

Issued June 14, 1915.

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

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

SOIL SURVEY OF DOUGLAS COUNTY,
NEBRASKA.

BY

A. H. MEYER, E. H. SMIES, AND T. M. BUSHNELL, OF THE
U. S. DEPARTMENT OF AGRICULTURE, AND R. R. SPAF-
FORD, R. R. BURN, AND C. W. SMITH,
OF THE NEBRASKA SOIL SURVEY.

THOMAS D. RICE, INSPECTOR, NORTHERN DIVISION.

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



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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., December 2, 1914.

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

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

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

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

CONTENTS.

	Page.
SOIL SURVEY OF DOUGLAS COUNTY, NEBRASKA. By A. H. MEYER, E. H. SMIES, and T. M. BUSHNELL, OF THE U. S. DEPARTMENT OF AGRICULTURE, and R. R. SPAFFORD, R. R. BURN, and C. W. SMITH, OF THE NEBRASKA SOIL SURVEY.....	5
Description of the area.....	5
Climate.....	9
Agriculture.....	10
Soils.....	21
Knox series.....	22
Knox silt loam.....	23
Marshall series.....	27
Marshall silt loam.....	27
Shelby series.....	29
Shelby loam.....	30
Waukesha series.....	30
Waukesha silt loam.....	31
Wabash series.....	32
Wabash silt loam.....	32
Wabash clay.....	34
Cass series.....	36
Cass fine sandy loam.....	36
Cass very fine sandy loam.....	37
Cass loam.....	40
Cass silt loam.....	41
Cass clay loam.....	43
Cass clay.....	43
Sarpy series.....	44
Sarpy fine sand.....	44
Sarpy very fine sandy loam.....	45
Sarpy silt loam.....	46
Miscellaneous material.....	46
Riverwash.....	46
Summary.....	47

ILLUSTRATIONS.

FIGURE.

Fig. 1. Sketch map showing location of the Douglas County area, Nebraska.....	5
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MAP.

Soil map, Douglas County sheet, Nebraska.

SOIL SURVEY OF DOUGLAS COUNTY, NEBRASKA.

By A. H. MEYER, E. H. SMIES, and T. M. BUSHNELL, of the U. S. Department of Agriculture, and R. R. SPAFFORD, R. R. BURN, and C. W. SMITH, of the Nebraska Soil Survey.

DESCRIPTION OF THE AREA.

Douglas County, Nebr., lies along the middle of the eastern boundary of the State, between the Platte and Missouri Rivers. It is bounded on the north by Dodge and Washington Counties, on the east by the Missouri River, which separates it from the State of Iowa, on the south by Sarpy County, and on the west by the Platte River, which separates it from Saunders County. From north to south the county is 14 miles wide, and its greatest length from east to west is about 29 miles. It comprises 331 square miles, or 211,840 acres. Omaha, the metropolis of Nebraska, is located in the eastern part of this county.

Douglas County includes three distinct topographic divisions: (1) the uplands, (2) the old alluvial terraces, and (3) the first-bottom lands along the Platte, Elkhorn, and Missouri Rivers and smaller streams.

The upland extends from the broad bottom lands of the Platte and Elkhorn Rivers on the west to the narrow Missouri bottom lands on the east. Its surface features are variable. The western border of the upland is skirted by a narrow, steep, dissected bluff line into which the streams have worn back only a short distance. Immediately to the east is the divide, which follows the direction of the bluff line and serves as a watershed between the Platte and Missouri Rivers. In the northwestern corner of the upland this divide occurs as small, disconnected flats or plateaulike areas, which are remnants of the loess plains, but in the southwestern corner such areas have, with one exception, been destroyed by stream action. Since the general direction of the drainage is from northwest to southeast, the divides become sharper, the slopes steeper, and the valleys deeper as the Missouri River is approached. The rolling land merges with a steeply rolling to hilly zone from 3 to 8 miles wide along the Missouri bottom lands. In this hilly section the roughest and most dissected topography occurs northwest of Florence. In the eastern part of the county the transition from the

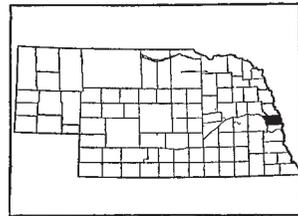


FIG. 1.—Sketch map showing location of the Douglas County area, Nebraska.

upland to the first-bottom land is marked by a high, precipitous bluff, while the upland is separated from the high second-bottom land by a fairly steep slope. In general, the western part of the upland is rolling to steeply rolling and the eastern part steeply rolling to hilly.

The alluvial terraces of the county occur as narrow second-bottom areas along the Missouri River, and are about 30 feet above the present flood plain. They extend from about 4 miles north of the Sarpy County boundary line northward almost to the northern city limits of Florence, and occur again in the extreme northeastern corner of the county. The second-bottom lands are developed as flat, benchlike areas, dissected only by the upland streams flowing to the Missouri River. There is a precipitous bluff line between the first bottoms and the second bottoms, the latter all lying above overflow.

Approximately one-third of the county is first-bottom land, of which about four-fifths is within the flood plains of the Platte and Elkhorn Rivers. The bottom lands of the latter vary in width from 9 miles along the northern county boundary line to about 1 mile along the southern county boundary. Only the lower benches along these streams are subject to overflow, except during unusual floods, when the water covers the entire flood plain. The Missouri River bottom lands are narrow and are changed and modified by frequent overflows. The width of the bottom lands varies with the progressive meandering of the streams. The upland streams have narrow bottom lands, varying in width from a few rods to about one-half mile. The surface of the bottom-land areas is level, and relieved only by low ridges and bars lying parallel to the streams and by intervening depressions, sloughs, and ox-bow lakes.

The upland has an average elevation of about 1,200 feet above sea level. The highest points, about 1,300 feet, occur in the plateau-like areas at Elk City, in the northwestern part of the county. The average elevation of the bottom land is about 1,100 feet, ranging in the Missouri bottoms from 965 feet on the southern county boundary line to 990 feet on the northern, and varying along the Platte and Elkhorn River bottom lands from 1,100 feet on the southern county boundary line to 1,180 feet on the northern line. The total range in elevation is approximately 345 feet.

Owing to its varied topography, the county has well-established drainage. In general the drainage is southeastward. There are three main drainage systems—the Missouri, Platte, and Elkhorn.

The Missouri River flows along the eastern boundary and together with its smaller tributaries drains the greater part of the county. It flows a little east of due south and hugs closely to the bluff line, except northeast of Omaha, where it swings out about

4 miles. The greater part of the upland is drained by the smaller tributaries of the Missouri River. Of these the largest stream is the Big Papillion, which, together with its branches, drains most of the upland, except along the bluff zone, where a strip about 4 miles wide is drained by numerous small streams flowing directly into the Missouri River. Of all these streams, only the Missouri River is navigable. The streams in this region are not now used for water power.

The Platte River drains a narrow strip along the western side of the county. It meanders slightly in a southeasterly direction until it reaches Cass County, where it gradually veers in an easterly direction, emptying into the Missouri about 12 miles south of South Omaha. It is a broad, shallow, overloaded stream, with numerous sand bars and low-lying, forested islands.

Most of the bottom land in the western part of the county and a narrow strip of upland along the bluff line are drained by the Elkhorn River, which enters Douglas County northwest of Elk City and flows through the county in a southeasterly direction, joining the Platte River about 5 miles south of the county line. The Elkhorn River was originally a very winding stream, but within recent years it has been straightened. In a few cases the stream has not yet taken the dug channel.

Besides the streams there are a number of lakes in the county. Of these Carter, Kings, and Florence Lakes are natural cut-off lakes, and Seymour and Ferrees Lakes are artificial.

The first attempt to establish a permanent settlement in this section was made by the Mormons in 1845, on the banks of the Missouri River at the present site of Florence. The clearing of the land by these settlers was objected to by the Indians, and they subsequently moved westward. Prior to this settlement, in 1825 a trading post was established with the Otoe Indians, on the terrace where a part of Omaha is now located. In 1847 a ferry was established at Omaha to accommodate the large number of gold seekers traveling from the Eastern States to the Pacific coast. When Nebraska was made a Territory, in 1854, the region was immediately occupied by settlers from Iowa, where they had assembled to await the opening of the new territory. Douglas County was established in 1854, and its original boundary lines were defined by an act of the first Territorial legislature in 1855. In 1857 Sarpy County was formed, including the southern part of Douglas County, and at that time the present boundary of Douglas County was established. The first settlers came from Illinois, Indiana, Ohio, and the New England States. The population was increased by German immigrants between 1865 and 1870 and by numbers of Swedes and Danes, who settled in the county between 1875 and 1880. At present the farming population consists mainly

of Germans, Swedes, Danes, Scotch, Irish, and Americans. The population is reported in the 1910 census as 168,546.

Omaha, with a population of about 124,000, according to the census of 1910, is the county seat of Douglas County and the largest city in Nebraska. The building of the Union Pacific Railroad in 1865 to 1869 gave Omaha a permanent advantage over rival river points. Ten trunk lines now pass through the city, and it is noted as a railroad, jobbing, grain, wool, manufacturing, milling, and wholesale center. As the "gateway" city of Nebraska, it is an important distributing point for farm implements and supplies, as well as a market for a large territory.

South Omaha, a suburb of Omaha, with a population of about 26,000, is an important live-stock center. It has five large packing houses, an alfalfa mill, and various other manufacturing establishments. It constitutes an excellent market for cattle, hogs, sheep, horses, and poultry. Dundee, a suburb west of Omaha, has a population of about 1,000. It is strictly residential, and the same is true of Benson, a city of about 3,000, situated north of Dundee and one-half mile west of Omaha. Florence, another suburb north of Omaha, is located on the Chicago, St. Paul, Minneapolis & Omaha Railroad and has a canning factory and flour mill.

Valley, a village of about 800, is located on the Union Pacific Railroad, and is noted for its sand pits, seed industry, and feeding yards for live stock in transit. Elkhorn, a village of about 300, located on the same railroad, has a flour mill and cement building-block factory. Waterloo and Millard are villages on the Union Pacific Railroad, and Mercer and Lane are merely railroad stations. At Waterloo the seed industry is important. Irvington, East Irvington, and Bennington are small villages on the Chicago & Northwestern Railway; Debolt Place is a junction point, and Briggs and South Cut are stations on the Chicago, St. Paul, Minneapolis & Omaha Railroad. Ralston is a small village on the Chicago, Burlington & Quincy Railroad and the Missouri Pacific Railroad, and Seymour is a station on the latter.

Douglas County is well supplied with railroads, no point being more than 8 miles from a railroad station.

The main country roads do not as a rule follow any definite land lines, but the minor roads usually extend along section lines. The important roads are kept in good condition, while those less used are given but little attention. The main roads leading out of Omaha are macadamized for a distance of approximately 10 miles. Elsewhere dirt roads predominate, as there is very little road-building material available in the county.

Douglas County has excellent local markets, Omaha and South Omaha demanding practically all the farm products. The rural

free delivery of mail and telephone lines reach practically every point in the county.

CLIMATE.

The climate of Douglas County is extremely variable. In general, the winters are cold and dry; the springs are cool and rainy; the summers, hot and dry; and the falls are characterized by mild, pleasant weather, with a few rainy spells. There are no modifying bodies of water or mountain ranges within 500 miles of the county. The climate is favorable to the successful production of general farm crops, such as wheat, oats, and corn.

The annual rainfall averages about 30 inches. Approximately 75 per cent of the precipitation occurs during the growing season, from April to September, inclusive. The precipitation is usually heaviest in June and lightest in January. The rainfall during the summer months usually occurs in storms accompanied by thunder and lightning. The rainfall in May and June is usually well distributed, and drought periods during these months are almost unknown. In July the distribution is not quite so favorable. On the average rain falls about four days during the three months, May, June, and July. The rainfall for August and September is considerably less, and the distribution is not nearly as favorable. Occasionally long droughts occur during the months of July, August, and September. Generally the rainfall during the growing season is sufficient with proper moisture conservation for crops to mature satisfactorily, and total crop failures are unknown.

The average annual snowfall is slightly more than 25 inches. Little snow falls before November or after March.

The mean annual temperature is 50° F. January and February are the coldest months, with a mean temperature of about 22°. July is the warmest month, with an average of 76.5°. The lowest temperature recorded at Omaha is 32° below zero, and the warmest 106° above.

There is an average growing season of about 170 days, which is sufficiently long for the maturing of all the ordinary farm crops grown. The average date of the first killing frost in the fall is October 13 and of the last in the spring April 26. September 18 is the date of the earliest killing frost reported, and May 19 is the date of the latest.

