 2½ tons per acre and Sudan grass 2 to 3 tons.

The Grundy silt loam is a rather heavy soil and requires strong machinery and heavy draft animals if the largest returns are to be realized. It can be cultivated under a rather wide range of moisture conditions, considering its fine silty texture. When plowed wet clods are formed, but the lumps are easily reduced by disking or harrowing. Tractors are operated on a few of the larger farms as the level topography is favorable to their use.

Wheat is sown with a press drill in the fall on double-disked corn or stubble land. Corn is usually listed in, though a few farmers

prefer to plant in checkrows so that the crop can be cultivated in several directions and more easily kept free from weeds. Oats are usually drilled in during the latter part of April or early May. Alfalfa is sown broadcast on plowed, double-disked, or harrowed stubble land. Commercial fertilizers are not used and little barnyard manure is available on account of the small number of cattle kept on this type.

Land of the Grundy silt loam sells for \$100 to \$175 an acre, depending largely upon improvements and location with respect to markets.

This type is naturally strong and fertile and will withstand severe cropping to one grain. Its productiveness is gradually diminishing, however, especially on the tenant farms. It is advisable to establish and use a more definite system of crop rotation, including a considerable acreage of alfalfa, sweet clover, or other legume. Heavy applications of barnyard manure obtained by raising more livestock would also be very beneficial to the soil. At present practically nothing is being done to maintain its productive power.

CARRINGTON SILT LOAM.

The surface soil of the Carrington silt loam is a dark-brown heavy silt loam, 8 to 15 inches deep, with an average depth of about 12 inches. It is thickest in the smoother areas where erosion has been least active. The soil is rich in organic matter and rather friable considering its heavy texture. The upper subsoil is a brown compact silty clay usually faintly mottled by lighter brown, though where thoroughly oxidized the mottling is entirely absent. Below 24 or 30 inches the subsoil becomes lighter in color and more friable, changing to a gray or in a few places yellow mottled with gray, and more or less stained with brown iron oxides. The change from soil to subsoil is rather gradual though distinct. Lime concretions occur in the substratum but rarely in the subsoil. Some pebbles and occasional boulders occur on the surface and throughout the soil section.

A few variations occur. Locally surface wash from the higher levels has accumulated at the foot of slopes, and the resultant soil is a dark-brown to black heavy silt loam, 20 to 40 inches deep. This material is usually underlain by the brown compact silty clay of the typical subsoil. Along many of the minor drainage ways narrow strips occur from which the dark surface soil has been removed by erosion, exposing the lighter colored subsoil. In these the surface material is a brown to light-brown rather heavy silty clay, 4 to 6 inches deep. This grades into a gray silty clay, which becomes lighter in color and slightly heavier in texture with depth. This variation is deficient in organic matter and is generally calcareous throughout the 3-foot section. In places along Rock Creek and a few of the deeper stream valleys, where erosion has greatly thinned the parent drift, the soil has been considerably modified by residual material from the underlying limestone. Here the soil is a dark-brown heavy silt loam 6 to 8 inches deep, underlain by a light chocolate brown heavy silty clay, which at 24 to 30 inches passes into a reddish-brown material differing little in texture or structure from the layer above it. In a few places erosion has removed the soil and upper subsoil, exposing the reddish substratum. These variations are all of such small extent

and local occurrence that they did not warrant separation on the soil map.

The Carrington silt loam differs from the Grundy silt loam in the lighter color of its surface soil, and in the lighter and more friable character of its subsoil. The type occupies the slope land or destructional topography, whereas the Grundy silt loam occupies high, almost flat constructional areas. The Carrington silt loam contains a few pebbles, while the Grundy silt loam has practically none. Even with these differences the types grade into each other so that the boundaries are difficult to establish and in places are more or less arbitrary.

The Carrington silt loam is the second in extent of the soils in Jefferson County. It occurs throughout the uplands, within or closely associated with the areas of Grundy silt loam. The type is developed where erosion has removed the original loess mantle and exposed the weathered surface of the underlying drift. In the more severely eroded areas, where streams have cut deeply into the drift deposit, the type occupies the upper slopes below the areas of Grundy silt loam, while the lower slopes are occupied by the Shelby soils. The type is practically wanting in that part of the county lying west of the Little Blue River, as there is very little drift here and the loessial mantle, where not removed by erosion, usually rests upon the underlying bedrock formation. The type is most extensive in the southeastern part of the county throughout the area lying east of the Little Blue River and south of Jansen and Harbine, where erosion has removed most of the loessial materials, and the drift is exposed over large areas. Throughout the remainder of its occurrence the type is confined to the valley slopes along the larger streams.

The Carrington silt loam represents the weathered surface of the coarse gravelly Kansan drift sheet which once covered the greater part of the county. Its fine texture is due partly to prolonged weathering, partly to textural differences within the drift, and largely to an admixture of fine silty material from the loessial deposit.

The topography ranges from gently rolling to hilly. The stream valleys, though numerous, are usually shallow. The slopes are gradual and the hill tops and divides well rounded. The type is thoroughly drained. In the more hilly sections the run-off is excessive and erosion is serious. The areas of Shelby soils are gradually increasing at the expense of the Carrington silt loam. With proper tillage and crop rotation this soil, owing to its rather high content of organic matter, is very retentive of moisture.

The Carrington silt loam is one of the most important farming soils in Jefferson County, ranking next to the Grundy silt loam in agricultural value. It is naturally strong and fertile and well adapted to all crops common to the region. Practically all of it, excepting a few small areas in pasture, is under cultivation. Corn, wheat, oats, and alfalfa are the leading crops, ranking in acreage in the order named. Corn does well, yielding 30 to 40 bushels per acre during normal years. The average yield of wheat is about 20 bushels, oats 30 bushels, and alfalfa 3 to 4 tons from 3 cuttings. During dry years crop yields are somewhat reduced. However, even during dry seasons the production is probably higher than the general average for eastern Nebraska, owing to the high water-retaining power of the soil.

Timothy and clover are not commonly grown owing to the difficulty experienced in obtaining a stand. The area of white sweet clover, however, is gradually being extended to take the place of alfalfa, which is not well adapted to short rotations. A few farmers grow kafir and sorgo for fodder.

Most of the corn and alfalfa is fed on the farms where produced or is sold locally to cattle feeders. The oats are fed chiefly to work stock. Wheat is hauled from the threshing machine direct to local elevators and later shipped to outside markets.

Stock raising is not practiced extensively, though every farm has a few milk cows, and some farmers fatten from one-half carload to two carloads of beef cattle each year. Hogs are raised on all farms. Most of the livestock is shipped to St. Joseph and Kansas City markets.

The Carrington silt loam is rather difficult to handle unless properly managed. When plowed wet it bakes and forms clods which are difficult to reduce. If plowed when dry the soil turns up in large lumps. During average moisture conditions, however, the soil is easily kept in good condition. In exceptionally dry seasons small seams and cracks form on the surface, but the resultant loss of moisture is seldom excessive and the type withstands drought as well as any of the upland soils.

Commercial fertilizers are not used in growing the staple crops, and the supply of barnyard manure is seldom adequate for the best results.

The selling price of farms on the Carrington silt loam ranges from \$100 to \$150 an acre, depending largely upon improvements and location.

The strong fertile nature of this soil has caused most farmers to overlook the necessity of careful management in order to maintain its present productiveness. Systematic crop rotation is not practiced, although many farmers follow rather indefinite systems subject to numerous substitutions. Leguminous crops should be grown at least once in every four years. It is good practice to plow under an occasional crop of sweet clover in order to increase the organic content. A good rotation for this soil would be corn 1 or 2 years, oats 1 year, wheat 1 year, and alfalfa or clover 2 to 4 years, returning to corn.

SHELBY GRAVELLY SANDY LOAM.

The Shelby gravelly sandy loam to a depth of about 6 inches is a grayish-brown to reddish-brown mixture of sand, clay, and gravel, having a friable, crumbly structure. The immediate surface is sometimes slightly darker in color than the lower part, owing to a small amount of organic matter. The subsoil is a reddish-brown gravelly clay, only slightly more compact in structure than the surface layer. This material usually continues throughout the 3-foot section, but in places at about 24 inches it passes into a gray to grayish-brown gravelly sand containing very little clay. The type is very deficient in organic matter and, as a rule, is not noticeably calcareous within the 3-foot depth. In a few places the type consists of a loose porous mass of coarse sand, gravel, and small bowlders throughout the 3-foot section.

The Shelby gravelly sandy loam is not very extensive in Jefferson County. It is confined chiefly to a few small bodies and narrow

strips upon the steeper slopes along the Little Blue River. One of the largest developments, including about 640 acres, lies southeast of Fairbury on the north side of the stream. A fairly uniform area lies south of Powell in the west-central part of the county.

The type is derived from the Kansan drift sheet. The weathering is incomplete, and over much of the area of its occurrence the soil differs only slightly from the unweathered parent material. It usually occupies steep and more or less gullied slopes, with occasional areas of gently rolling land. Drainage is everywhere excessive.