The winds are prevailing from the northwest. During the months of June, July, and August, however, they are mainly from the south and southeast. The average velocity of the wind at Omaha at an elevation of about 100 feet is 9 miles per hour. In storms, winds of 30 to 50 miles per hour frequently occur. Torna-

does are rare, though two tornadoes have been recorded during a single season.

The humidity is quite regular, the average for the year being about 70 per cent. The humidity is about 17 per cent lower at 8 o'clock in the evening than at 9 o'clock in the morning. On the average there are 170 to 180 clear days and 80 to 90 cloudy days during the year, the remainder being partly cloudy.

The following table gives the normal monthly, seasonal, and annual temperature and precipitation as recorded at the Weather Bureau station at Omaha:

Normal monthly, seasonal, and annual temperature and precipitation at Omaha, Nebr.

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.
	^o F.	^o F.	^o F.	Inches.	Inches.	Inches.
December.....	27.1	71	-17	0.89	0.94	0.73
January.....	20.5	63	-32	.62	.51	1.01
February.....	23.7	78	-26	.81	1.30	1.09
Winter.....	23.8			2.32	2.75	2.83
March.....	36.0	91	- 7	1.36	.91	.52
April.....	50.5	92	6	2.96	2.31	3.20
May.....	62.5	97	25	4.35	.61	11.29
Spring.....	49.7			8.67	3.83	15.01
June.....	71.6	100	42	5.17	4.74	12.70
July.....	76.5	106	50	4.43	0.61	4.79
August.....	74.4	105	44	3.45	0.36	3.39
Summer.....	74.2			13.05	5.71	20.88
September.....	65.8	102	30	2.95	2.48	4.53
October.....	54.2	92	15	2.47	2.94	5.03
November.....	37.7	80	-14	1.00	.11	.64
Fall.....	52.6			6.42	5.53	10.20
Year.....	50.0	106	-32	30.46	17.82	48.92

AGRICULTURE.

Immediately after the settlement of Douglas County the virgin prairies were broken by oxen and devoted to the production of farm crops. At first only those crops were grown which were needed to supply the immediate demands of the family. Subsequently wheat became the chief money crop, though some oats were sold. It was not until about 1867 that corn was produced for market. It was

generally believed that the climate was too dry for the extensive production of corn. The completion of the Union Pacific Railroad through the county in 1867 gave a great impetus to agricultural development by giving access to large markets. More attention was devoted to corn, and in a short time it became the leading cash crop.

Between 1865 and 1875 flax and barley were important crops. The former was soon abandoned, but barley was grown profitably until the railroads were extended farther west into an area where a lighter-colored berry was produced. This caused a decrease in the demand for Douglas County barley and the crop soon became unimportant.

In 1879 corn was by far the most important crop in the county. There were about 4 acres of corn to every acre of spring wheat. The 1880 census reports 37,533 acres in corn and 9,006 acres in wheat. It was at about this time that spring wheat began to decline in importance, as owing to the poor yields of this crop it was found more profitable to grow corn. Oats were grown extensively for feeding to all kinds of live stock. About 7,000 acres were devoted to oats. Owing to the large acreage of bottom lands in the county, hay was second to corn in acreage, a total of 19,430 acres being reported. Some of the hay was fed at home, but most of it was sold. The census of 1880 reports 1,662 acres in barley. All other crops were relatively unimportant.

About 1885 the seed industry gained prominence on the Platte and Elkhorn River bottom lands. In a short time about 1,100 acres were devoted to the production of small seeds, including cucumber, watermelon, squash, gourd, and muskmelon seed. This industry was profitable until about 1900, when it was practically discontinued, owing to the advent of various destructive insects and the existence of low prices. The seed industry was resumed in 1910, but now consists mainly of the production of seed corn.

The growing of wheat was resumed about 1895, when the State Experiment Station demonstrated the superior qualities of a variety of winter wheat which was imported from Russia, known as Turkey Red. This produces better yields than the spring varieties, and as a result the acreage of wheat has steadily increased. The 1910 census reports a total of 5,786 acres in this crop. Corn has decreased in acreage since about 1900, owing to the increased acreage of the small grains, hay, and alfalfa. Corn was grown on 67,378 acres, according to the census of 1910. The oat crop has steadily increased in importance, and now holds second place among the small grains. Oats are reported grown on 20,823 acres in 1909. A total of 9,807 acres are reported in wild grasses, with 3,730 acres in alfalfa. Only

771 acres were devoted to barley. Potatoes are reported on 2,509 acres, and 1,136 acres were devoted to other vegetables.

The first methods of farming were very crude and wasteful. No attention was given to the proper cultivation of crops, seed selection, crop rotation, or fertilization. Crop yields decreased from year to year, and the productive capacity of the soil was greatly reduced. As the cause of the reduced yields became apparent the farming system was gradually improved, until at present the farmers give more attention to crop rotation, exercise considerable care in the selection of seed, and improve the soil by growing alfalfa and other legumes.

As in other sections of eastern Nebraska, grain production is the chief type of farming in Douglas County, though dairying and the raising of hogs and other live stock are important industries. Corn, oats, wild grasses, wheat, alfalfa, barley, and clover are the chief general farm crops grown, ranking in acreage in the order named. The tendency today is to grow less corn and more wheat, oats, and leguminous crops.

Corn is by far the most important crop, and on farms where it is not fed to live stock it is the chief cash crop. A little over two-fifths of the total area of the improved farm land in Douglas County is devoted to the production of corn. It is grown on all the soil types of the county. It does best on the heavier soils, although fair returns are obtained from the sandy soils. The average yield for the county in 1910 was about 34 bushels per acre. Both the yellow and white dent varieties are grown. Pride of the North, Reids Yellow Dent, and Improved Leaming of the former, and Iowa Silver Mine of the latter are the leading varieties. In planting, most of the corn is listed, some is check rowed, and in a few cases it is double listed. At present most of the corn is sold, though a large percentage is fed to hogs and beef cattle. On farms with silos a large part of the corn is cut for silage; in other cases only the grain and the finer part of the stalk are utilized. It is a general practice to pasture the corn lands after the ears have been removed. On many of the farms corn is grown for 4 or 5 years in succession on the same field, and in some cases it has succeeded itself for 20 years or more. Better results are obtained where corn is rotated with small grains and leguminous crops. With better farm management the average yield could easily be increased.

The growing of oats is steadily increasing in importance. At present about one-eighth of the improved farm land of the county is devoted to the production of this crop. It does well on all the soils except the bottom-land types, where it is likely to lodge, and the Kherson oat, a very short, stiff-strawed variety, has given excellent results on these soils. The average yield is only 27 bushels per acre, but this yield is greatly exceeded on well-managed farms. As a

rule oats follow corn in the rotation, and they are very seldom sowed on the same land two years in succession. Most of the crop is fed to horses and other live stock, though some of it is sold.

According to the census of 1910, only a small part of the farm land was used for the production of wheat. However, a large acreage is now devoted to this crop. In 1913 at least one-twelfth of the improved farm land was in wheat. The greater part of the crop is winter wheat, very little spring wheat being grown. Winter wheat has almost entirely taken the place of spring wheat, because it is a better yielder, can be sowed in the fall, a time of the year when there is comparatively little other farm work, and stands drought better, maturing before the hot winds and dry weather occur. It is grown profitably on all the soil types except the Knox silt loam, which is too hilly for successful grain production. As a rule wheat is grown on the same land for 2 to 4 years in succession, and is placed after oats in the rotation. The Turkey Red variety is grown practically to the exclusion of other varieties. Wheat is a cash crop and is usually sold directly from the thrashing machine.

The acreage of wild hay in the county is comparatively large, owing to the extensive areas of unreclaimed bottom-land soils better suited to this product than to cultivated crops. The wild hay is produced mainly on the Platte and Elkhorn Valley bottom lands; only a few acres of upland remain in virgin prairie. Within the last few years large tracts of land have been reclaimed by ditching and tiling, and this has reduced the acreage of wild hay considerably. The average yield of wild hay is $1\frac{3}{4}$ tons per acre. Most of the hay is stacked in the fields and as time permits pressed in bales and hauled to town. A large part of it is shipped to Omaha, where it sells for \$6 to \$12 a ton, depending on the quality. Some of the hay is left in stacks and hauled from the fields as it is needed for feed.

Alfalfa promises to become the leading hay crop in Douglas County. It does particularly well on the upland soils and the well-drained bottom-land soils, three cuttings and sometimes four being obtained each year, with a total yield ranging from 3 to 5 tons per acre. Alfalfa is grown chiefly on the Knox silt loam and to some extent on the Marshall silt loam and the higher lying areas of bottom land. Most of the crop is fed to cattle and horses, though in the vicinity of Omaha a large part is sold to the alfalfa mill located in South Omaha. Alfalfa is usually sowed after a wheat crop and is grown on the same land for five to seven years. It requires a good seed bed and should be sowed after the first rain in August. Fifteen pounds of seed per acre is considered sufficient to insure a good stand. The alfalfa is grown successfully with a nurse crop. Owing to its high feeding value and adaptability to most of the soils of the county,

the extensive use of alfalfa in the crop rotations is highly advantageous.

Clover is grown to a very small extent, as it is difficult to get a catch. There is comparatively little rainfall between the middle of July and the middle of September, and the delicate clover plants are exposed to extremely hot winds and sometimes to long droughts after the nurse crop is removed. If rain falls immediately after the cutting of the grain, the clover does well and yields from $1\frac{1}{2}$ to $2\frac{1}{2}$ tons of hay per acre. As a rule clover and timothy are sowed together. During the last few years the crop has practically been a failure. A small acreage is devoted to millet and Hungarian grasses and to other tame grasses. The 1910 census reports 576 acres of clover, 763 acres in millet and Hungarian grasses, and 273 acres in tame grasses.

The less important crops of Douglas County are potatoes, sorghum, buckwheat, and rye. While the total acreage in potatoes is relatively large, not enough are produced to meet home demands. Only a few acres are devoted to the production of sorghum, buckwheat, and rye.

During recent years some attention has been directed to the production of seeds of special and general farm crops. Practically all the seed crops are grown on the bottom-land soils along the Platte and Elkhorn Rivers. The special crops grown for seed are squashes, pumpkins, gourds, and sweet corn, with a small acreage of muskmelons, cucumbers, and the flint and dent varieties of field corn. Of the vine crops, squashes are the most important. The chief varieties grown are the Red Hubbard, Chicago Warty Hubbard, Early White Bush Scallop, and the Warren. They do well and yield on an average 200 pounds of seed to the acre, though yields of 400 pounds are sometimes obtained. The average price for this seed is 16 cents per pound. Pumpkins do well and yield on the average about the same as squashes. A somewhat higher price, about 20 cents per pound, is received for the seed. The chief varieties grown are the Kentucky Field, Connecticut Field, and Calhoun. Like the other vine crops, gourds do well and produce an average of about 400 pounds of seed per acre. The gross return is about \$120 per acre and the net profit about \$80. Hercules Club is the chief variety grown. Since the advent of the green aphid the growing of muskmelons, cucumbers, and watermelons has been almost entirely abandoned, though a few fields are still devoted to these crops. The vine crops are left to mature and then run through a thrasher to separate the seed from the hull. The seed is placed in a large vessel and washed free from the fleshy material. All the above crops are grown on the Cass very fine sandy loam, and to a small extent on the Cass fine sandy loam. The former

type is especially adapted to these crops, as they do best on a light-textured soil.

Sweet corn for seed purposes does particularly well on the Cass very fine sandy loam and also on the better drained areas of the Cass silt loam. The acreage is gradually being increased to advantage. Sweet corn yields an average of about 25 bushels per acre. Stowell's Evergreen and Ferry's New Early Evergreen are the chief varieties grown. The price received for the crop varies from \$1.60 to \$2 per hundred pounds, depending on the variety.

Corn of the dent, both the yellow and white, and the flint varieties is the most important crop grown for seed on the Platte and Elkhorn River bottom lands. The dent varieties do best and give an average return of 40 to 45 bushels per acre. Of the yellow dent varieties, the Improved Leaming, Pride of the North, and Iowa Gold Mine are the most popular, and of the white dent corn Iowa Silver Mine and Champion White are the principal varieties. The flint varieties, of which the Sanford, Longfellow, and Early Eight-Rowed Canada are the most popular, are not very extensively grown. The flint corn produces lower yields than the dent, averaging between 20 and 35 bushels per acre. The average price obtained for the dent corn is 5 cents over market price for ordinary corn, and for the flint varieties 10 to 15 cents over market price. Most of the seed corn is grown on the Cass very fine sandy loam and to some extent on the other bottom-land types.