This type is of little agricultural importance on account of its low organic matter content, gravelly nature, and excessive drainage. Practically all of it is included in pasture land. Corn, alfalfa, and oats are grown on a few of the more favorably situated areas, but they seldom yield as well as on the better upland soils. The soil warms up early in the spring and is fairly well adapted to garden vegetables and melons, and a small part is used for these crops. The native vegetation consists largely of the common prairie grasses. About 30 per cent of the type is covered with scrub timber, including fairly dense mixed stands of bur oak, cottonwood, hackberry, elm, ash, and boxelder. The soil is droughty, and during dry seasons even the pasture grasses wither and die down.

This type is usually sold in connection with better soils. It has a tendency to lower the general value of the farms on which it occurs.

SHELBY VERY FINE SANDY LOAM.

The surface soil of the Shelby very fine sandy loam is a brown to dark-brown, friable, very fine sandy loam 8 to 10 inches deep. The soil usually contains considerable silt and some fine sand, though little material of a coarser nature, and is rich in organic matter which imparts the dark color. The subsoil is a reddish-brown sandy clay which usually continues to below the 3-foot depth. The material has a plastic gritty feel when wet, but becomes brittle and crumbles easily upon drying, and the sand is largely of the medium and coarse grades. The transition between the two soil layers is quite abrupt. Neither the soil nor the subsoil is noticeably calcareous, and the latter is very deficient in organic matter. Scattering pebbles and occasional small boulders occur upon the surface and throughout the soil section.

A few variations are included. Around the margins of the type, where it borders areas of the Shelby loam or of the Carrington silt loam, the soils merge gradually into one another and it is often necessary to draw arbitrary lines separating them. In places on the steeper slopes the surface layer has been largely removed by erosion. Here the type consists of a brown to light-brown very fine sandy loam about 4 inches deep, underlain by a reddish-brown gravelly clay to about 24 inches, below which the gravel and small boulders become so abundant as to prevent penetration with a soil auger.

The Shelby very fine sandy loam does not occupy a large total area in Jefferson County. It occurs as numerous, usually small bodies and narrow strips upon the lower slopes bordering the flood plains throughout the greater part of the area. The largest developments border the bottom and terrace lands along the Little Blue River. The type is locally developed along Little Sandy, Big Sandy, and Cub Creeks and many smaller drainage ways. One of the largest and most

typical areas lies north of Powell in the west-central part of the county. A narrow strip borders the bottom and terrace lands near the junction of Rose Creek and the Little Blue River. A rather long, narrow strip lies south of Endicott, on the south side of the river. The remaining areas seldom exceed 320 acres in size.

The type has been derived through weathering from the Kansan drift proper. It is associated with the Carrington silt loam, which has been derived from the weathered surface of the drift sheet, while the Shelby very fine sandy loam is on eroded areas within the drift. The Shelby soil has been subject to less prolonged weathering and contains more coarse material, especially in the subsoil. The relatively fine texture of the surface is due largely to the addition of silty materials washed from the higher lying Carrington soil.

The Shelby very fine sandy loam generally occupies the lower and steeper slopes between the areas of Carrington silt loam and the flood plains or terraces along streams. The surface is steeply sloping and usually rather gullied. The surface drainage is usually excessive and erosion severe. The type has free internal drainage, owing to the porous nature of its subsoil. The soil has a low water-retaining capacity and is rather droughty during dry weather.

Owing to its small extent, unfavorable topography, and excessive drainage, the type is of little agricultural importance in Jefferson County. About four-fifths of it remains in native grasses and the remainder, including the less eroded parts, is under cultivation to corn, oats, and alfalfa. The grazing of beef cattle and milk cows is the principal industry. The cattle are mostly native stock. Very little winter feeding is practiced, as most of the beef animals are sold to feeders located on better cropping soils. The native grasses on this type will support 40 to 60 head of cattle per quarter section during the summer grazing season. The average yield of corn is about 25 bushels, oats 20 to 25 bushels, and wheat about 18 bushels per acre. The soil warms up early in the spring and is well adapted to all vegetables, but the absence of local markets prevents its extensive use for market gardening. Many of the farm gardens and melon fields are located on this soil.

The Shelby very fine sandy loam is easy to handle and can be cultivated under almost any moisture conditions without injury, provided care is taken to prevent erosion. No commercial fertilizer is used, although much of the barnyard manure is applied to this soil. The supply is seldom sufficient for best results.

The type is always sold in connection with the more productive upland, terrace, and bottom-land soils, and has a tendency to lower the general value of the farms on which it occurs.

SHELBY LOAM.

The surface soil of the typical Shelby loam, as it occurs in Jefferson County, is a friable brown to dark grayish brown loam to sandy loam 6 to 10 inches deep. It contains considerable silt and organic matter, a large proportion of the several grades of sand and gravel, and a few boulders. The upper subsoil is a brownish-yellow or reddish-brown clay loam containing considerable coarse sand and fine gravel. The material is moderately compact in its natural condition, though when dry it is brittle and crumbles easily. Below 30 inches

the subsoil becomes lighter in color and consists of a grayish-brown mass of coarse sand and fine gravel loosely cemented with clay. The change from surface soil to subsoil is abrupt. The type contains only traces of organic matter below 18 inches and is deficient in lime throughout the 3-foot section.

Although the soil described above occupies the greater part of the type there are numerous variations. Along many of the larger creeks throughout the northern part of the county are local areas in which the surface soil is slightly heavier in texture than typical, probably owing to the addition of silt and clay washed from the higher lying Carrington and Grundy types. In these places the surface soil is a heavy silty clay loam containing a large proportion of coarse sand and some fine gravel. The subsoil is a grayish-brown, compact gravelly clay, which usually continues to below the 3-foot depth, although it may pass abruptly at about 30 inches into a reddish-brown mass of coarse sand and gravel loosely cemented with clay. Locally along the Little Blue River and its tributaries the surface soil has become so mixed with sand that it has assumed a fine sandy loam to loamy sand texture. The subsoil in these localities contains less clay and more sand than typical and has a rather loose open structure. In a few places throughout the type the subsoil below 30 inches contains so much gravel as to be almost impenetrable with a soil auger. Throughout the type are small areas from which the dark-colored surface soil has been entirely removed by erosion, exposing the brown to reddish-brown gravelly clay subsoil. Over local areas the subsoil below 24 inches contains a little lime, chiefly in the form of angular concretions from one-sixteenth to one-fourth inch in diameter. These variations, although rather numerous and of large total area, are not sufficiently extensive in any one locality to warrant their separation on the soil map.

The Shelby loam is rather extensively developed in Jefferson County. It occurs as numerous strips and small bodies along most of the larger creeks in the northern, central, and eastern parts of the county. It is also well developed in the Little Blue River valley throughout its distance across the area. The bodies are seldom continuous though often rather long. The type usually occupies the lower and steeper slopes between the areas of Carrington silt loam and the flood plains. Two of the largest developments, with a combined area of about two square miles, lie near the mouth of Little Sandy Creek. Another large area lies north of Steele City in the southeastern part of the county.

The Shelby loam is derived through weathering from the Kansan drift sheet, but is more or less influenced by silty wash from the fine-textured upland soils. The bowlders and pebbles on the surface and the gritty or sandy clay subsoil distinguish it from the Carrington silt loam.

Drainage is everywhere thorough and in many places excessive. Erosion is a serious factor over most of the soil. The type is not as drought resistant as the Carrington silt loam. The subsoil, however, retains moisture remarkably well because of its high clay content and crops suffer only in seasons of prolonged drought.

The type is not important agriculturally, owing to its unfavorable topography, excessive drainage, and high stone content. Only a small proportion is under cultivation. The native vegetation consists of a

good growth of the common prairie grasses and some scrub-oak timber. The oak does well and spreads rapidly where not cut for firewood and post material. About 2 per cent of the type is still in forest; the greater part is in native hay and pasture land. The type is the principal grazing land throughout the northeastern half of the county and cattle grazing is practiced quite extensively. Most of the cattle are raised locally, though a few farmers ship in a carload or two each year for summer grazing. The animals are sold in the fall to local feeders or shipped to outside markets. Dairying is practiced as extensively on this type as on any soil in the county. Most farmers keep 4 to 10 cows, chiefly of the beef breeds. The surplus cream is shipped or hauled to the creameries at Fairbury, Beatrice, and Lincoln. The native grasses on the Shelby loam will support 70 to 80 head of cattle per quarter section during the summer grazing season, or when cut for hay will yield three-fourths to 1 ton per acre. Of the cultivated crops, corn occupies the leading acreage and yields 20 to 30 bushels per acre. The average yield of oats is about 20 bushels and of wheat 18 bushels per acre. Alfalfa does quite well on the more gradual and less gravelly slopes, yielding 2 to 3 tons per acre.