There are between 30 and 60 acres devoted to the production of onion sets. These do well, a gross return of about \$100 per acre being obtained.

Practically all the seed produced in Douglas County is sold to two seed houses, one located at Valley and the other at Waterloo. Most of the seed is contracted for at a certain price, though a large quantity is bought on the open market. Where contracted for the seed must be delivered at the warehouse in good condition. The chief objection of the farmers to seed production, aside from corn, is the extra help which it requires. No special fertilizers are used in growing seeds, but a large quantity of barnyard manure is applied to the land annually.

The trucking industry is confined to the vicinity of Omaha and its suburbs. The chief crops grown are Irish potatoes, sweet potatoes, cabbage, asparagus, cucumbers, carrots, beans, tomatoes, onions, beets, and muskmelons. Irish potatoes are the most important of these crops. They do well on the bottom-land soils, yielding from 150 to 250 bushels per acre. Sweet potatoes on the average yield 250 bushels per acre, and sell for about \$1 per bushel. Cabbage does exceptionally well, yields of 7 to 8 tons per acre being obtained,

giving a gross return of approximately \$150 per acre. A very small area is devoted to the production of asparagus, which gives an average return of \$250 per acre. Owing to the ravages of the green aphid, the cucumber crop is successful in only about 1 out of 3 years. Where not damaged by insect pests cucumbers give excellent returns. However, many failures have discouraged the truck farmers and as a result the acreage planted is small. Carrots do well, averaging about 150 bushels per acre. Beans are grown profitably, yielding about 75 bushels per acre. They are sold green and as a rule bring about \$2.50 a bushel. Yields of 200 to 300 bushels of tomatoes per acre are reported by truck farmers. These are usually sold in market baskets, and bring about \$1.20 per bushel. Onions produce good yields, ranging from 300 to 400 bushels per acre. Beets do well on the bottom-land soils and produce about 150 bushels per acre. As the green aphid destroys the muskmelon plant, the growing of this crop is rapidly declining.

Trucking is practiced mainly on the Sarpy silt loam, and to a small extent on the Sarpy very fine sandy loam and the Wabash silt loam in the Missouri River bottoms. Some of the Wabash silt loam and Knox silt loam, dark-colored phase, west of Omaha, is also devoted to small vegetables. The Wabash silt loam, especially after being reclaimed by drainage, is admirably adapted to trucking. As the Missouri bottom lands are very limited in extent and subject to river action, the Wabash silt loam promises to become the principal trucking soil of the county. Of the upland soils the Knox silt loam, dark-colored phase, when heavily fertilized makes a good trucking soil.

The farms in the trucking region are very small and are given very intensive cultivation. The land is plowed in the fall and again in the spring. Before planting the crop the field is worked to a very deep and mellow condition. The land is very heavily fertilized with horse and cow manure, at the rate of about 50 tons to the acre, every 2 years. The manure is hauled mainly from the large stockyards of South Omaha. As a rule the only expense involved is that for the hauling, and in some cases the farmers are paid to carry the manure away. The small vegetables produced in the county are largely marketed in Omaha and its suburbs.

The fruit industry is confined to the eastern part of the county, and mainly to the northeastern corner. The most important fruit crops are grapes, apples, strawberries, raspberries, and blackberries. The grape industry is best organized and most extensively developed. With proper care grapes do well and give excellent returns. The size of the vineyards varies from about one-fourth acre to five acres, averaging about one acre. The leading varieties are the Concord, Moore Early, Worden, and Campbell Early, the two former being

most popular. Taking an average of good and bad years, the Concord variety yields about 1,000 eight-pound baskets and the Moore Early about 600 eight-pound baskets per acre. The average price obtained for Concord grapes is from 15 to 18 cents per basket, and for Moore Early from 19 to 20 cents. Grapes do best and are most extensively grown on the Knox silt loam and the Knox silt loam, dark-colored phase. The north and northeast slopes are preferred for vineyard sites.

Most of the grapes produced in Douglas County are marketed through a fruit growers' association. This association has succeeded in advancing prices. The product is shipped wherever a market is found, although most of it goes to points between the Mississippi River and the Rocky Mountains. Individuals not belonging to organizations supply the Omaha market. About 150 acres are grown by members of the association and about 50 acres by other growers. The total shipment for 1913 was 86 cars.

Although the zone of broken land along the Missouri River is noted for its adaptability to apples, it is not extensively devoted to their production. There are a number of very successful orchards, and the profit derived from them is satisfactory. The apples produced have good flavor, color, and keeping qualities. Excellent shipping facilities favor the extension of the industry.

As in other sections, the apple trees require special care and cultivation, pruning, and spraying. For commercial orchards the Duchess and Maiden Blush are the most popular summer varieties, and the Jonathan, York Imperial, Stark, Minkler, Eastman, Winesap, Grimes, Black Twig, and Ben Davis are the winter varieties most commonly grown. For the farm orchard Grimes, Early Harvest, Red June, Wealthy, Maiden Blush, Jonathan, Winesap, Minkler, and Black Twig give best results.

Small-fruit production is receiving increased attention. The small fruits are largely grown on the typical Knox silt loam and its dark-colored phase. Strawberries are grown in patches ranging in size from one-half to 3 acres; raspberries, from one-half to 8 acres; and blackberries, from one-half to 10 acres. Small fruits give a gross return of \$200 to \$400 an acre. Currants and gooseberries are grown to a small extent. A fruit growers' association handles these crops, but not the apple crop.

The dairy industry is not well developed in Douglas County, except in the immediate vicinity of Omaha. There are a few pure-bred herds of Holsteins, Guernseys, and Ayrshires in the county, but most of the dairy animals have more or less Shorthorn blood. Holsteins are rapidly taking their place. In general, the farmers each keep 5 to 8 cows, and practically every farmer has a separator.

Farmers who do not have a separator send their milk to skimming stations. The milk or cream is hauled to the station either by the farmer himself or by collectors. A charge of 20 to 25 cents per hundred is made for hauling. There are three skimming stations in the county—at Bennington, Elkhorn, and Waterloo—and another is being installed at Millard. A price of \$1.20 per hundredweight of milk is paid in summer and \$1.35 in winter. Practically all the cream sold in the county finds its way to one of the seven creameries located in Omaha, where it is manufactured into butter and ice cream. During the summer all the milk shipped from the stations of Elkhorn, Waterloo, Lane, and Millard is taken to a condensery located at Papillion, where it is sold at \$1.55 per hundredweight in the winter time and \$1.30 in the summer.

There are a number of large dairies in the vicinity of Omaha which supply most of the fresh milk for the city. Each dairy keeps from 30 to 50 cows. The feed is largely bought. With few exceptions, the large dairies buy their fresh cows from the stockyards, milk them until they no longer pay, and then fatten and sell them. The milk is sold from wagons throughout Omaha and its suburbs at 8 cents per quart. The buttermilk of the large creameries is returned to the milk stations in tank cars. It is emptied into large containers at the station, and sold to the farmers for 10 cents per hundred.

Not enough attention has been given to breeding cows of milk strain, the feeding of balanced rations, or the proper sanitation of barns. There are only a few silos in the county, although the number is slowly increasing.

The raising of beef cattle has never been an important industry in Douglas County. Every farmer fattens a few head each year and sells them when prices are most favorable. A few farmers buy a carload or more of stock from the stockyards in the fall, fatten them on corn, and sell them back to the stockyards when the prices are favorable. As a rule, only a few farmers make a success of this business. Most of the beef cattle show more or less Shorthorn breeding.

Some attention is paid to the breeding of farm and draft horses. Nearly every farmer raises one or two colts each year, and in this way supplies his own work horses and frequently has a team to sell. Percherons are the favorite breed. The price received for a good team of horses ranges from \$400 to \$500. A few mules are raised.

Hog raising is carried on extensively, being the most important of the animal industries. The average farmer supplies his own family with pork and fattens from 20 to 40 hogs a year for market. On a few farms all the corn is fed to hogs, which are marketed profitably. Duroc-Jersey, Poland China, and Chester White are the chief breeds, though very few herds are pure bred.

The poultry industry is quite extensively developed in Douglas County. There are a number of large poultry farms in the vicinity of Florence and Omaha. A few chickens are kept on every farm, and on many farms a few ducks and geese are raised.

The adaptation of the various soils of the county to different crops receives but little attention, practically all the general farm crops common to the region being grown upon most of the soil types. Corn does well on the silt loams and heavier types, but little effort is made to determine whether any other crop, besides oats and wheat, might be grown profitably. The lighter soils of the county seem to be most profitably used for trucking and the production of special crops.

No definite system of crop rotation is followed in the county, except by a few progressive farmers. The general practice is to keep the land in corn from 2 to 4 years, following this crop with 1 year of oats and 1 or 2 years of wheat. Occasionally the wheat land is seeded to clover and timothy for 2 years, and then returned to corn. On farms where there is no permanent pasture, the clover and timothy is usually pastured the following year. Owing to the difficulty in getting a stand of clover during the last few years, this crop has been largely dropped from the rotation. Alfalfa is taking the place of clover. It is usually grown for 5 to 7 years on the same field. Apparently the best rotation practiced in the county is 2 years corn, 1 year oats, 1 to 2 years wheat, and 2 to 3 years clover and timothy, or 3 to 5 years alfalfa. Fields in which a single crop, corn or wheat, has succeeded itself for 15 years or more are common.

Little attention is given to the proper cultivation and fertilization of most of the crops. The stubble field is generally plowed in the fall either for winter wheat or corn. Corn land is usually listed and sometimes double listed where the crop succeeds itself. If the field is put in oats, the land is either double disked or the oats are cultivated between the rows of corn. Variations and modifications of the above practices are very common. It is necessary to exercise considerable care in handling the heavier soils of the county, and the methods of cultivation necessarily vary with the difference in the soils. The better practice seems to be to plow or disk the stubble fields immediately after the grain is harvested, to prevent the ground from drying out. Except in the vicinity of Omaha, but little manure is applied. The barnyard is usually cleaned twice a year, in the fall and spring, and as a rule the manure is used on the wheat land, and sometimes on the corn land. The plowing under of green crops is not practiced, nor are commercial fertilizers used to any extent. According to the census of 1910 the expenditure for fertilizers during 1909 was but \$1,184.

With few exceptions the farm improvements in Douglas County are exceptionally good. The farm buildings, especially the houses, are usually well painted and kept in good repair. The appearance of the farm homes gives an impression of general prosperity. Most of the fences are of barbed wire, though some are of woven wire. There are only a few hedge fences in the county. As a rule the farm machinery is left exposed to the weather.

Farm labor is rather scarce, especially during the harvest season, although enough help is usually obtained to do the farm work. Laborers are paid \$15 to \$30 a month, with board and washing. Most of the labor is employed from April 1 to December 1, though a large number of farmers hire labor for the entire year. The daily wage for transient labor during harvest time is \$2 to \$3, with board. Most of the farm work, however, is done by the family, and at times women and children work at the lighter tasks in the fields.

The 1910 census reports a total of 176,860 acres in farms, of which 164,611 acres are improved. The average size of the farms is given as 102.7 acres.¹ Only a little more than one-half of the farms are operated by the owners. The cash and share systems of renting the land, and a combination of the two, are very common. The cash system is probably most generally practiced. Cash rent varies from \$3 to \$6 an acre for general farming land, depending on the character of the soil and location, and seed houses pay rents of \$8 to \$10 per acre for land used in raising special seed crops. In share renting the owner receives two-fifths of the products of the farm, where the tenant furnishes all implements and stock. Where land is rented for an equal share of the crops the owner furnishes all tools and the work stock. In the combination system of cash and share renting the permanent pasture and the land not used for crops are rented for cash and the grain and hay land on shares. Under each system of leasing the tenant is required to deliver the grain to the elevator. Land values in Douglas County range from \$15 to \$250 an acre, depending on the soil, improvements, and location. In the immediate vicinity of Omaha land utilized for trucking is valued at \$500 an acre.

In general, throughout Douglas County there is a need for greater attention on the part of the farmers to the maintenance of the productiveness of the soils. In some areas, particularly on the Wabash clay, Wabash silt loam, Cass clay loam, Cass silt loam, and Cass loam, artificial drainage is needed, and in a few areas it is necessary to exercise care to prevent the soil from washing. The present tendency is toward a more diversified agriculture.

¹The average size of individual holdings is probably more than this, as the census tabulates each tenancy as a "farm."

SOILS.

The soils of Douglas County may be divided into three groups—upland, terrace or second-bottom, and first-bottom soils. The upland group embraces the Knox, Marshall, and Shelby series. The terrace or second-bottom soils are included in the Waukesha series, and the first-bottom soils are mapped as the Sarpy, Wabash, and Cass soils, and Riverwash.

In texture most of the upland and all of the terrace soils are silty, while those of the bottom land vary from loose, incoherent sand to heavy clay. With the exception of the Knox soils and the recently deposited Missouri River and Platte River bottom-land soils, the soils of the county are dark colored and rather high in organic matter.

The upland is covered by a bed of loess which varies from a thin mantle to approximately 100 feet in depth.¹ The loess varies in color from yellow or pale yellow to light gray, and is always more or less impregnated with lime and mottled with iron stains. This formation gives rise to the extensively developed Knox and Marshall soils. In the northwestern part of the upland the loess occurs as loess-plains material. Along the Missouri bluff line it has received a covering of more recent loess, which has been blown from the sand bars and bottom lands of the valley. This loess gives rise to the Knox silt loam and a part of the Knox silt loam, dark-colored phase.

Directly underlying the loess are the three drift sheets, the Kansan, Aftonian, and Nebraskan. The Kansan sheet, where oxidized, has a yellowish, brownish, or reddish-brown color, but in the lower part it is a light-gray or bluish color. It consists of a mass largely clay and silt with some fine grit, pebbles, and boulders. The upper part of this formation has a browner or yellower color, is more silty, and carries fewer boulders than the lower part. The former is spoken of as the weathered phase of the Kansan drift. Where exposed the Kansan drift proper gives rise to the Shelby loam, which is very inextensive.

Below the Kansan sheet lies the Aftonian, which consists largely of stratified sands and gravels, with few boulders. The lowest drift sheet, the Nebraskan, consists of blue clay, containing small pebbles and boulders. It is exposed only in deep ravines and steep valley sides.

The oldest consolidated rocks exposed in the county consist of well-defined layers of limestones and shales of Pennsylvanian age. Outcrops of these occur in the vicinity of Omaha and Florence. The beds extend westward in the county, lying in a nearly horizontal position. Along the western border of the upland, the Dakota for-

¹ Unpublished manuscript of G. E. Condra.

mation, consisting of a rusty-colored sandstone, and lying unconformably on the Pennsylvanian rocks, is exposed in a few places. The bedrock lies in a horizontal position. Aside from its water supplies, the bedrock has no economic importance owing to its inaccessibility and its thick covering of unconsolidated material. Though somewhat friable, a little Dakota sandstone is used for building purposes.

The terrace, or second-bottom soils occur along the Missouri River and are never subject to overflow. They consist of deep loess beds underlain by almost white sand and gravel. The loessial material is approximately 30 feet deep. This bench loess gives rise to the Waukesha silt loam.

The stream alluvium, or first-bottom, soils of Douglas County are of recent origin, and in many places are still in process of formation. Along the smaller streams, owing to uniformity of wash, the alluvium as shown in a cross section consists largely of stratified clay and silt. The bottom lands of the Platte and Elkhorn Rivers consist largely of alternating layers of stratified medium and coarse sand and gravel, with a few seams of fine sand, silt, and clay in the upper part, while the bottom lands of the Missouri River consist largely of alternating layers of very fine sand, silt, and clay. The alluvium along the smaller streams is shallow as compared with that of the Missouri, Platte, and Elkhorn River first bottoms, in which it varies in depth from 60 to 100 feet. The first-bottom soils along the smaller streams in the upland region are included with the Wabash series, and those along the Missouri, Platte, and Elkhorn Rivers with the Sarpy, Cass, and Wabash series and Riverwash.

The following table gives the name and the actual and relative extent of each soil type mapped in Douglas County:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Knox silt loam.....	13,504	37.7	Cass loam.....	2,176	1.0
Dark-colored phase.....	66,240		Wabash clay.....	1,792	0.8
Marshall silt loam.....	47,680	24.0	Sarpy fine sand.....	1,600	.7
Flat phase.....	3,072		Sarpy silt loam.....	1,472	.7
Wabash silt loam.....	22,848	12.1	Riverwash.....	1,472	.7
Colluvial phase.....	2,816		Cass clay.....	1,088	.5
Cass very fine sandy loam.....	18,880	8.9	Cass clay loam.....	704	.3
Cass fine sandy loam.....	12,032	5.7	Shelby loam.....	64	.1
Cass silt loam.....	8,384	4.0			
Sarpy very fine sandy loam...	3,200	1.5			
Waukesha silt loam.....	2,816	1.3	Total.....	211,840

KNOX SERIES.

The Knox soils are prevailingly light brown. The subsoil is yellow or light grayish yellow. These soils occur mainly in the cen-

tral prairie States. They are derived from loessial deposits. The loessial covering where the Knox series is found is always thick enough to form the subsoil as well as the surface soil, the deeper lying glacial till being far enough from the surface to have no marked influence on the general character of the soil. The topography is gently undulating to rolling, and the surface drainage is generally good.

The silt loam is the only type of the Knox series encountered in Douglas County.

KNOX SILT LOAM.

The soil of the Knox silt loam consists of a light-brown to pale-yellow, extremely smooth silt loam, with an average depth of 8 inches. This is underlain by a yellow or light yellowish gray heavy silt loam, which at depths of 24 to 40 inches passes into a light-gray somewhat looser stratum. Reddish-yellow iron stains and lime concretions are common in the subsoil. The surface soil varies considerably with difference in topographic position. On the sharp divides and upper steep slopes the light yellowish gray or gray silt loam with numerous lime concretions is exposed. On the broader divides or on the lower slopes of the hills and in forested areas the soil is brown and in places approaches a dark-brown color. Throughout the 3-foot soil section the type is entirely free from rock fragments. It has a rather vertical and open structure, a characteristic of the Missouri River bluff loess.

The typical Knox silt loam differs from its dark-colored phase principally in being much more dissected and rolling, and in containing less organic matter.

The Knox silt loam occupies a total area of 21.1 square miles, and occurs in the eastern and extreme western parts of the upland region. The largest area is encountered in the northeastern corner of the county and the next largest as a narrow continuous strip along the bluffs of the Elkhorn River. Another area is developed in the southeastern corner of the county.

This soil has an extremely dissected topography, and is thoroughly drained. It is subject to erosion, though since the subsoil is practically of the same character as the soil, the washing away of the surface material does not render the type useless for agriculture. Where the type occurs as a bluff line along the Missouri River bottom land it has an almost precipitous slope. Along the Elkhorn River it is very steep to precipitous.

Practically all this type was originally forested. The chief growth on the upper slopes and crests of hills was scrubby bur oak and sumac, and on the lower slopes and in draws, bitter hickory, elm, box elder, ash, and some black walnut. Approximately 50 per cent of the type is still forested, though it is rapidly being cleared.

Owing to its extremely rough topography, the growing of small grain on this type is impracticable. Only a small acreage is devoted to corn, and the fields are mostly on the lower slopes of hills and in draws. In such locations the crop does well, yields of 30 to 40 bushels per acre being obtained. Where it is grown on the high crests and upper slopes, the yields are rather low, except where the land is heavily fertilized. Alfalfa is grown very extensively on this soil and owing to the thorough drainage and lime content gives excellent returns. Yields of 3 to 4 tons from three cuttings per season are usually obtained.

The growing of small fruits, principally grapes, raspberries, blackberries, and strawberries, is becoming a very important industry on this soil. Approximately 175 acres are devoted to grapes, and the vineyards are being rapidly extended. The upper slopes, preferably the northern and northeastern slopes, are considered the best sites for the vineyards. About 1,000 eight-pound baskets per acre is the average yield. On the lower slopes and in the draws, where there has been an accumulation of organic matter, grapes are more susceptible to disease and insect pests, and as a rule such areas are devoted to the production of small fruits, truck crops, and corn. Raspberries, blackberries, and strawberries do well in such places, though where the land is heavily fertilized they do equally as well at higher elevations. The lower situations are best suited to truck crops, such as potatoes, cabbage, carrots, beets, and turnips. Potatoes do well, and yields of 150 to 175 bushels per acre are obtained.

The Knox silt loam is a valuable soil for the production of apples, and to some extent pears and plums. There are a few large orchards on the type, and the yield and quality of the fruit are good. Proper cultivation, spraying, and pruning are essential to success in this industry.

Farms on the Knox silt loam are small and the farming practices intensive. About 20 to 40 acres constitutes the average farm. Owing to its comparatively loose structure and favorable texture, this soil is very easy to handle, except in areas where lime concretions are plentiful enough to interfere with tillage operations. This type, where used for small fruit, apples, and truck crops, is heavily fertilized, though very little manure is applied to alfalfa fields, except in seeding.

In the western part of the county land values on this soil range from \$50 to \$75 an acre, and in the eastern part from \$125 to \$200 an acre, or even more in cases of especially desirable location. Where planted to vineyards the land is held at \$500 an acre.

Knox silt loam, dark-colored phase.—The Knox silt loam, dark-colored phase, is a yellowish-brown to brown silt loam, 8 to 10 inches deep, underlain by a yellow or pale-yellow, rather compact

heavy silt loam. Below an average depth of 30 inches the color changes to yellow mottled with light gray. The color of the soil varies with the topography. On the rather flat divides the soil is somewhat darker than typical, and is about 12 inches deep. On the shoulders of hills and along small gullies the soil in many places has been entirely washed off and the subsoil with its limy concretions is exposed. The soil becomes deeper down the slope and at the foot of the hill it is sometimes comparable with the Marshall silt loam. The surface soil, when freshly plowed, has a mottled color, with patches of brown, light brown, yellowish brown, and light gray in the same field. Owing to severe erosion, practically all the organic matter has been removed, and as a result the phase is low in this constituent. The subsoil is highly impregnated with lime in the form of nodules, and in places where erosion has been severe a scattering of lime concretions is very common in the lower part of the subsoil and at greater depths. Outcrops of the Kansan drift occur on some of the steeper slopes of this phase, but most of these are not large enough to be indicated on the soil map. The phase includes small patches of Marshall silt loam and narrow colluvial areas along the intermittent streams. These, likewise, are too small to be mapped separately.

The Knox silt loam, dark-colored phase, is the most extensive upland soil in the county, and comprises an area of 103.5 square miles. It has its best development in the eastern part of the county, where it covers a large continuous area. In the extreme northeastern corner of the county it gives way to the typical Knox silt loam, and again in the southeastern corner. Elsewhere it extends to the second terrace proper. West of a line running due north and south through Irvington the dark-colored phase of the Knox silt loam is more or less interspersed with areas of the Marshall silt loam, and in the extreme western part of the upland it occurs only as a few small patches.

In the eastern part of Douglas County this phase has a rolling to steeply rolling topography. Throughout the remainder of the upland it occupies the steep slopes and sharp divides. The phase is thoroughly drained. Erosion is a serious problem.

A small part of this phase along the Missouri River bluff was originally forested mainly with bur oak; the remainder supported a growth of prairie grasses.

Approximately 80 per cent of this soil is utilized for farming; the remainder is chiefly occupied by Omaha and its suburbs. Grain farming is the principal type of agriculture, though there is a tendency toward the extension of dairying. The principal crops are corn, oats, wheat, and alfalfa. Corn does well, and yields from

30 to 35 bushels per acre. Oats rank second in acreage, and produce an average of 30 bushels per acre. A small part of the phase is devoted to wheat. Where heavily fertilized this crop does well, producing an average of 18 bushels per acre. Alfalfa is coming into favor on this soil and its acreage is being rapidly extended. Owing to the high lime content and thorough drainage this crop does particularly well, and an average of 3 cuttings are obtained, though as many as 4 are sometimes made. It is easier to get a catch of alfalfa on the Marshall silt loam than on this soil, but after a stand has been obtained the crop does almost as well on the Knox silt loam, dark-colored phase. Alfalfa is most successful where the field is heavily fertilized with barnyard manure before it is seeded. The total yield per season ranges from 3 to 4 tons per acre. There is considerably more pasture land on this phase than on the Marshall silt loam.