The soil is handled in the same manner as the other upland soils of the county. Over the greater part of the cultivated areas little difficulty is experienced in obtaining a loose, mellow seed bed. In the heavier textured parts, however, moderate moisture conditions are required for best results, as the soil clods are usually difficult to reduce. In the more stony areas cultivation is necessarily slow and difficult. No commercial fertilizer is used. Barnyard manure is applied when available, but most of the soil has received little or no manure since first broken.

The selling price of the Shelby loam ranges from \$35 to \$85 an acre, depending upon the topography, improvements, location, and the adaptability to crop production.

CRAWFORD SILT LOAM.

The surface soil of the Crawford silt loam is a brown friable silt loam about 12 inches deep. On the flatter areas the soil occasionally reaches a depth of 18 inches. It is rich in organic matter, which imparts the dark color. The subsoil is reddish-brown, heavy, and rather compact silty clay loam containing sufficient sand to give it a gritty feel. It is stiff and plastic when wet but becomes hard and crumbly upon drying. The transition from the surface soil to the subsoil is very gradual, both in color and texture. Small scattering pebbles are occasionally encountered below an average depth of 30 inches, and locally in the more rolling sections, where erosion has greatly thinned the weathered surface soil, lime is abundant at a depth of 24 inches, occurring in both the finely divided form and as numerous small concretions. In the more level lying areas the calcareous material has been leached to below the 3-foot section. The substratum becomes lighter in color and texture and consists of a yellowish-brown friable silt to silt loam.

Included with this type are small areas of Crawford silty clay loam. They usually occur along the narrow drainage ways where erosion has removed the weathered surface soil and exposed the reddish-

brown silty clay subsoil. Where such areas were of sufficient size they were mapped separately.

The Crawford silt loam is rather extensively developed north of Reynolds and Thompson in the southwestern part of the county. It occupies the rolling slope land between the higher lying divides of Grundy silt loam and the flood plains along streams. Typical developments may be seen throughout the Buckley Creek valley and along the larger drainage ways south of Gladstone.

The type is of residual origin. It has weathered directly from the underlying limestones and shales of the Benton formation. The lime which occurs so abundantly in the parent materials has been largely leached out below the 3-foot depth.

The surface over the greater part of the type varies from gently undulating to steeply rolling. On some of the lower divides the topography is nearly flat. Very little of this soil is too rough for farming. Drainage is everywhere thorough and in many places excessive. Erosion is becoming a serious factor in the steeply rolling sections.

The type is a rather important agricultural soil in Jefferson County. It is naturally productive, quite retentive of moisture, and well adapted to all crops common to the region. About 90 per cent of it is under cultivation and the rest is devoted to pasture, woodlots, and building sites.

Corn is the leading crop. During average years it yields from 30 to 40 bushels per acre. Wheat ranks second in acreage, with average yields of about 18 bushels per acre. Turkey is grown chiefly. Oats and barley are grown in a small way for feed, and are usually grown between corn and wheat in the rotation. Oats yield about 25 bushels and barley 20 bushels per acre. Alfalfa does well on this soil because of the high lime content in the substratum. The crop is very beneficial to the land, as it checks erosion, adds nitrogen, and increases the content of organic matter. It yields 3 to 4 tons per acre from three cuttings.

The soil is handled in the same manner as the Carrington silt loam. It can not be cultivated under quite as wide a range of moisture conditions, however, as the soil bakes if plowed while wet and when very dry does not break up well under cultivation. On many of the tenant farms the land has received little manure for many years and the productiveness is materially decreasing. The more progressive farmers apply all the available manure and plant considerable alfalfa in order to maintain the fertility. Few of the farmers keep enough livestock to increase the productiveness of the soil. There are seldom more than 10 or 12 cattle on the average farm and only enough horses to supply the motive power.

Farms on the Crawford silt loam range in value from \$65 to \$125 an acre, depending upon the location, topography, improvements, and condition of the land.

CRAWFORD SILTY CLAY LOAM.

The surface soil of the Crawford silty clay loam to a depth of about 10 inches is a heavy silty clay loam of brown or reddish-brown color. Locally the soil contains considerable very fine sand but little material of a coarser nature. It is quite sticky and plastic when wet and

becomes hard and brittle upon drying. The subsoil is a heavy, compact clay or silty clay, slightly darker in color and more compact in structure than the surface soil, and continues to below the 3-foot depth with but little change. Scattering pebbles are occasionally encountered in both soil and subsoil. The type is seldom calcareous within the 3-foot section, but lime is abundant in many places below 4 feet, chiefly as small angular concretions. The type is low in organic matter and is conspicuous in cultivated fields because of its reddish color. The soil differs from the Crawford silt loam chiefly in its heavier texture and lower organic content; it is in reality an eroded phase of that type and occurs wherever surface wash has removed the dark-colored soil of the silt loam, exposing the reddish-brown subsoil.

The Crawford silty clay loam is not extensive in Jefferson County. It occurs chiefly as narrow disconnected strips upon the lower slopes within the areas of Crawford silt loam. The largest developments are along Rose Creek and a few of its tributaries in the southwestern part of the county. The areas seldom exceed 160 acres. One of the longest strips is along the north side of Buckley Creek, about 2 miles northeast of Reynolds; a smaller though typical area lies northwest of Kesterson, in section 4, T. 1 N., R. 2 E.

The surface of the type is usually steeply sloping and is precipitous in a few places. Drainage is excessive and erosion severe.

This type is of little agricultural importance in Jefferson County on account of its small extent, unfavorable topography, and low organic matter content. Much of it, however, is included within areas of Crawford silt loam and is under cultivation. It is a poor cropping soil and where possible it has been left in pasture. A few of the larger and less steeply sloping areas have been sown to alfalfa, which does quite well, yielding $2\frac{1}{2}$ to $3\frac{1}{2}$ tons per acre, although considerable difficulty is experienced in obtaining a stand. On land that has received heavy applications of barnyard manure the yield of corn is increased from about 12 to 30 or 35 bushels per acre, and yields of wheat are increased proportionately.

The soil is difficult to handle on account of its heavy, compact structure. It clods badly when plowed wet and remains in an impaired condition until subsequent freezing and thawing or wetting and drying have restored granulation. It is almost impossible to plow the land when extremely dry.

This type usually occupies only a small part of the farms on which it occurs. It has a tendency to lower the general value of the land where it occupies a considerable acreage.

The chief need of this soil is organic matter in the form of barnyard or green manures. Leguminous crops, such as alfalfa or clovers, are very beneficial, as they increase the humus content, add nitrogen, and prevent destructive erosion. Deep tilling and the plowing under of green crops would also prove beneficial. Surface erosion could be largely controlled by deeper plowing to increase the water-retaining power of the soil. Contour cultivation and planting, especially of listed corn, would also decrease the danger of washing.

SUMMIT SILT LOAM.

The surface soil of the Summit silt loam is a very heavy, dark-gray to almost black silt loam 12 to 18 inches deep. It is relatively high in clay and over much of the type it approaches a silty clay loam in texture. It is rich in organic matter. In its natural condition the soil is crumbly and friable, but it becomes hard and brittle upon drying. The upper subsoil is a gray to light-gray, heavy silty clay of compact structure. Over much of the type this layer resembles a clay pan. It continues to an average depth of about 24 inches. The lower subsoil is a yellowish-gray to almost white, fine-textured silty material of decidedly less compact structure than the layer above it. This continues to below the 3-foot section. The transition between the different soil layers is very gradual in color, texture, and structure. Small reddish-brown iron stains are abundant throughout the 3-foot depth. The surface soil has a low lime content, but the subsoil is highly calcareous below 24 inches, the lime existing in both the finely divided form and as numerous small concretions.

The type varies little in character throughout the area of its occurrence. In the more hilly sections it has an intermediate layer less compact than elsewhere. It differs from the Grundy silt loam chiefly in the lower humus and higher lime content of its subsoil and consequently lighter color. The type is of residual origin, having weathered chiefly from the limy shales of the underlying bedrock.

The Summit silt loam is not extensive in this county. It occurs chiefly in a few small areas scattered throughout the uplands west of the Little Blue River and south of the railroad in the southern part of the county. Two of the largest areas lie about 2 miles west and 3 miles southwest of Steele City. A typical area lies southeast of Thompson. The remaining areas are few and small, seldom exceeding 160 acres.

The topography ranges from rolling to hilly. The type is thoroughly dissected by small intermittent stream channels which have carved the surface into a succession of shallow V-shaped valleys separated by narrow though usually rounded divides. Drainage is everywhere thorough and in most places excessive, and erosion is usually severe.

Owing to its small extent and unfavorable topography the type is of little agricultural importance in Jefferson County. It is also rather droughty, owing to the heavy compact subsoil layer, which prevents a sufficiently free upward capillary movement of water to supply the needs of growing crops, especially during dry seasons. About half of the type is under cultivation to wheat, corn, and alfalfa, and the remainder is included in pasture and hay land. During protracted dry spells both crops and native vegetation suffer for lack of moisture.

In average seasons the prairie grasses will support 30 to 40 cattle or horses per quarter section during the summer grazing season, or when cut for hay will yield three-fourths ton to $1\frac{1}{4}$ tons per acre. In very dry years little hay is cut. Wheat is the chief cultivated crop and yields 15 to 20 bushels per acre during normal seasons. In dry years the yield is sometimes too low to warrant harvesting.

Corn yields 15 to 40 bushels and alfalfa 1 to 3 tons per acre, depending upon the rainfall. The alfalfa is usually cut twice.

The soil of this type is difficult to handle and can be worked only within a narrow range of moisture conditions. It bakes and clods badly when plowed wet and the lumps are difficult to reduce. Most farmers prefer to keep this soil in pasture and cultivate the better types.

Land of the Summit silt loam sells for \$80 to \$100 an acre, depending upon the character of the other soils included in the farm.

SOGN SILT LOAM.

The surface soil of the Sogn silt loam is a gray to dark-brown heavy silt loam with an average depth of about 12 inches. It is usually well supplied with organic matter. The change from soil to subsoil is rather abrupt. The subsoil is a grayish-yellow or light-gray silt to silty clay, mottled with numerous white splotches and yellowish-brown iron stains. It is slightly more compact in structure than the surface layer. The subsoil usually continues to below the 3-foot depth. The surface soil is slightly calcareous in places and the subsoil has a high lime content.

A few variations are included. On the more gradual slopes, where conditions have especially favored deep soil weathering and the accumulation of organic matter, the soil is often very dark brown to almost black in color and about 15 inches deep. On the steeper slopes, where erosion has been severe, the dark-colored soil has been greatly thinned and consists of a gray to light-brown silt loam seldom over 8 inches deep. In a few places the soil has been entirely removed, exposing the light-gray subsoil, the surface of which has been only slightly darkened by organic matter. Locally around the heads of drainage ways and upon the steeper slopes and sharper ridge crests both soil and subsoil have been removed by erosion, exposing the light-gray to cream-colored limestone from which the soil has weathered. These variations are usually of such small extent and local occurrence as to not warrant showing on the soil map.

The Sogn silt loam is rather extensively developed in Jefferson County. It occurs chiefly south of Rose Creek in the southern part and along the Little Blue River in the west-central part. The areas are usually irregular and vary in size from a few acres to about 5 square miles. As a rule they are broken by numerous developments of other upland types and narrow strips of bottom land within their borders. Some of the largest and most typical areas lie south of Reynolds and Thompson, in the southwestern part of the county. A large area occupies the slope on the south side of the Little Blue River, in the west-central part. The remaining areas are usually small, seldom exceeding 320 acres.

The topography varies from gently rolling to hilly. The greater part has a sharply rolling relief. Drainage is everywhere good, and over most of the area surface run-off is excessive and erosion a serious factor.

The type is of residual origin, having weathered from the Greenhorn limestones of the Benton formation. It differs from the Crawford silt loam chiefly in the larger humus content of its surface soil

and in the lighter color and more calcareous nature of the subsoil. The type much resembles the Summit silt loam, except for its less compact subsoil.

The Sogn silt loam is not an important agricultural soil in Jefferson County, because of its unfavorable topography and excessive drainage. It is quite fertile, retentive of moisture, and in the moderately rolling areas is well adapted to farm crops. The native vegetation consists chiefly of buffalo grass, bunch grass, and blue grass. Fairly dense mixed stands of cottonwood, elm, hackberry, willow, and dogwood border the larger drainage ways. About 60 per cent of the soil is under cultivation and the remainder is included in pasture land and woodlots. The grazing of beef cattle is practiced extensively. Most of the animals are native raised, although a few farmers ship in stock for summer grazing. Hereford and Shorthorn are the principal breeds. Hogs are raised on all farms where corn is produced, and some farmers have large herds of the Duroc-Jersey, Hampshire, or Poland-China breeds.

Corn is the leading cultivated crop and yields from 30 to 40 bushels per acre during average seasons. The soil is especially well adapted to alfalfa on account of its high lime content. Alfalfa yields $3\frac{1}{2}$ tons per acre from three cuttings. It should be grown more extensively, as it checks erosion, adds humus and nitrogen, and produces good yields of hay. Wheat is grown to a small extent, Turkey being the principal variety. Yields range from 15 to 25 bushels, depending upon the rainfall. Oats are grown as a step in the rotation between corn and wheat or alfalfa, and yield 25 to 30 bushels per acre.

The Sogn silt loam is handled in much the same manner as the other upland soils of the county. It can be cultivated under a rather wide range of moisture conditions, considering its heavy silty nature. Clods are formed if plowed when wet, but the lumps are easily reduced. The uneven topography and danger of erosion are the chief factors limiting the area of cultivated land. No commercial fertilizer is used, but barnyard manure is applied when available.

The selling price of the Sogn silt loam ranges from \$50 to \$125 an acre, depending largely upon the topography. The improvements and the location with respect to markets are also important in governing the sale price.

In cultivating this soil it is advisable to use every possible means to prevent erosion and maintain the organic-matter content. A larger acreage in alfalfa, sweet clover, or other legumes would assist greatly in obtaining the desired results. After gullies have been formed it becomes more difficult to control erosion. Small dams of brush, stone, or rubbish anchored in the gullies at short intervals will decrease the velocity of the current and cause it to deposit much of its sediment.

Sogn silt loam, stony phase.—The stony phase of the Sogn silt loam includes the more eroded and rougher parts of the silt loam type. It occurs wherever the underlying bedrock is either exposed or lies so near the surface that it hinders cultivation. The phase is not extensive. It is confined to the steeper valley slopes, hill crests, and ridges, either within or closely associated with areas of Sogn silt loam. The areas are usually small, though numerous. The largest developments lie south of Reynolds and southwest of Kesterson. The surface is usually extremely uneven and gullied. In the less

eroded sections the bedrock is covered by a thin veneer of light-gray to cream-colored soil, the immediate surface of which has been slightly darkened by accumulated organic matter. Over most of the phase the rock outcrops at frequent intervals. The land is all included in pastures and supports a fair growth of grama and bunch grasses during normal seasons. In dry years the phase is of little value even for pasture, on account of the nearness of the underlying bedrock to the surface.

LANCASTER FINE SANDY LOAM.

The soil of the Lancaster fine sandy loam is a light-brown to brown or rusty-brown fine sandy loam 6 to 8 inches deep. It is underlain by a reddish-brown fine sand which becomes lighter in color with depth and in places is bright yellow below 30 inches. When dry the subsoil is loose and incoherent, but it contains enough clay, except in the lower part, to bind the particles together when wet. The unweathered sandstone is too hard to penetrate with a soil auger. Where the rock is resistant to weathering scarcely any soil has formed, but where it is soft it gives rise to a deep sandy soil. Over the harder sandstone the soil is heavier than usual and approaches a loam in texture. This surface soil on the lower slopes has been considerably deepened by wash from the higher levels; it ranges in thickness from 16 to 20 inches and contains more silt and organic matter than usual. As a whole the type is low in organic matter, the dark color being due chiefly to the large proportion of iron in the original material.

In many places, usually of small extent, fragments of the parent Dakota sandstone are in the soil or scattered over the surface. Such areas constitute a stony phase of the Lancaster fine sandy loam and are shown on the map by stone symbols. Areas in which erosion has entirely removed the weathered soil material, exposing the consolidated Dakota sandstone, are indicated on the map by rock-outcrop symbols.

The Lancaster fine sandy loam is confined chiefly to a large area between Silver and Dry Creeks in the south-central part, and a few small, irregular-shaped developments along Rock Creek and south-east of Endicott in the southeastern part of the county. The remaining areas lie mainly in that part of the county south of Rose Creek and west of the Little Blue River.

The soil has been derived through weathering from the Dakota sandstone. In places it has been slightly modified by glacial action and contains small quantities of extraneous materials, such as Sioux quartzite and granite.

The topography is for the most part steeply rolling to hilly. The type occupies steep to precipitous slopes and narrow eroded divides, except in small areas underlain by the sandstone, which have been carved into a rolling relief, with well-rounded hilltops and gradual slopes.

The drainage is everywhere thorough, and over most of the type excessive. The soil is droughty and crops suffer from lack of moisture during dry seasons.

Owing to its small extent, unfavorable topography, and excessive drainage, the type is of little agricultural importance in Jefferson County. Practically all of it is used for grazing land. Corn and

alfalfa are grown on some of the better situated parts, but the total area of cultivated land is almost negligible. Cattle, horses, and mules find excellent grazing during the early summer, but in the latter part of July and during August the grass dries up and affords little nourishment. Pockets of clay and shale found in the Dakota sandstone yield excellent material for the manufacture of brick. Land of this type sells for \$30 to \$70 an acre, depending largely upon its location and topography.

LANCASTER VERY FINE SANDY LOAM.

The surface soil of the Lancaster very fine sandy loam is a grayish-brown to brown friable very fine sandy loam with an average depth of 6 inches. The surface layer of 2 inches is somewhat darker, owing to a larger content of organic matter. The upper subsoil is a reddish-brown fine sandy loam, often containing considerable clay and is slightly more compact than the surface soil. Below about 20 inches the clay content decreases and the material usually becomes gradually lighter colored and looser in texture. In places it is a light yellowish brown, loose, incoherent sand below 30 inches. The type is not noticeably calcareous within the 3-foot depth.