In the vicinity of the suburbs of Omaha a small part of this phase is devoted to trucking. Where heavily fertilized the soil gives good yields of most vegetables. Cabbage, beets, potatoes, asparagus, onions, beans, and carrots give large returns. Potato yields average about 150 bushels per acre. They are grown on a commercial scale in the vicinity of Omaha; outside of that section hardly enough are produced to meet home demands. In the eastern part of the county a large area is devoted to the growing of small fruit. Blackberries, raspberries, and strawberries do well with proper care. The patches of small fruit range from 1 to 10 acres in extent. The average gross return is about \$250 per acre, though a return of as high as \$500 is sometimes realized. About 75 acres of this phase are in vineyards. In favorable seasons the grape crop is very profitable. As on the other soils of the county, the farmers do not follow a definite rotation. A common practice is to grow corn 2 years, followed by oats 1 year and wheat 1 year. In about every third rotation alfalfa follows wheat for a number of years. On farms where both the Marshall silt loam and the Knox silt loam, dark-colored phase, occur, as much as possible of the latter is kept in alfalfa and pasture, while the former is largely devoted to corn and small grain. It is not unusual to use the dark-colored phase of the Knox silt loam for alfalfa for 5 to 7 years, returning the field to corn and wheat.

The texture and structure of this soil make it rather easy to cultivate. It can be worked under a rather wide range of moisture conditions and unless plowed when extremely wet does not bake or clod. Very little barnyard manure, except in the vicinity of Omaha, is applied to this soil, and no commercial fertilizers are used.

This phase is very low in organic matter, and its productiveness is gradually decreasing under the present methods of farming. Owing

to its steep topography it should be utilized less for corn growing and kept as much as possible in cover crops.

The land values on this phase are considerably lower than on the Marshall silt loam, except where its value is due to location. The land is held for \$100 to \$125 an acre, and in the vicinity of Omaha for \$200 to \$500.

MARSHALL SERIES.

The Marshall series includes types with dark-brown to black surface soils and a lighter yellowish-brown subsoil. This series includes the dark-colored upland loessial soils which predominate in the prairie region of the Central West. The soils are characterized and distinguished from those of the Knox series by the large quantity of organic matter in the surface soil. The topography is level to rolling. The Marshall series is represented in Douglas County by a single type, the silt loam.

MARSHALL SILT LOAM.

The Marshall silt loam is a dark-brown moderately heavy silt loam, 12 to 15 inches in depth, underlain by a light-brown or brownish-yellow heavy silt loam which extends to a depth of about 20 inches. This layer, in turn, rests on a yellow, rather compact heavy silt loam to silty clay loam which at about 30 inches usually merges into a yellow mottled with light gray silty clay loam. As a rule the subsoil becomes decidedly looser in structure at depths of 32 to 40 inches, and is more nearly a silt loam. The subsoil is highly calcareous, the lime being chiefly in the form of concretions, varying in size from a small pebble to that of an egg. Faint markings of yellowish and brownish iron oxide occur within the 3-foot section, becoming more pronounced with increasing depth. A high percentage of organic matter gives this soil its characteristic dark color.

The depth of the soil is variable, and depends upon the topographic position. On rather flat divides it is usually 15 inches deep, while on the shoulders of hills and along gullies the depth is only 6 to 8 inches. Going down the slopes the soil becomes deeper and at the foot it commonly extends to a depth of 24 to 40 inches.

Within this type along intermittent streams are included small, narrow strips of colluvial material which are not sufficiently extensive to be mapped separately. The type also includes along the shoulders of hills and small gullies small spots of the Knox silt loam, dark-colored phase, which were too patchy to be indicated satisfactorily on the map. On the other hand, small areas of Marshall silt loam are also encountered in areas of the dark-colored phase of the Knox silt loam. As erosion progresses the tendency is to increase the extent of the Knox silt loam, dark-colored phase, at the expense of the Marshall silt loam.

The Marshall silt loam differs from the dark-colored phase of the Knox silt loam in having a higher content of organic matter. In many instances it is very difficult to draw a definite boundary line between the two soils on account of their patchy occurrence. In the eastern part of the county the Marshall silt loam approaches the Knox silt loam, dark-colored phase, and is really a transitional type. In structure and texture there is no apparent difference between the two. Both have the vertical structure and extremely smooth feel which are characteristic of loess soils.

This type occurs almost entirely west of the Little Papillion Creek in the upland region. It is best developed east of the Elkhorn River bluff, and becomes more interspersed with the Knox silt loam, dark-colored phase, to the east, until finally it gives way entirely to the latter soil. The Marshall silt loam comprises a little more than one-third of the upland region, or 74.5 square miles. In the western and southwestern part of the upland section this soil has a rolling topography, but farther east, where it is interspersed with the dark-colored phase of the Knox silt loam, it occupies rather broad divides, gentle slopes, and the lower part of some of the steep slopes. The drainage is good. In some places erosion is a serious factor. On steep slopes a large amount of material is washed down by sheet erosion, and in such cases it is necessary to keep the land in cover crops. This type lies between an elevation of 1,000 and 1,300 feet above sea level.

This type originally supported a thick growth of the prairie grasses common to this section, but only a few small remnants of the native sod remain. Nearly all of the Marshall silt loam is under cultivation. This type is the most important corn soil of eastern Nebraska. A little over one-half of it in Douglas County is in corn, and the remainder is largely in oats, with some wheat and alfalfa. The soil gives good yields of corn, during average seasons from 35 to 45 bushels per acre. In more favorable seasons, with proper cultivation, much higher yields are obtained. Oats do well, average yields of about 35 bushels per acre being obtained. Only a small area is devoted to wheat, but the acreage of this crop is being rapidly extended. The soil yields 20 to 30 bushels, and sometimes as high as 40 bushels per acre are obtained. The acreage of clover, timothy, and alfalfa is very small. Owing to light rainfall during recent years it has been difficult to get a good stand of clover. In favorable years yields of 1½ to 2 tons of hay per acre are obtained. Alfalfa does well on this soil, producing from 3 to 4 tons of hay per acre in three cuttings. The present tendency on the Marshall silt loam is to grow less corn, more wheat, and more leguminous crops, and to keep more live stock.

The usual rotation followed is corn for 2 or 3 years, oats 1 year, and wheat 1 year, returning the field to corn. Occasionally the

wheat field is sowed to alfalfa, and in that case it is usually left in that crop for 5 to 7 years, when it is generally returned to corn. Most of the farmers do not follow any definite rotation, but use the same field in corn or wheat for 4 or 5 years.

This soil is friable and silty and free from stones, and is very easy to handle. It can be cultivated under a wide range of moisture conditions. It is easier to handle than the Knox silt loam, dark-colored phase, owing to its higher organic-matter content. The four-horse hitch is largely used for tillage operations.

Only a small quantity of barnyard manure is applied to this soil, and no commercial fertilizer is used. Owing to its higher organic-matter content it is more retentive of moisture than the dark-colored phase of the Knox silt loam type, and where proper attention is given to the conservation of soil moisture the Marshall silt loam stands drought for long periods.

Farm values on this type range from \$125 to \$200 an acre, depending on location, improvements, and the condition of the land.

Marshall silt loam, flat phase.—The Marshall silt loam, flat phase, to an average depth of 18 inches, consists of a dark-brown, moderately heavy smooth silt loam. This is underlain by a yellowish-brown, heavier and more compact silt loam, and at about 24 inches by a yellow heavy silt loam to silty clay loam. At about 30 inches the color of the subsoil changes to yellow mottled with light gray. The lower subsoil is slightly stained with yellow iron oxide and is highly calcareous. As the color indicates, this phase, like the typical soil, is high in organic matter.

This phase is of small extent, covering but 4.8 square miles. It occurs in four separate areas in the western part of the upland region and extends into Washington County. It occupies high, flat, plainlike areas. The streams have not cut back into it, but are near enough to provide adequate drainage.

This phase is used for the same crops as the typical soil, but owing to its flat topography it is preferred for farming. In general the yields on the phase are somewhat larger than on the typical soil.

The value of the Marshall silt loam, flat phase, ranges from \$150 to \$200 an acre.

SHELBY SERIES.

The types included in the Shelby series are predominantly brown, though they range to yellowish brown or yellowish gray. The subsoil is composed of yellow, reddish-yellow, or light-brown, tenacious sandy clay. The subsoil frequently contains pipy iron concretions and streaks of calcareous material. These soils are derived from the Kansan drift and occupy steep stream slopes and narrow divides. They are subject to extensive erosion. This series is represented in Douglas County by a single type, the Shelby loam.

SHELBY LOAM.

The Shelby loam consists of a dark brown silty loam, underlain at an average depth of 12 inches by a brownish-yellow, gritty clay loam, which at about 20 inches rests upon a light-gray, slightly mottled with yellow, heavy, tenacious, gritty clay. The subsoil is calcareous and contains black iron oxide concretions. The subsoil is extremely compact and breaks down in the same manner as the subsoil of the Lufkin fine sandy loam. A silty veneering, consisting largely of wash from the higher land, is very common. Occasionally the subsoil, the Kansan drift proper, is exposed, and gives rise to a reddish-brown, very heavy clay loam soil. Such areas are numerous along the bluffs of the Elkhorn River and on steep slopes along West Papillion, North Branch West Papillion, and Big Papillion Creeks, but these are too small to be mapped satisfactorily. Small pebbles and a few boulders are scattered over the surface and throughout the soil section.

This type occurs in seven small areas. The largest of these lies immediately south of Millard. Two areas are encountered west of Millard, one southwest of Elkhorn, and the other three in Jefferson Precinct on the east side of Big Papillion Creek. The soil occupies rather steep slopes along large drainage ways and, owing to its high position, is well drained.

The Shelby loam is derived from the Kansan drift sheet proper, but has been more or less influenced by wash from the silty upland soils. The large boulders and pebbles on the surface and the gritty, heavy subsoil distinguish this type from the Marshall silt loam.

Originally the type supported a growth of prairie grasses, but all of it is now under cultivation. It is devoted mainly to the production of corn, wheat, and oats. These crops do not do nearly as well on this type as on the Marshall silt loam. Where the subsoil is exposed crops have a stunted growth.

This type compares favorably with the Marshall silt loam in ease of cultivation where there is a fairly deep surface soil. There are, however, in the fields small spots where the subsoil is exposed, which are extremely difficult to handle.

Land values on this type range from \$60 to \$80 an acre.

WAUKESHA SERIES.

The surface soils of the Waukesha series are dark brown to black, and the subsoils are yellow. They are derived from water-assorted glacial débris, deposited in broad filled-in valleys or as outwash plains and terraces. The topography is mainly flat to undu-

lating. Drainage is good. The Waukesha silt loam is the only member of the series encountered in Douglas County.

WAUKESHA SILT LOAM.

The surface soil of the Waukesha silt loam is dark brown or dark grayish brown when dry, and consists of a smooth silt loam with an average depth of 15 inches. The surface soil has a very smooth and velvety feel, which is characteristic of soils high in silt. The subsoil consists of a light-brown heavy silt loam to silty clay loam. At about 20 inches the color changes to brownish yellow. There is no other change in color or texture throughout the subsoil section. The color becomes lighter with depth and at about 30 inches is a decided yellow. The soil is highly calcareous, the lime being largely in the form of concretions. Below a depth of 36 inches the subsoil becomes lighter in texture, and is not nearly as compact as between 12 and 36 inches from the surface. The heavier texture and more compact structure indicates that the clay from the surface soil has been carried downward by percolating water and deposited mainly between the depths of 12 and 36 inches. In general with prairie soils, this type has a high content of organic matter.

In structure, texture, and color this soil is very similar to the Marshall silt loam, but it differs from that type in topography and origin. The Waukesha silt loam has a flat, benchlike topography and is derived from valley loess, while the Marshall silt loam has a rolling topography and is derived from upland loess.

This type is developed as second bottoms along the Missouri River. It is encountered in two strips, the largest of which occurs in the northeastern part of the city of Omaha and the eastern part of the village of Florence. The other area is in the extreme northeastern corner of the county. The type comprises an area of 4.4 square miles. Outside of Douglas County it has a wide distribution as high terraces along the valleys of the Missouri and Platte Rivers and Salt Creek.

The Waukesha silt loam occupies flat areas about 30 feet above the present flood plain. It is slightly dissected by a few upland streams. This fact, together with its occurrence as a narrow belt, accounts largely for its good drainage.

Practically all the Waukesha silt loam in Omaha and Florence is used for building sites. Only the area in the extreme northeastern corner of the county, comprising about 110 acres, is devoted to farming. The crops grown consist principally of corn and oats, the former averaging 45 bushels and the latter from 45 to 50 bushels per acre.

The value of this land for agriculture ranges from \$175 to \$200 an acre.