Many variations occur, depending upon the character of the parent bedrock, the topography, and the degree of weathering. Around the margins of the type, where it borders higher lying areas of other soils, surface wash has accumulated, greatly deepening the soil and increasing its organic-matter content. In these localities the surface soil is a dark-brown very fine sandy loam 20 to 24 inches deep, usually underlain by the reddish-brown fine sand of the typical subsoil.

In many places the Dakota sandstone from which the soil has weathered lies within the 3-foot depth, and in numerous areas the thin soil veneer is so thickly covered with sandstone boulders as to be useless except for pasture. Such areas, where of sufficient size, are shown as a stony phase by means of stone symbols. Where the bedrock outcrops the areas are indicated by the rock-outcrop symbol.

Locally within the type are small areas in which the surface is so thickly covered with small, dark-red iron concretions as to appear much darker in color than typical. This variation is too small in extent to warrant locating on the soil map. It is similar to larger areas southeast of Beatrice in Gage County, which are locally termed the "Iron Mountains."

In a few places the surface of the type contains a scattering of glacial pebbles, probably washed down from the higher lying Carrington and Shelby soils.

The Lancaster very fine sandy loam is rather extensive in the southern and southwestern parts of the county. It is confined chiefly to that part lying west of the Little Blue River and south of Rose Creek, where it occurs in large, irregular, fairly continuous bodies.

The type has weathered from the reddish-brown Dakota sandstone of the Benton formation. The topography varies from rolling to extremely rough and gullied. Much of the type occupies the steeper slopes along drainage ways and the sharper and more gullied divides. In a few places where the sandstone is unusually soft, erosion has created a series of well-rounded hills and divides with moderate slopes. Drainage is everywhere thorough and over most of the type excessive. Erosion is active on all but the more gentle slopes.

The Lancaster very fine sandy loam is of little agricultural importance on account of its unfavorable topography and low content of organic matter. It is also rather droughty, and crops usually suffer from lack of moisture during dry, windy seasons. A very small proportion of the type, including small patches in the more level situations, is under cultivation to corn, wheat, oats, and alfalfa. The yields are usually low, except in seasons of abundant precipitation. Nearly all of the type is devoted to grazing. From 6 to 10 acres are required to support an animal during the grazing season. The native grasses afford excellent pasture throughout the spring and early summer, but during the latter part of July the grass often withers and lies dormant until the next spring. In the vicinity of Fairbury, bricks of excellent quality are manufactured from clays and shales found within the Dakota formation. Land of this type sells for \$30 to \$75 an acre, depending upon location and topography.

WAUKESHA VERY FINE SANDY LOAM.

The surface soil of the Waukesha very fine sandy loam consists of 12 to 18 inches of brown very fine sandy loam, rich in organic matter and generally having a relatively high percentage of silt. The upper subsoil is a light-brown to gray very fine sandy loam or silt loam, slightly more compact than the surface soil. At an average depth of about 30 inches it becomes gradually lighter in color and looser in structure, grading into a light-gray loose silty material which extends below the 3-foot depth. The transition between the different soil horizons is very gradual in color, texture, and structure. The content of organic matter gradually decreases with depth and is deficient below 30 inches. As a rule, the type is not calcareous within the 3-foot section, although locally it may contain some lime in the lower part. The substratum below 4 feet is highly calcareous.

The type varies in places toward a silt loam and may include small bodies of Waukesha silt loam. On the north side of Rose Creek in its lower course the upper subsoil between 14 and 24 inches is a heavy compact silty clay resembling a clay pan in physical characteristics; it is stiff and plastic when wet and becomes extremely hard and tough upon drying.

The Waukesha very fine sandy loam has a total area of about 4 square miles. It is confined to a few small areas and narrow strips near the mouth of Rose Creek and along the Little Blue River. The largest body, including about $1\frac{1}{2}$ square miles, occurs along Rose Creek southeast of Kesterson. Typical areas lie south of Endicott along the Little Blue River.

The Waukesha very fine sandy loam has been formed in the same manner as the silt loam. Its larger sand content is probably due in part to the coarser nature of the alluvial sediments from which it has weathered, and in part to wind-blown sands from the river channel.

The type occupies terrace or bench positions and lies from 10 to 15 feet above the present bottom land. The topography is flat, with a gentle slope down the valley and toward the stream channels. Drainage is thorough, though not excessive.

The Waukesha very fine sandy loam is of little agricultural importance, owing to its small extent. It is a naturally strong and fertile

soil and well adapted to all crops common to the region. All of it is under cultivation to corn, oats, wheat, and alfalfa. These crops do as well as upon any other soil in the county and give good yields in all but the driest seasons. The average yield of corn is about 35 bushels per acre, although 50 to 60 bushels are not uncommon in favorable seasons. Wheat yields 20 to 25 bushels, oats 30 bushels, and alfalfa 3 to 4 tons per acre. Alfalfa is usually cut three times. It is grown quite extensively upon those parts of the type having an extremely heavy and compact upper subsoil layer, as the roots are able to penetrate the clay pan and obtain sufficient moisture for growth. Garden vegetables do well on this type.

The Waukesha very fine sandy loam is easily handled and can be cultivated under a wide range of moisture conditions without injury. It is slightly more retentive of moisture than the silt loam because of its looser structure, and crops seldom suffer from any but the most prolonged droughts.

Barnyard manure is applied when available, but the supply is seldom sufficient for best results, and the productiveness of the soil is gradually decreasing, owing to the absence of systematic crop rotation and of sufficient fertilizer.

Soil of this type sells for about \$150 an acre. It is considered to be equal to any land in the county in productiveness.

WAUKESHA SILT LOAM.

The soil of the Waukesha silt loam is a dark-brown to nearly black silt loam, ranging in depth from 12 to 18 inches, with an average depth of 15 inches. It is rich in organic matter, prevailing fine in texture, and has a smooth velvety feel. The change from soil to subsoil is gradual but distinct. The subsoil is a grayish-brown to yellowish-brown, compact, heavy silty clay, which becomes hard and tough upon drying. Below about 24 inches it grades into a yellowish-gray, loose, friable silt to silty clay which continues to below the 3-foot section. Lime concretions are commonly present below 40 inches, but rarely occur above this depth. Rusty-brown iron stains are abundant throughout the subsoil.

A few variations are included. Along the western county line, on the north side of the Little Blue River, there is a small area in which the surface soil has been slightly modified by coarse sand and fine gravel washed from the adjoining upland, and the subsoil consists of alternating layers of light yellowish brown silt loam and sandy loam containing some coarse sand and gravel. In a few places around the outer margins of the type where it borders the uplands the soil has been greatly thickened by the addition of colluvial wash and is 20 to 24 inches deep. In some of these places the heavy subsoil layer is absent and the subsoil is a brown silt loam to silty clay loam only slightly more compact than the surface soil. The principal variation in surface texture is toward a very fine sandy loam, and it is possible that small areas of Waukesha very fine sandy loam are included. The two types merge into one another and it is often necessary to draw arbitrary lines separating them. The above variations are of such small extent and minor importance as not to warrant separate mapping.

The Waukesha silt loam does not occupy a large total area in Jefferson County. It is confined chiefly to a narrow strip varying in width from one-fourth to about one-half mile along Rose Creek in the southwestern part. It is also locally developed along the Little Blue River and Swan Creek, although the areas are usually less than 3 acres in size and many are not shown on the soil map.

The type has weathered from transported sediments carried down and deposited by the streams when they were flowing at higher levels. Subsequent deepening of the channels has left the deposits as terraces or benches well above present overflow.

The topography is flat with a gentle slope down the valley and toward the stream channels. The surface lies 10 to 15 feet above the bottom land and 40 to 70 feet below the general upland level. The transition to the uplands is usually marked by a long gradual slope, while that to the flood plains is rather steep and often nearly vertical. Drainage is everywhere good though not excessive. Even the flatter areas have sufficient slope to carry off all excess water.

The type was originally covered with a thick growth of native prairie grasses. It is considered one of the best soils in the county, and about 95 per cent of it is used for the common farm crops. Corn is grown chiefly; it does well except in dry years, the ordinary yields being 30 to 35 bushels per acre, while under favorable conditions as high as 60 bushels have been obtained. Wheat ordinarily yields 20 to 25 bushels per acre. Oats are grown to a small extent, chiefly as a step in the rotation between corn and wheat, and yield about 30 bushels per acre. Alfalfa does very well, yielding 3 to 5 tons per acre from three cuttings. Small fields of other grains, such as sorghum, kafir, millet, and rye, and patches of garden vegetables and potatoes are also grown and do well under ordinary conditions.

Hogs are raised on nearly every farm and the fattening of hogs is practiced quite extensively. Most of the animals are native raised and of good breeding. A few farmers have purebred herds.