The results of mechanical analyses of samples of the soil and subsoil of the Waukesha silt loam are given in the following table:

Mechanical analyses of Waukesha silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
371023.....	Soil.....	0.0	0.2	0.3	0.8	13.2	74.1	11.3
371024.....	Subsoil.....	.0	.0	.0	.4	14.2	75.5	9.5

WABASH SERIES.

The Wabash soils are prevailing black, ranging to dark brown, and contain a high percentage of organic matter. The subsoils are drab or gray. These soils are developed in the first bottoms of streams in the Central Prairie States. They extend for long distances along the Mississippi River. The material is derived by wash from the loessial and associated soils of the region. Two types of the Wabash series, the silt loam and the clay, are encountered in Douglas County.

WABASH SILT LOAM.

The soil of the Wabash silt loam consists of a dark grayish brown or almost black smooth silt loam extending to an average depth of 20 to 24 inches. It is underlain by a dark grayish brown to dark-gray silt loam, which is somewhat heavier and more compact than the surface soil. The change in color and texture between the soil and subsoil is almost imperceptible, and in places there is no difference in the 3-foot section.

Locally, in poorly drained spots, the subsoil has a light-gray color. Small areas of light-brown to brown silt loam occur also in the eastern part of the county, closely associated with the Knox silt loam, dark-colored phase. These areas usually comprise very recent wash from the Knox silt loam, dark-colored phase, and occur as a veneering over the typical soil. The material varies in depth from a few inches to 3 feet or more. Owing to its small extent and patchy occurrence this variation can not be satisfactorily shown on the map. Another departure from the typical soil consists of areas along the larger upland streams, where there are numerous small patches locally known as "gumbo" spots. The soil of these spots consists of an almost black silty clay loam about 10 inches deep, underlain by silty clay of the same color.

In addition to the variations just considered, a distinctly heavier phase of this type occurs in the first bottoms of the Platte and Elkhorn Rivers. The soil here is a very heavy black silt loam, underlain at about 12 inches by a black silty clay which merges into a very dark gray, mottled with brown, more tenacious silty clay. In places

the heavy subsoil is absent. This phase is also commonly spoken of by the farmers as "gumbo" land. Both the typical soil and the variations are high in organic matter.

The Wabash silt loam is quite extensively developed in Douglas County. It covers 35.7 square miles, and is encountered in practically every section of the county.

The topography is generally flat, and is only relieved by minor changes in surface due to old stream channels and cut-offs. In the Missouri River bottom this soil occupies a bench along the bluff line and is about 3 to 4 feet higher than the other soil types of the bottom. This area is rather poorly drained, owing to seepage from the higher land. Originally all this type needed drainage, though a large part has been reclaimed by straightening and cleaning out the stream channels, and by ditching and tiling. Along the bluff line of the Elkhorn River the type is also poorly drained at present on account of its low position and seepage from the upland. The type is seldom overflowed.

The Wabash silt loam is alluvial in origin. Along the smaller stream courses it is composed partly of material deposited by successive overflows and partly of wash from the Knox and Marshall soils. Along the Elkhorn and Missouri Rivers it is apparently derived from fine material which was deposited from slowly-moving waters during overflows, though even here some local wash from the bordering upland has been added to it.

Though most of it is now cleared, this soil was originally forested, mainly with cottonwood, willow, elm, box-elder, ash, and some black walnut, linden, hackberry, and hickory.

Approximately one-third of this type is now devoted to the production of general farm crops. On well-drained areas practically all this soil is used for growing corn, which does better than on any other soil in the county, the ordinary yields ranging between 45 and 55 bushels per acre. With proper cultivation as much as 80 bushels per acre is obtained in favorable years. Only a small acreage is sowed to wheat and oats because these crops are likely to grow too rank and lodge. In the vicinity of Omaha the trucking is being rapidly extended. Truck crops do well and give profitable returns. A large part of this type is used for pasture, and as a rule it furnishes a very good quality and an abundant supply of grass. Most of the type along the bluff line of the Elkhorn River and a few areas elsewhere are used for the production of wild hay, of which yields of 1 ton to 2 tons per acre are obtained.

A one-crop system prevails on this type, corn being grown continuously for long periods on the same field. Scarcely any manure and no commercial fertilizers are applied, but the soil receives a veneering of silt washed from the upland every year, and this tends

to maintain its productiveness. Where reclaimed, this soil is very easy to handle and can be cultivated under a rather wide range of moisture conditions. In the "gumbo" spots cultivation is difficult, and it is necessary to plow the soil when the moisture conditions are at their best.

The value of this type ranges from \$80 to \$150 an acre, depending on improvements, location, and drainage.

Wabash silt loam, colluvial phase.—The soil of the Wabash silt loam, colluvial phase, is a brown to dark-brown smooth silt loam, with an average depth of 24 inches. It is very friable and mellow, and, as the color indicates, rather high in organic matter. The sub-soil is somewhat heavier and lighter in color, though the change is very imperceptible and in many places there is apparently no change within the 3-foot section.

This phase is very inextensive, including about 4.4 square miles. The largest areas occur at the foot of the bluffs along the Elkhorn River, and small areas are scattered elsewhere along the streams throughout the upland region.

The colluvial phase of the Wabash silt loam occupies a position between the upland and bottom-land soils. It has an appreciable slope, and is well drained. In a few places it occurs along intermittent streams, where there has been extensive side-hill wash. It is derived from materials washed from the Knox and Marshall soils, and occurs as colluvial fans or series of connected colluvial fans.

Practically all the phase is used for the production of corn, though a few small areas are sowed to wheat, oats, and alfalfa. Corn does particularly well, ordinarily yielding from 45 to 55 bushels per acre, with yields of 80 bushels per acre under particularly favorable conditions. The phase produces good crops of alfalfa, yields of 4 to 6 tons per acre being common.

No crop rotation is practiced on this phase and scarcely any barnyard manure is applied. The soil is easily cultivated and can be worked under a rather wide range of moisture conditions. There are no farms in the county composed entirely of the colluvial phase of the Wabash silt loam. Land of this phase is valued at \$125 to \$150 an acre.

WABASH CLAY.

The Wabash clay is a black, heavy, silty clay loam, from 4 to 6 inches deep, underlain by a black clay which extends to an average depth of 18 inches, where a slightly lighter though still dark-gray, stiff, compact clay is encountered. This in turn rests on a bluish-gray silty clay loam, which passes quickly into a mottled light-gray and brownish-yellow silty clay loam. In a number of places the profile does not show all these changes, the black soil extending to a depth of 30 inches or more.

The lower part of the subsoil is highly calcareous, the lime being in the form of shells and nodules. Small black iron concretions are very abundant, and where the subsoil is slightly oxidized concretions of a rusty-brown or yellowish color are also found. As the color indicates, the soil is high in organic matter, and it is not uncommon to find the remains of plants throughout the soil section. The record of one well indicates that the clay extends to a depth of 20 feet, and is underlain by gravel, with another seam of clay at 30 feet.

The Wabash clay differs from the Cass clay in that it is darker in color and is not underlain by sand. In this county the Wabash clay is not as recent a deposit as the Cass clay.

With one exception, the areas of Wabash clay occur in the first bottoms of the Platte and Elkhorn Rivers. They are small and elongated and run in the same general direction as the drainage channels. This type is inextensive. It is found mainly northeast of Valley with a small tract northwest of Seymour Lake.

The type has a flat topography and is naturally not well drained. Most of it is ditched, though only a small part is tile drained. It is an alluvial soil, and the material has been deposited in quiet water.

The original vegetation on this soil was rank and consisted of coarse marsh grasses.

About 80 per cent of the type is reclaimed and devoted to the production of general farm crops. Grain farming is the dominant type of agriculture, though each year more attention is given to the raising of hogs and other live stock. Corn, oats, wheat, and hay are the more important crops. Except in very wet years, corn does particularly well, producing 40 to 50 bushels per acre. Short-strawed oats, such as the Kherson and Silver Mine, do well, particularly so because they do not lodge. Average yields of 40 bushels per acre are obtained, though as much as 70 bushels have been produced. The type is a fairly good soil for wheat production, and yields of 20 to 40 bushels per acre are obtained. A few farmers grow timothy and clover with good results, the yields ordinarily ranging from 2 to 2½ tons per acre. Native grains yield from 1½ to 2 tons of hay per acre.

Corn is the most important crop on this soil and about one-half the type is devoted to its production. Oats is next in importance, though, with wheat, it is a subordinate crop. The rotation most commonly practiced is 2 to 4 years or more of corn, 1 year oats, and 1 year wheat, returning to corn. Many fields have been in corn continuously for 10 to 15 years.

For corn and wheat the land is plowed in the fall, and for oats in the spring. When corn succeeds itself it is listed instead of being check rowed. The Wabash clay is the most difficult of the reclaimed soils in the county to handle. It can only be worked

within a narrow range of moisture content, and if cultivated too wet forms hard, refractory clods. Where cultivated under the proper moisture conditions, the soil breaks up into granules and is similar to a loam so far as subsequent tillage is concerned. This soil cracks considerably, and fissures more than an inch in width are common. Only a very small quantity of barnyard manure is applied to this soil, owing to the fact that very little stock is kept on the farms. The productiveness of this soil is practically the same as when it was first cultivated.

The Wabash clay ranges in value from \$125 to \$150 an acre, depending on the drainage and improvements.

CASS SERIES.

The surface soils of the Cass series are prevailingly dark brown to black. The subsoils are lighter in color and in texture. These soils are alluvial, and most extensively developed in the bottoms along the Mississippi and Missouri Rivers and their tributaries. They occur in association with the Sarpy soils, occupying, however, areas having somewhat less perfect drainage, being subject to overflow. At low stages of the streams the drainage is thorough. Six types of the Cass series, the fine sandy loam, very fine sandy loam, loam, silt loam, clay loam, and clay, are recognized in Douglas County.

CASS FINE SANDY LOAM.

The soil of the Cass fine sandy loam consists of a gray to dark-gray fine sandy loam, with an average depth of 15 inches, underlain by a light-gray to almost white, mottled with yellow or light-brown, fine sand, which becomes somewhat coarser with depth. The subsoil is very loose and is almost devoid of silts and clays. Occasionally some fine gravel is encountered in the material between 24 and 36 inches from the surface, but usually it occurs at a lower depth. Where the soil has been under cultivation for a long time the organic-matter content is low, and the surface soil is light gray. Ordinarily the content of organic matter is fairly high. Streaks of black silt and clay are common in the lower subsoil. In the depressions and sloughs the soil is a black, light-textured loam, 8 to 12 inches deep, the subsoil being typical. Such areas are too small to be shown on the map as a separate phase.

A peculiar phase of this type occurs about $3\frac{1}{2}$ miles due east of Mercer, where the soil consists of a dark-gray to almost black sandy loam from 2 to 8 inches deep, and the subsoil of a black heavy muck to silt loam. At 30 to 40 inches a bed of almost white sand with an admixture of gravel is encountered.

The Cass fine sandy loam comprises 18.8 square miles. It occurs in a continuous strip varying from about one-half mile to 2 miles in width along the Platte River. The type is more or less interspersed with areas of other Cass soils and of the Sarpy fine sand. An isolated area occurs $3\frac{1}{2}$ miles east of Mercer, and another about a mile north-east of that place.

In general the topography is level, though extremely ridgy in detail. There are numerous sloughs which, like the low ridges, run in the same direction as the Platte River. The surface soil is well drained, though on account of the close proximity of the water table the subsoil is poorly drained except in the higher areas. The water table lies 3 to 6 feet from the surface. The Cass fine sandy loam is occasionally overflowed. A part of it is protected by a low levee, constructed about a mile southeast of Mercer, to protect the railroad.

The islands in the Platte River and a narrow strip along its banks originally supported a forest growth consisting mainly of cottonwood, elm, oak, willow, box elder, basswood, black walnut, hackberry, honey locust, and cedar. A large part of the forested area has been cleared. Farther from the stream most of this type was originally in native marsh grasses, and a large part of this land has never been broken.

About 50 per cent of the type is used for pasture and hay land and the remainder, usually the higher areas, for general farm crops. Owing to the high water table, this soil, though very sandy, makes good pasture and hay land. In the vicinity of Valley it is used to a large extent for pasturing sheep in transit from the west to Omaha and Chicago. In other places it is used for pasturing beef cattle. Wild hay is cut from a large area of the type and yields of 1 to 2 tons per acre are obtained. The higher areas are extremely droughty, except where the subsoil is heavy. Corn does not do very well on this soil, yielding 10 to 30 bushels per acre. Some wheat and oats are grown with only fair results. Pumpkins, squashes, and other vine crops are grown successfully, though they do not do as well as on the Cass very fine sandy loam.