The soil of the Waukesha silt loam is easily handled. It is retentive of moisture and drought resistant, except locally where the upper subsoil layer is unusually compact and impervious. It does not clod or bake badly upon drying. Corn is generally check planted where it follows some other crop in a rotation and listed where it succeeds itself. Very little attention is given to fertilization and crop rotation, although rotation is practiced more than formerly. A rotation used by a few of the better farmers consists of corn 2 years, oats or wheat 1 or 2 years, followed by alfalfa 4 or 5 years, and back to corn. These farmers apply all the available barnyard manure to the soil. On the tenant farms many fields have remained in the same crop several consecutive years and very little manure has been applied to the land. The result of such management is a gradual decrease in the productive power of the soil.

Farm land of the Waukesha silt loam sells for \$100 to \$150 an acre, depending upon the improvements and location.

WABASH VERY FINE SANDY LOAM.

The surface soil of the Wabash very fine sandy loam is a gray to dark grayish brown, friable, very fine sandy loam 10 to 18 inches deep. The soil is usually rather high in organic matter, but contains less of the silt loam and is slightly lighter in color. The subsoil is a very dark gray, moderately compact silt loam containing a small proportion of very fine sand. Its content of organic matter is high and often exceeds that of the surface soil. The type is not noticeably calcareous within the 3-foot depth.

Although the above description represents the typical soil, there are large areas in which practically no change in texture or color occurs throughout the 3-foot section, and the structure is only slightly more compact in the subsoil.

Included with the type are small areas in which the surface soil contains so much sand and so little organic matter as to approach a loamy very fine sand in texture. It is usually gray in color and seldom over 10 inches deep. The subsoil in these localities is a dark-gray very fine sandy loam containing much humus, and is more compact in structure than the surface soil.

Locally the type has been greatly influenced by wash from the exposed beds of Dakota sandstone. In these places the soil and subsoil are light brown in color and consist largely of medium sand with sufficient organic matter to give the whole a loamy texture. Where such areas were of sufficient size to warrant mapping they were included with the Cass or Genesee soils.

Small areas of colluvial material are included with the Wabash very fine sandy loam. They occur as narrow isolated strips bordering the outer edge of the type and represent an accumulation of surface wash from the higher slopes. Subsequent weathering of this colluvial material has produced a dark-brown to almost black very fine sandy loam, differing little in color or texture in the 3-foot depth. These areas have a decided slope toward the center of the valley. If they were of sufficient size to warrant mapping they would be correlated as Judson very fine sandy loam, but owing to their small extent and local occurrence they are included with the Wabash soil.

The Wabash very fine sandy loam does not occupy a large total area in Jefferson County. It occurs in narrow strips along many of the drainage ways in the southern and southwestern parts, in a few medium to large areas upon the flood plains bordering the Little Blue River and its tributaries, and in a large area along Swan Creek in the northern part of the county. One of the most extensive and uniform areas lies west of Powell along Big Sandy Creek.

The topography is prevailingly flat, modified locally by cut-offs, tributary stream channels, and scattered depressional areas. The surface along the larger streams is nearly level with an almost imperceptible slope down the valleys and toward the channels. Along the smaller drainage ways, however, the slope is more distinct, though very gradual.

Drainage in general is good. Most of the type lies 8 to 15 feet above the normal flow of the stream and is seldom overflowed. Along a few of the minor drainage ways the surface is much lower and parts of the type are subject to inundation during periods of high water.

Owing to its rather small extent the type is only locally important in the agriculture of the county. About half of it is under cultivation and the remainder, including the narrow strips along the smaller drainage ways, where there is danger of overflow, is used for pasture land. Along the larger streams, where the type is most extensively developed, it is considered one of the best agricultural soils of the county, being equal to the Wabash silt loam in productiveness. Corn, the most important crop, ordinarily yields 40 to 50 bushels per acre, and in favorable seasons with good cultural methods 60 to 80 bushels are obtained. Wheat, oats, and barley do well, but sometimes produce a rank vegetative growth at the expense of the grain and are liable to lodge. Alfalfa is grown quite extensively and yields 3 to 4 tons per acre from three cuttings. The native grasses will support a cow or steer per acre during the grazing season. Bordering the stream channels are fairly dense growths of boxelder, cottonwood, maple, dogwood, oak, ash, and willow, which afford considerable firewood and post material.

The soil is easily handled and can be worked under a wide range of moisture conditions. It does not clod or bake badly even when worked shortly after heavy rains. It is very retentive of moisture and crops seldom suffer during any but the longest dry spells. Barnyard manure is applied when available. The soil is not quite as strong as the Wabash silt loam, owing to its lower organic-matter content. It is necessary to rotate crops more frequently and use more manure to maintain its fertility. The selling price of this soil is about the same as that of the silt loam.

WABASH SILT LOAM.

The surface soil of the Wabash silt loam is a dark-gray to black, smooth silt loam, 18 to 24 inches deep. It is rich in organic matter, which imparts the dark color and smooth velvety feel. The subsoil is of about the same color as the surface soil but usually heavier and more compact in structure. It ranges in texture from a silt loam to a heavy silty clay loam and invariably contains a larger percentage of clay than the surface soil. Faint brown mottlings are often encountered below 30 inches. The type is not noticeably calcareous within the 3-foot depth, although there is no evidence of a deficiency in lime.

The principal textural variation is toward a very fine sandy loam, and it is possible that small patches of Wabash very fine sandy loam are included. The two types merge gradually into each other, and in places it is difficult to separate them. Locally along the larger streams the subsoil is much lighter in color than usual and consists of a gray to light-gray, moderately compact, silty clay loam resembling the lower subsoil of the Waukesha types.

Included with the Wabash silt loam are a few basinlike areas in which water stands for a considerable time after rains. In these the soil is a heavy silt loam to silty clay loam with little change throughout the 3-foot section, though usually somewhat lighter in color and slightly mottled with brown in the lower part. Crops do not do so well in these depressions. Along many of the smaller streams and a few of the larger creeks where the type borders the uplands, there are narrow strips of colluvial material which have been washed down from the

adjoining slopes and deposited upon the flood plains. The soil here differs little in color or texture to the 3-foot depth and consists of a dark-brown to black heavy silt loam becoming slightly more compact in the lower part. These areas have an appreciable slope and are well drained. The soil resembles that of the Judson silt loam (a colluvial type), but owing to its small extent and local occurrence it was included with the Wabash silt loam.

The Wabash silt loam is extensively developed in Jefferson County. It occurs as narrow, usually continuous strips within the flood plains of most of the larger streams and tributaries throughout the areas of Grundy silt loam. The largest and most continuous area is along Cub Creek in the northeastern part of the county. The soil is also well developed along Indian Creek in the southeastern part. Very little of the type occurs along the Little Blue River or south of Rose Creek, as the bottom soils in these localities are usually of a sandy nature.

The type is generally flat, though locally modified by shallow depressions, old stream channels, and cut-offs. The greater part lies 8 to 15 feet above the normal flow of the streams and is not subject to flooding from the main channels. Along many of the smaller drainage ways the type is covered during flood stages and crops can not be profitably grown.

The Wabash silt loam is an important soil in Jefferson County. Its level topography and high organic-matter content make it a highly prized soil for general farming. About three-fourths of it is under cultivation and the remainder, including the narrower stream bottoms which are subject to overflow, is included in farm pastures.

Corn yields on this type usually average 25 to 30 per cent higher than on the better upland soils on account of the lower position and more favorable moisture conditions. Corn, the dominant crop, yields ordinarily from 40 to 50 bushels per acre, and in favorable seasons with thorough tillage as much as 70 to 90 bushels. Where the soil has been devoted to the production of corn for a number of years and its productiveness has been lowered, wheat does well, yielding 25 to 30 bushels, and in favorable seasons 35 to 50 bushels per acre. Where the soil is very productive wheat is likely to produce a rank vegetative growth at the expense of the grain and is also likely to lodge. Kherson oats do well on this type, yielding from 35 to 50 bushels per acre, but the long-strawed varieties generally lodge except where the productiveness of the soil has been materially reduced by cropping. Except in a few poorly drained areas, alfalfa does well and yields 3 to 5 tons from three cuttings. The native grasses will support a cow or horse per acre during the summer grazing season. Potatoes and garden vegetables are grown chiefly for home consumption.

Owing to its flat topography, silty texture, and friable structure the soil is easy to handle, and crops seldom suffer from lack of moisture even during protracted droughts. The soil can be cultivated under a rather wide range of moisture conditions and seldom bakes or clods badly except in the depressional areas, which are mostly included in pastures. The soil is exceptionally strong and fertile and will withstand continued cropping to one grain probably better than any other soil in the county. A one-crop system, however, is bound

to decrease its productive power. Crop rotation is not systematically practiced, and there is seldom sufficient barnyard manure for best results. Even under the present more or less indifferent method of handling the land, the soil is only slightly reduced in fertility, as the addition of sediments washed from the higher lying soils tends in a large measure to maintain its productiveness.