The value of land of this type ranges from \$50 to \$90 an acre.

CASS VERY FINE SANDY LOAM.

The surface soil of the Cass very fine sandy loam consists of a gray to dark-gray very fine sandy loam, extending to an average depth of 15 inches. It is underlain by a usually mottled light-gray and yellow very fine sandy loam, though in places the mottling is entirely absent. At a depth of about 32 to 36 inches a black silty clay loam to silty clay is encountered, and this is underlain at about

50 or 60 inches by a light-gray very fine sandy loam. In places the heavy stratum is not encountered before a depth of 40 inches is reached, in others it is within 24 inches of the surface, while in the drainage ditches the heavy layer is sometimes seen at 4 to 5 feet below the surface. This stratum is high in organic matter and highly calcareous. Seams of coarser material, though not common, occur in local spots on this type.

A light-colored phase of the Cass very fine sandy loam occurs along the Elkhorn River. The material of this phase is of more recent origin than the typical soil and is continuously modified by deposits from overflows. This soil is a light-gray to gray very fine sandy loam, 15 to 20 inches deep, underlain by an almost white fine sand. In lower lying situations the soil is deeper, and the fine sand is not encountered at depths of less than 30 inches. In some places where there has been a very recent deposit it is not uncommon to find an old soil within 2 or 3 feet of the surface. This phase of the Cass very fine sandy loam includes areas of Cass silt loam and Cass fine sandy loam, which are too small to justify mapping. It differs from the typical soil mainly in having a lower organic-matter content.

Another phase is encountered along the Platte River. It is closely associated with the Cass fine sandy loam. The soil of this phase consists of a light-textured very fine sandy loam about 15 inches deep and rather low in organic-matter content. The soil is usually of a light-gray to gray color, and is underlain by a light-gray very fine sandy loam, which at about 24 to 30 inches passes into a fine sand. A large number of areas of this character, too small to map, are included with the Cass fine sandy loam.

The Cass very fine sandy loam differs from the Sarpy silt loam in having a lighter texture and better drainage. However, in a great many instances the former grades imperceptibly into the latter, and only an arbitrary boundary can be drawn between the two types. The marginal areas of the Cass very fine sandy loam contain a high percentage of silt.

This type is the most extensive of the first-bottom soils. It occurs as a continuous narrow strip along the Elkhorn River and in more or less irregular areas in other parts of the Platte and Elkhorn River bottom lands.

In general the Cass very fine sandy loam has a flat topography, broken only by a few dry, meandering sloughs. An exception is the strip along the Elkhorn River, which is very badly dissected by abandoned stream and overflow channels. Owing to its light-textured subsoils, the type is for the most part well drained, though in many places its natural drainage is supplemented by ditching.

The native vegetation consists largely of marsh grasses, sedges, and tall rushes, except along the Elkhorn River, where the type was originally rather heavily forested. Willow and cottonwood are the principal trees, with a scattering of ash, elm, box elder, black walnut, and hackberry.

Approximately 80 per cent of this type is under cultivation, and the remainder is largely in woodlots along the Elkhorn River. Grain farming is the chief type of agriculture practiced on this soil. Corn is by far the most important crop, and about two-thirds of the Cass very fine sandy loam is devoted to its production. On some farms it is grown almost to the exclusion of other crops. It does well, yielding an average of about 40 bushels per acre. In dry years wheat is a more certain crop than corn. It is a valuable crop in the rotation. Wheat yields an average of 25 bushels per acre. Oats do particularly well, and this crop is second to corn in acreage. The yields average 35 bushels per acre, though yields of 65 bushels have been obtained. Some alfalfa is grown with good results. The tendency of farmers on this soil is to grow less corn, more wheat, and oats, and more alfalfa, clover, and timothy.

Production of corn and vegetable seeds is important on this type. Dent, flint, and sweet corn are the seed crops most extensively grown. The vine crops rank next in importance, and of these pumpkins, squashes, and gourds are most commonly grown. From 1 to 30 acres on each farm are usually devoted to such crops. Many farmers object to these crops on account of the labor required.

Squashes and pumpkins do well, and yields of 250 pounds of seed per acre are usually obtained. Gourds are grown to some extent, with an average yield of 300 pounds per acre. At present prices, the average gross return for pumpkin and squash seed is about \$40, and for gourds about \$90 an acre. Onion sets are also produced successfully, though only a small acreage is used for this purpose. Since the advent of the green aphid and other destructive pests, the growing of muskmelons, watermelons, and cucumbers has practically been discontinued.

A few farmers follow a rotation which consists of 2 to 4 years of corn, 1 year oats, 1 year wheat, and 2 to 3 years clover and timothy, returning to corn. In some cases the clover and timothy are omitted. Most of the farmers grow corn mainly, and give little attention to crop rotation. The Cass very fine sandy loam, owing to its rather light texture, does not require a heavy farm equipment. It is easily worked into a mellow seed bed. Only small quantities of barnyard manure are applied, and no commercial fertilizers are used.

The Cass very fine sandy loam ranges in value from \$125 to \$175 an acre, depending upon improvements and location.

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

Mechanical analyses of Cass very fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
371007.....	Soil.....	0.0	0.2	0.2	7.9	53.6	34.0	4.0
371008.....	Subsoil.....	.0	.0	.1	2.1	41.6	52.8	3.0
371009.....	Lower subsoil.	.1	.6	.8	7.5	19.6	49.1	22.0

The following sample contained more than one-half of 1 per cent calcium carbonate (CaCO_3): No. 371009, 7.09 per cent.

CASS LOAM.

The soil of the Cass loam consists of a dark grayish brown to black loam, 12 to 18 inches deep, containing a relatively large proportion of very fine sand and fine sand. The texture of the soil varies from an extremely light loam to silt loam, though the average is a loam. The surface soil is underlain by a light-gray, mottled with yellow or light-brown, very fine sandy loam, which at 24 inches grades into a medium to coarse sand with a slight admixture of fine gravel. The color of the lower stratum is light gray, more or less stained with rusty brown. Like the soil, the subsoil is quite variable in texture. The very fine sandy loam stratum extends in some places to a depth of 30 inches, but in others it is absent, the soil being underlain directly by a bed of fine sand or coarser material. The soil contains much organic matter and the subsoil is highly calcareous.

The type is widely variable, and a few of the variations are of some importance. The area along Rawhide Creek, excepting a narrow strip along the stream channel itself, has more the characteristics of the Wabash loam, but owing to its small extent it is included with the Cass loam. The three areas in the vicinity of Waterloo and the two smaller areas in the southern part of the Platte and the Elkhorn River bottoms approach in texture the Cass very fine sandy loam, while the largest area in this section approaches the Cass fine sandy loam.

The Cass loam occurs as small areas in the Platte and Elkhorn River bottoms. The total area is only 3.4 square miles.

This soil has a flat surface, broken by few old stream channels, except immediately along Rawhide Creek. Owing to its sandy subsoil and relatively high position in the bottom land it is well drained. The type is occasionally flooded by the Platte or Elkhorn Rivers, mainly when ice gorges in the latter stream cause overflows of short duration.

The native vegetation on this type consisted of wild marsh grass, and, along the streams, cottonwood, willow, and other trees common to the bottom lands.

Practically all this type is under cultivation, a small part being used for farm woodlots. Corn is the most important crop, and does particularly well, yielding from 35 to 40 bushels per acre. Oats and wheat are grown to a small extent. Both crops do well, oats yielding an average of 25 to 30 bushels and wheat 20 to 25 bushels per acre. Very little barnyard manure and no commercial fertilizers are used in growing these crops.

The value of this land ranges from \$100 to \$125 an acre, depending upon improvements and location.

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

Mechanical analyses of Cass loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
371014.....	Soil.....	0.9	2.7	3.4	17.9	31.2	35.6	8.0
371015.....	Subsoil.....	1.6	8.2	18.2	36.5	17.8	11.9	5.5

CASS SILT LOAM.

The surface soil of the Cass silt loam consists of a dark grayish brown to black heavy silt loam, 15 to 18 inches deep. It is underlain by a thin stratum of yellowish-gray coarse silt loam, varying in thickness from 2 to 4 inches. This layer rests upon a very fine sandy loam of light yellowish gray, mottled with yellow or light-brown colors. Between 24 and 40 inches a black silty clay loam or silty clay is usually encountered, though in many instances this heavy stratum is not reached with a 40-inch auger. The subsoil is highly calcareous, the lime being present in the form of shells and concretions. Owing to its original marshy condition, a large quantity of organic matter is incorporated with the soil and with the heavy subsoil layer which apparently at one time formed the surface soil.

This type comprises several minor variations. In sections 27, 28, and 33, Waterloo Precinct, the surface soil, extending to a depth of 18 to 20 inches, is a black extremely heavy silt loam approaching a silty clay loam. The subsoil is similar to that of the typical areas except that the material is somewhat finer. This variation occurs in another spot in the northwestern corner of sec. 4, T. 16 N., R. 9 E. The marginal areas of the Cass silt loam, adjoining the Cass very fine sandy loam, are rather wide and contain a large quantity of fine sand in the surface soil. In secs. 31, 32, and 33, T. 16 N., and secs. 4 and 5, T. 15 N., R. 10 E., the soil of this type is a light-textured silt loam containing a high percentage of very fine sand. There are also a number of local spots within the typical areas which are rather light

in texture. On the other hand, a number of typical areas of this type too small to map are encountered in the Cass very fine sandy loam.

Owing to the imperceptible change from one type to the other the boundary line between the Cass silt loam and the Cass very fine sandy loam is largely arbitrary. This type differs from the Wabash silt loam in having a light-textured subsoil, while the Wabash silt loam has a subsoil of practically the same texture as the soil or heavier. Along the Platte and Elkhorn River bottoms, where the elevations of the two types are practically the same, the Cass silt loam is better drained.

This type has a total area of 13.1 square miles and is entirely confined to the first bottoms of the Platte and Elkhorn Rivers. It occurs mainly as small areas, the largest and best developed one lying immediately southwest of Waterloo.

The topography is flat and only slightly modified by a few meandering sloughs. Originally the type was poorly drained and marshy, but completion of the drainage project of the Platte and Elkhorn Rivers has greatly improved conditions. Where properly reclaimed this soil is one of the most drought resistant of the soils of the county, except locally where coarse sand and gravel beds occur near the surface.

Originally all this type was occupied by marsh grasses, sedges, and rushes. Approximately 20 per cent of it is still in this vegetation, though it is rapidly being brought under cultivation. It is devoted mainly to grain farming. Corn is the most important crop. It does well except where the land is not thoroughly drained, and yields average between 40 and 50 bushels per acre. Ordinarily oats grow too rank to be very profitable, though the short-strawed varieties give good results. The soil produces better yields of winter wheat than of oats, from 20 to 30 bushels per acre being obtained. Wild hay is cut from about 1,000 acres of this type annually, the yield running from 1 to 2 tons per acre. The hay is stacked in the fields, and a part of it is later baled. Some seed corn is grown with good results. The soil is too heavy for the growing of the vegetable seed crops grown on some of the other bottom-land types.

Hardly any crop rotation is practiced on this type. The soil is generally used for corn until the yields decline, when small grain is occasionally grown. Many fields have been in corn for 15 to 20 years.

Where properly drained it is comparatively easy to obtain a mellow seed bed on this type, though not nearly as easy as on the Cass very fine sandy loam. Heavy teams and implements are required for farming. Only small quantities of barnyard manure and no commercial fertilizers are used. Very little live stock is kept on this type. The physical qualities and flat, even surface of this type, with its high natural productiveness, make it an excellent general farming soil. The land is valued at \$125 to \$150 an acre.

CASS CLAY LOAM.

The surface soil of the Cass clay loam consists of a black, heavy clay loam containing a high percentage of fine sand. It is about 18 inches deep, and is underlain by a dark-brown loam, which grades quickly into an almost white fine sand, becoming coarser with depth. The layer between the soil and subsoil varies in thickness from 2 to 4 inches. Ditches cut through this type show that the sand at depths of 4 to 5 feet is considerably coarser than that nearer the surface and contains considerable fine gravel. As a rule the subsoil is stained with iron. This type is inextensive, and occurs in the Platte and Elkhorn River bottoms. There are four areas south and south-east of Valley, and one to the northwest. They occupy depressions from 2 to 4 feet lower than the surrounding land and are poorly drained. The water table is also very close to the surface, except along the drainage ditches.