Land of the Wabash silt loam sells for \$125 to \$175 an acre, depending upon its location, drainage, and improvements.

CASS FINE SANDY LOAM.

The surface soil of the Cass fine sandy loam is a dark grayish brown, loose fine sandy loam, rich in organic matter, 10 to 15 inches deep. The subsoil is a loose, incoherent medium to fine sand, gray or light brown in color, which generally continues below the 3-foot depth, but locally contains considerable coarse sand and gravel below 30 inches. It is deficient in organic matter. The change from soil to subsoil is generally abrupt, but in places the two horizons are separated by a layer of 4 to 6 inches of light-brown loamy fine sand, and the change from soil to subsoil is very gradual. The type is not calcareous within the 3-foot section. Throughout the type there are many small areas in which the surface texture varies considerably from the typical soil, but these were of such small extent and local occurrence as to not warrant separation on the soil map.

The Cass fine sandy loam has a total area of less than 3 square miles. It is confined to a few disconnected areas and narrow strips upon the flood plains bordering the Little Blue River. Some of the longest areas lie south of Powell, in the west-central part of the county. The remaining areas are few and small, seldom exceeding 320 acres in size. The type has weathered from sandy alluvial materials deposited on the flood plain during flood stages of the stream.

The topography is flat, modified by old and present stream channels and local depressional areas. The surface lies somewhat below the general level of the Cass very fine sandy loam, but is fairly well drained during seasons of normal precipitation. In wet years much of the type is subject to overflow and the underdrainage is poor, as the water table rises near the surface.

About 40 per cent of the type still supports a fairly dense stand of mixed timber, including cottonwood, willow, boxelder, ash, elm, and hackberry. The remainder is used largely for farming, a small part being retained for pasture land. Corn, alfalfa, and truck crops are grown for feed and home consumption. The yields are about the same as those obtained on the Cass very fine sandy loam.

The soil is easily tilled and can be cultivated under any moisture conditions without injury. Corn is usually listed in. Small grains are grown very little on account of the loose sandy nature of the seed bed. They are usually sown with a press drill on plowed and harrowed corn or stubble land. Alfalfa is sown broadcast on a well-prepared seed bed.

No systematic crop rotation is practiced. Barnyard manure is applied to the land when available, but the supply is seldom sufficient for the best results. Continued cropping to corn has greatly reduced the fertility of this soil on many farms. The Cass fine sandy loam sells for \$50 to \$100 an acre, depending upon drainage, location, and improvements.

CASS VERY FINE SANDY LOAM.

The surface soil of the Cass very fine sandy loam is a dark grayish brown, friable, very fine sandy loam, 8 to 12 inches deep. It is rich in organic matter and when wet appears black. The subsoil is a gray to light-gray, loose, incoherent, fine to medium sand, which usually continues throughout the 3-foot depth, but in places contains coarse sand and gravel below 30 inches. The change from soil to subsoil is generally abrupt, both in color and texture. The type is not noticeably calcareous, and below 14 inches is very deficient in organic matter.

Locally the subsoil differs from the typical in that it is composed of alternating layers of the various grades of sand, with an occasional layer of silt or very fine sandy loam. The principal variation in surface texture is toward a fine sandy loam, and small bodies of Cass fine sandy loam may be included with this type. Over small areas a layer of light-brown fine sandy loam, 4 to 6 inches thick, is developed between the soil and subsoil, and represents a transition both in color and texture between the two soil horizons. These variations are of small extent and local occurrence.

The Cass very fine sandy loam has a total area in Jefferson County of less than 3 square miles. It is confined to a few small bodies and narrow strips upon the flood plains bordering the Little Blue River. One of the largest areas, comprising about 1 square mile, lies on the north side of the stream between Endicott and Steele City. A narrow strip lies west of Fairbury on the west side of the river. The remaining areas are few and small, seldom exceeding 160 acres.

The type has weathered from sandy alluvial materials washed from the surrounding areas of glacial drift and deposited upon the flood plain during periods of high water.

The surface is prevailingly flat, though locally modified by old cut-off channels and shallow depressions. There is usually a very gentle slope down the valley and toward the stream channel. The greater part of the type lies 8 to 12 feet above the channel and is adequately drained, except for a few shallow depressions where water accumulates after rains. In places, however, the surface is only a few feet above the normal flow of the stream and is subject to occasional inundation and the water table usually lies too near the surface for crop production. The type as a whole is not retentive of moisture on account of its porous structure, and during dry seasons crops sometimes suffer from drought.

The Cass very fine sandy loam is of little agricultural importance in Jefferson County on account of its small extent. About 60 per cent of it supports a luxuriant growth of the common marsh and prairie grasses with marginal strips of timber along the stream. The principal trees are cottonwood, willow, boxelder, hackberry, elm, and ash. In the depressional areas slough grass and other water-loving plants and weeds abound. In some of the deeper depressions water stands throughout the year and bulrushes, cat-tails, and sedges flourish.

Of the cultivated crops, corn occupies the largest acreage. It makes a good growth in ordinary seasons and yields 35 to 40 bushels per acre. Alfalfa is grown to a small extent and yields 3 to 4 tons per acre from three cuttings. Small grain is not commonly grown on

this soil on account of the difficulty encountered in obtaining a firm seed bed and also on account of the danger of lodging. Potatoes, garden vegetables, and melons do well, as the soil warms up early in the spring and contains sufficient moisture for good yields of truck crops.

The soil is easily handled and can be cultivated under any moisture condition without injury. The supply of barnyard manure is seldom adequate for best results. The type is not as strong as the Wabash soils, and yields decrease rapidly unless crops are frequently changed. The selling price ranges from \$50 to \$100 an acre, depending largely upon drainage and location.

GENESSEE FINE SANDY LOAM.

The Genessee fine sandy loam consists of a light-brown fine sandy loam, 10 to 14 inches deep, grading into a yellowish-brown or light-gray very fine sand containing very little silt or clay. The soil section has a loose open structure throughout. As the color indicates the surface soil is rather low in organic matter and the subsoil is very deficient in this material. The type is not noticeably calcareous within the 3-foot depth.

In a few places the subsoil is mottled with scattering rusty-brown stains due to poor drainage. The principal textural variation is toward a very fine sandy loam, and it is possible that patches of Genessee very fine sandy loam are included. The two soils merge into one another and arbitrary lines were often drawn in separating them.

This is the least extensive type in Jefferson County. It is confined to a few isolated bodies and narrow strips scattered throughout the flood plains of the Little Blue River. One of the largest areas, including about 300 acres, lies northwest of Steele City. A smaller area borders the north side of the channel, in the vicinity of Fairbury. Most of the remaining areas contain less than 100 acres.

The type is composed of sandy materials recently deposited near the river channels during periods of high water. Sufficient time has not elapsed for the growth and decay of plant life to develop the dark-colored surface layer characteristic of the Cass soils. The subsoil is generally finer in texture than the Cass subsoil.

The surface of the type is flat to very gently undulating, locally modified by old stream channels, oxbows, cut-offs, and slight elevations. Drainage is generally good. Most of the type is subject to annual overflow, but the water soon runs off or seeps away through the porous subsoil when the water subsides.

Owing to its small extent and low organic-matter content, the Genessee fine sandy loam is of little agricultural importance in this county. About half of it is under cultivation and the remainder supports a fairly dense mixed stand of elm, ash, hackberry, maple, cottonwood, willow, and boxelder, with an undergrowth of brush and nutritious grasses which afford good pasture. Corn is practically the only cultivated crop grown. It yields an average of about 25 bushels per acre. A few melons and garden vegetables are grown.

Owing to its sandy nature, the soil can be worked in the spring before most of the other bottom-land types and is one of the first to become warm enough for seed germination. Little attention is given to crop rotation or to any method of maintaining the productiveness.

Very little manure is applied, as most farmers depend upon the material deposited by the spring floods to maintain the fertility of the soil. The type is usually sold in conjunction with other soils and is considered less valuable than most of the other bottom soils.

GENESEE VERY FINE SANDY LOAM.

The surface soil of the Genesee very fine sandy loam is a gray to light grayish brown very fine sandy loam, relatively low in organic matter, 10 to 14 inches deep. The subsoil differs little from the surface soil, except that it is slightly lighter in color owing to a deficiency in organic matter. The type is porous and friable in structure, and contains barely enough silt and clay to bind the sand particles together loosely when dry. Neither the soil nor subsoil is noticeably calcareous.

In spots throughout the type the subsoil below 30 inches contains considerable coarse sand and fine gravel. Numerous patches of fine sandy loam, loamy very fine sand, or very fine sand are also included, but these are small and unimportant as compared with the area having a very fine sandy loam texture. Locally the subsoil may vary in color, being in spots light gray mottled with scattering rusty-brown splotches due to poor drainage. In a few places wash from higher lying soils has considerably darkened the surface layer of 6 inches, giving it a brown to dark-brown color.

The Genesee very fine sandy loam is not extensive in Jefferson County. It occupies numerous narrow strips and small bodies bordering the channel of the Little Blue River throughout its distance across the area. One of the largest areas lies in the vicinity of Steele City, and a fairly uniform body lies west of Fairbury, on the east side of the river. Narrow strips occur south of Endicott and Powell.

The topography is prevailingly flat, although modified by occasional depressions, stream channels, oxbows, and cut-offs. The type occupies first-bottom positions, and the drainage is variable. The surface lies from 6 to 10 feet above the normal flow of the river, but is subject to inundation during flood stages. The water seldom remains on the land longer than a few hours after the stream subsides, as the loose porous subsoil usually affords ample underdrainage. In seasons of abnormal precipitation, however, the water table lies too near the surface for most crops. During normal seasons the type is seldom too wet for cultivation.

The Genesee very fine sandy loam has only local agricultural importance on account of its small extent and low content of organic matter. About 60 per cent of it is under cultivation and the remainder is in forest, consisting largely of mixed stands of elm, hackberry, maple, boxelder, cottonwood, ash, and willow. Underbrush is common over most of the forested areas, and in places is so dense as to be almost impenetrable. A small part of the type is used for pasture.

The cultivated areas are devoted almost exclusively to corn, and the yields range from 20 to 35 bushels per acre during average years. Small grains are seldom grown on account of the loose sandy nature of the soil and the low yields. A few small patches of oats are grown. Melons do well on this soil and a few are grown for home consumption. The corn is usually listed. Plowing is seldom neces-

sary, as the soil is sufficiently loose without stirring. The corn crop is cultivated three or four times to keep down weeds. Very little manure is applied. The occasional overflows aid in maintaining the productiveness, but organic matter should be applied in the form of manure or by turning under green crops if the fertility is to be conserved.

The value of the Genesee very fine sandy loam ranges from \$40 to \$100 an acre, depending upon its location, drainage, and improvements.

ROUGH BROKEN LAND.

Rough broken land includes areas which are topographically unsuited to farming. It occurs where streams have cut deeply into the underlying bedrock of the region, carving it into an intricate system of narrow, steep-sided valleys and sharp-crested divides. The relief is extremely harsh and broken. The greater part of the surface is covered with a thin veneer of soil, but outcrops of the Dakota sandstone or Greenhorn limestone are numerous and in many places form vertical cliffs or steep rocky slopes.

Rough broken land occurs as small scattering bodies along the breaks south of Rose Creek in the south-central part, along Rock Creek and the north side of the Little Blue River in the southeastern part, and locally along the latter stream in the west-central part of the county. The largest developments are southwest of Endicott along Dry Creek, a tributary to Rose Creek. A rather large area borders the Rose Creek terrace lands southeast of Kesterson. The rough topography is also well developed between Endicott and Steele City on the north side of the St. Joseph & Grand Island Railway.

All of this land is in pasture. Several nutritious grasses, including buffalo, bunch, grama, and bluegrass, afford fair grazing during the spring and early summer. In the latter part of July, however, they usually wither and can not be depended upon for grazing. The gullies and canyons afford excellent protection to stock during the winter. This land is usually sold in connection with farming or better grazing soil. It has a tendency to lower the general value of the farms in which it is included.

SUMMARY.

Jefferson County is situated in southeastern Nebraska. It contains 578 square miles, or 369,920 acres. The physiography of the county is that of a flat to steeply rolling and hilly plain sloping gradually toward the southeast. The flatter areas occupy the broader divides throughout the uplands, and the narrow terraces and flood plains along streams.

The county has an average elevation of about 1,320 feet above sea level. Drainage is effected through the Little and Big Blue Rivers and their tributaries. As a whole the county is well drained.

The earliest settlers were of Russian and German descent. Later settlers came from eastern States. According to the census of 1920, the population of the county is 16,140, about two-thirds of which is classed as rural. Fairbury, the county seat, has a population of 5,454.

The county has good transportation facilities, being crossed by railroads in several directions. These lines furnish good connections with outside points. Public roads reach all farming communities. Omaha, St. Joseph, Kansas City, and Chicago are the chief livestock and grain markets. Dairy products are shipped to Lincoln or Beatrice.

The climate of Jefferson County is favorable for the production of the common staple crops, such as corn, wheat, oats, potatoes, and alfalfa. The mean annual temperature is 52.2° F., and the mean annual precipitation 29.61 inches. The average length of the growing season is 163 days.

The type of agriculture generally practiced consists of diversified farming, including grain and hay production and the raising of hogs. Dairying and the raising of cattle and other livestock is practiced less extensively, although many farmers fatten a few cattle each winter for market. The chief crops are corn, wheat, oats, alfalfa, wild hay, and coarse forage, ranking in acreage in the order named. The work stock consists of a good grade of horses and mules. A few tractors are used on the more level lands.

The adaptation of certain soils to particular crops is observed to some extent by the farmers. There is not sufficient variation in the soils, however, to cause specialized farming in any part of the county, except in those areas which are topographically unsuited to crop production and are used for pasture. A rather indefinite system of crop rotation, subject to numerous variations, is practiced. No commercial fertilizer is used, but all the manure produced is applied to the land.

The soils of Jefferson County are the result of two factors: (1) The character of the parent rock from which they have weathered and (2) the soil-forming processes to which these parent materials have been subjected. The latter factor, which includes weathering, leaching, aeration, oxidation, all of which are controlled to a large extent by climatic conditions, is believed to have exerted the greater influence in determining the present character of the soils.

The climate has favored the growth of a luxuriant grass vegetation. Most of the soils therefore have those characteristics which are produced by weathering under prairie conditions. The most obvious of these is the dark color of the surface soils, caused by the intimate mixing of organic matter with the mineral constituents of the soil. The shade of color naturally varies with the topography and drainage conditions. It is darkest in the flat poorly drained areas where the grass vegetation is especially luxuriant and lightest upon the steeper slopes where erosion is severe.

Variations in the degree of weathering have also produced differences in the physical and chemical characteristics of the soils. Those soils having the same or similar characteristics have been grouped into series. Eleven series representing 19 soil types and one type phase are recognized.

The Grundy silt loam is the leading upland soil of the county both in extent and fertility. It is rich in organic matter and dark brown to black in color. The subsoil is compact in structure. The type has weathered from silty loessial deposits. Corn and wheat are the principal crops.

The Carrington silt loam has been developed upon the weathered surface of the Kansan drift sheet. It is rich in organic matter and very fertile. All crops common to the region do well on this type.

The Shelby soils represent a less thoroughly weathered condition of the Kansan drift sheet than the Carrington silt loam. They are characterized by a rather high sand and gravel content. Where the topography is favorable and the stone content small, the soils are adapted to corn, wheat, and alfalfa. Some areas of Shelby soils are too rough or too stony for cropping and are used for pasture land.

The Crawford silt loam and silty clay loam are residual soils and have weathered from the underlying limestone and shale bedrock of the region. Extensive weathering and leaching have largely removed the lime to below the 3-foot depth. The types are inextensive. They are devoted to the production of corn, wheat, and alfalfa.

The Summit silt loam has weathered upon the limy shales of the bedrock formations underlying the county. It differs from the Crawford silt loam in the heavier and more compact structure of its upper subsoil and the highly calcareous nature of its lower subsoil. The topography is rough and the greater part of the type is used for pasture.

The Sogn silt loam has weathered from the limestone bedrock of the county. The surface soil is usually well supplied with organic matter and the subsoil is highly calcareous. The type differs from the Summit silt loam in the looser and more friable nature of its subsoil and from the Crawford silt loam in its higher lime content. The type is productive. Corn and alfalfa are the leading crops.

The soils of the Lancaster series are rather inextensive. They occur in the more eroded sections of the county and have weathered from the Dakota sandstone formation. The topography is rough and most of the land is used for grazing.

The Waukesha silt loam and very fine sandy loam are dark-colored terrace soils. They are very strong and fertile and produce large yields of all crops common to the region. The types are inextensive and only of local agricultural importance in this county.

The Wabash soils occupy first-bottom or flood-plain positions along many of the larger streams and tributaries throughout the county. They have weathered from transported loessial deposits and are among the strongest corn and alfalfa soils in the area.

The Cass soils have weathered from water-deposited sandy materials on the flood plains along streams. They differ from the Wabash soils chiefly in the sandy texture and less compact structure of the subsoil. The soils of both the Wabash and Cass series contain an abundance of organic matter in their surface layers.

The Genesee fine sandy loam and very fine sandy loam occupy flood plains adjacent to the channel of the Little Blue River. They are of a sandy nature and have weathered from recent-alluvial deposits. The types are low in organic matter. They are inextensive in Jefferson County.

Rough broken land includes areas which are topographically unsuited to farming. The land has no value except for pasture.

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Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the

Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English.

To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at http://www.ascr.usda.gov/complaint_filing_cust.html and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by:

- (1) mail: U.S. Department of Agriculture
Office of the Assistant Secretary for Civil Rights
1400 Independence Avenue, SW
Washington, D.C. 20250-9410;
- (2) fax: (202) 690-7442; or
- (3) email: program.intake@usda.gov.

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