Practically all this type is in native water-loving grasses. Since it is closely associated with the lighter textured soils, which do not require artificial drainage, it is used for pastures. A little hay is harvested, the yields ranging from 1½ to 2 tons per acre. On drained land corn yields from 40 to 50 bushels per acre. This soil is rather difficult to handle, as compared with the silt loam soils.

This type is valued at \$70 to \$90 an acre, depending on location and drainage conditions.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Cass clay loam:

Mechanical analyses of Cass clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
371035.....	Soil.....	0.5	3.1	6.0	24.4	13.5	28.1	23.9
371036.....	Subsoil.....	.2	3.8	10.6	55.3	18.3	8.2	3.1

The following sample contained more than one-half of 1 per cent calcium carbonate (CaCO₃): No. 371035, 1.09 per cent.

CASS CLAY.

The soil of the Cass clay consists of about 10 inches of dark-gray, stiff, waxy clay, slightly mottled with reddish yellow. The subsoil is slate colored or light gray, mottled slightly with reddish yellow, and has the same texture as the soil to an average depth of 24 inches, where a mottled light-gray, brown, yellow, and reddish-yellow, sticky very fine sandy loam is encountered. At about 30 inches the material becomes coarser, and approaches a fine sandy loam. In local areas the clay extends to a depth of 40 inches. Owing to its swampy condition a large quantity of organic matter has accumulated in the surface soil, and partly decayed wood and other organic remains are

present throughout the soil section. The subsoil is highly calcareous. On drying the soil cracks and breaks down into granules.

This type occurs as small, depressed areas in the Missouri River bottoms. It usually occurs some distance from the stream, with a lighter type of the same series between it and the river. It has a low, flat surface and is poorly drained, especially along the bluff northeast of Florence, where water from springs issuing from the upland flows over it.

This soil owes its origin to the silting up of old abandoned channels of the Missouri River. Small areas in which but a few inches of clay and silt have been deposited are quite common, and if not disturbed these will later develop into this type by further deposition from back water and general overflows.

The type supports a growth of cottonwood, willow, and low shrubs. As a rule the forest growth is not very thick, though the willows are so dense in some areas as to make them almost impenetrable. About one-half of the type is not forested, though no part of it is devoted to the production of crops. It is used for pasture.

SARPY SERIES.

The soils of the Sarpy series are brown to light brown. They differ from the Wabash and Yazoo soils in having a loose silt or fine sandy subsoil, distinctly lighter in texture than the surface soils, and from the Cass soils in having a lighter color. The series, which is alluvial in origin, is developed in the bottoms of the Mississippi and Missouri Rivers and their larger tributaries. The soils are subject to overflow, although between the flood stages of the streams the nature of the subsoil is such that drainage is thorough to excessive. In general the topography is flat. Three members of this series are mapped in Douglas County, the Sarpy fine sand, very fine sandy loam, and silt loam.

SARPY FINE SAND.

The Sarpy fine sand consists of a gray or brownish-gray loamy fine sand, 10 to 15 inches deep, underlain by a light yellowish gray fine sand which immediately passes into a loose, incoherent, almost white fine sand. The material becomes coarser with depth, and medium sand and small gravel are commonly encountered in the lower subsoil. The subsoil always shows some iron stains.

Over a large part of this type in Douglas County the surface soil has been removed by the wind, leaving the loose, almost white sand subsoil exposed. Such areas are commonly spoken of as "sand blows." In secs. 4 and 9, T. 14 N., R. 10 E., a coarse phase of the type is encountered, consisting of a medium to coarse sand with a slight admixture of fine gravel. Small spots of this character too small to map are distributed throughout the type.

The Sarpy fine sand is not extensive in this county. It occurs as small areas in a narrow belt along the Platte River and as islands in the river. It forms natural levees or ridges along this stream, making an extremely complicated topography over a narrow strip of country. The type is closely associated with the Cass fine sandy loam, and a number of ridges, too small to map separately, are included within the latter type. The areas in general lie from a few feet to 20 feet above the surrounding soils, and the type is extremely droughty.

The Sarpy fine sand is not used for farming except where it occurs in small patches within better agricultural soils. The greater part of it is in native grass and sand bur, though a large part is bare of vegetation. It affords fair pasturage in the spring, but during hot weather the grasses turn brown and lie dormant until the following year. The areas adjoining and within the Platte River channel are forested with cottonwood, willow, and elm. This type ranges in value from \$15 to \$30 an acre.

SARPY VERY FINE SANDY LOAM.

The soil of the Sarpy very fine sandy loam is a grayish-yellow or yellowish-gray very fine sandy loam, which in places approaches a coarse silt loam. At about 15 inches the soil is underlain by a somewhat lighter colored, or light yellowish gray, very fine sandy loam, more or less mottled with rusty-brown iron stains. This type, owing to its recent origin, is very variable in texture, and includes narrow ridges of fine sandy loam too small to be indicated separately on the map. As a rule the subsoil increases in coarseness with depth, though seams of silt and clay are commonly encountered in the subsoil. The type is very deficient in organic matter, as its color indicates.

The Sarpy very fine sandy loam differs from the Cass very fine sandy loam in being lighter in color, lower in organic matter, and more subject to change by overflow.

The type is limited in extent and occurs as narrow, discontinuous strips varying from a few rods to four-fifths mile in width along the Missouri River. It occupies a low topographic position, about 8 feet above the normal flow of the stream. The surface in general is flat, though very ridgy on a miniature scale. During low stages of the river the drainage is good; at high stages the type is subject to overflow.

Most of this type is either occupied by a thick growth of willow or, where the land has not been changed for some time, is in forest, including cottonwood, elm, box elder, and willow. A small part has been reclaimed and is used for trucking and general farming. Where not damaged by overflows, both truck crops and general farm crops do well. Corn yields from 30 to 40 bushels per acre, and alfalfa 4

to 6 tons. Some kafir is grown with good results. Heavy applications of manure are made every two years.

SARPY SILT LOAM.

The surface soil of the Sarpy silt loam consists of a light yellowish gray or brownish-yellow silt loam, with an average depth of 15 inches. It usually contains a relatively large percentage of very fine sand, and as the color indicates is rather low in organic matter. The subsoil is a yellowish-gray heavy silt loam or brownish-yellow silty clay loam underlain at 24 to 32 inches by a light-gray very fine sandy loam. There is no abrupt change in color between the soil and the subsoil, though the subsoil is slightly lighter. Rusty-brown iron stains are common throughout the subsoil. Occasionally seams of rather loose fine sand are encountered in the lower substratum. This type differs from the Cass silt loam in that it is lower in organic matter, lighter in color, and of more recent origin.

The Sarpy silt loam is encountered in only a few small areas, amounting in all to a little more than 2.3 square miles. These occur in the bottom lands of the Missouri River.

Practically all this type is under cultivation, being used almost entirely for trucking. In the northeastern part of the county corn is grown; on the remainder of the type Irish potatoes, sweet potatoes, cabbage, asparagus, carrots, beans, peas, onions, and beets are the most important crops. These vegetables all do well.

Owing to the intensive farming practiced, the soil is thoroughly cultivated. Large quantities of barnyard manure, varying from 40 to 60 tons per acre, are applied every two years. The productiveness of the type has been considerably increased under the present methods of cultivation.

MISCELLANEOUS MATERIAL.

RIVERWASH.

Riverwash, as mapped in Douglas County, comprises mainly areas of mud, silty flats, and sand bars in the Missouri River, and sand flats and sand bars in the Platte and Elkhorn Rivers. The Riverwash material of the Platte River is considerably coarser than that of the Missouri. It consists of light-colored fine, medium, and coarse sand, with an admixture of fine gravel. There are about two square miles in the Platte, and only a few small areas in the Elkhorn River. The surface is only a few feet above the normal level of the river, and inundated with slight rises of the stream. The Riverwash is not permanent, changing with each overflow of the stream, and even during the normal flow some of the material is washed away, to be deposited in another place. It is considerably modified by wind action, especially on the Missouri River, where the material drifts easily, and on stormy days forms dust clouds.

The areas of Riverwash are practically devoid of vegetation.

SUMMARY.

Douglas County is situated in the eastern part of Nebraska. It comprises an area of 331 square miles, or 211,840 acres, and consists of a rolling to rough and extremely dissected upland division, and an extensive bottom-land division. The Platte, Elkhorn, and Missouri Rivers carry the drainage.

The first permanent settlement was made in 1854 and the county was established in the same year.

Good railroad facilities and excellent local markets exist. Omaha, the metropolis of Nebraska, is located in the eastern part of this county.

The climate of Douglas County is variable. The mean annual precipitation is about 30 inches, and the mean annual temperature about 50° F. The average growing season of about 170 days is sufficiently long for the maturity of all the ordinary farm crops grown.

The type of agriculture generally practiced consists of grain farming and stock raising. Dairying is gradually being extended in the vicinity of Omaha. Corn, oats, wheat, wild hay, and alfalfa, with a smaller acreage of clover, timothy, potatoes, barley, sorghum, buckwheat, and rye are the leading farm crops. In the western part of the county the production of seed crops is of some importance, and in the eastern section the same attention is given to commercial fruit growing and trucking.

Drainage is one of the most important problems which confront the farmer on the heavier soil types of the bottom land.

Fifteen soil types, representing seven series, and one nonagricultural type, Riverwash, are mapped in Douglas County. They form three groups, the upland soils, the terrace or second-bottom soils, and the alluvial first-bottom soils.

The Knox silt loam is a naturally productive upland soil. It is too rough for general farming. A fruit industry is developing upon it.

The Knox silt loam, dark-colored phase, is the most extensive upland soil in the county. Grain farming is the leading type of agriculture, except near Omaha, where dairying is becoming the leading interest. Erosion is a serious problem on this type.

The Marshall silt loam is a very extensive soil in the western part of the upland region. It is used mainly for the production of corn, oats, and wheat. It is somewhat more productive than the Knox silt loam. The flat phase of this type, owing to its topography, is somewhat more desirable than the main type for agriculture.

The Shelby loam is very inextensive, and owing to its higher content of clay, gravel, pebbles, and bowlders, is not as well suited to grain farming as the Knox silt loam, dark-colored phase, or the Marshall silt loam.

The Waukesha silt loam is a second-bottom type. It is largely used in the production of corn.

The Wabash silt loam is one of the dominant soils of the first-bottom group. It occurs largely along the smaller streams, and to some extent in the bottoms of the larger streams. It is the best corn soil in the county, though not so well suited as other soils to wheat and oats.

The Wabash clay is confined largely to the Platte and Elkhorn River bottoms. It is the heaviest and most difficult to handle of all the reclaimed types in the county. It is an excellent corn soil when thoroughly drained.

The Cass fine sandy loam, another alluvial type, occurs as islands in the Platte River and as narrow strips along its channel. It is used largely for pasture and hay land, though to a small extent for the production of staple crops.

The Cass very fine sandy loam is the most extensive alluvial soil in the county. It occurs in the Platte and Elkhorn River bottoms. It is well drained, and produces good crops of corn, wheat, oats, and alfalfa. Seed crops, consisting mainly of dent, flint, and sweet corn, pumpkins, squashes, and gourds are also grown successfully.

The Cass loam is developed in the Platte and Elkhorn River first bottoms. Its total area is small. This type produces good crops of corn, wheat, and oats.

The Cass silt loam is closely associated with the Cass very fine sandy loam. Natural drainage is poor, but a system of ditches affords fair artificial drainage. This soil produces good crops of corn, oats, and wheat.

The Cass clay loam is an inextensive type in the Platte and Elkhorn River bottoms. It is poorly drained, and is largely utilized for pasture and hay land.

The Cass clay has a very small total area and occurs in the Missouri River bottoms. It is very poorly drained and almost entirely used for pasturage.

The Sarpy fine sand occurs generally as small, elongated areas in the Platte River bottoms. It is droughty, and supports a scant growth of grass which affords fair pasturage during the spring.

The Sarpy very fine sandy loam is confined entirely to the Missouri River bottoms. Only a small part of this type is used for crop production.

The Sarpy silt loam is encountered in the Missouri River bottoms. This type is inextensive, and is utilized mainly for trucking.

Riverwash includes the sand bars and silty flats of the Missouri River and the sand flats and sand bars of the Platte and Elkhorn Rivers. It is practically devoid of vegetation.

[PUBLIC RESOLUTION—No. 9.]

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

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

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

Approved, March 14, 1904.

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

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