

SOIL SURVEY OF SEWARD COUNTY, NEBRASKA.

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DESCRIPTION OF THE AREA.

Seward County is located in the southeastern part of Nebraska, south of the Platte River. It is bounded on the north by Butler County, on the east by Lancaster County, on the south by Saline County, and on the west by York County. The eastern limit of the county is but 10 miles from Lincoln, the State capital; the southern boundary is 48 miles from the Kansas State line. The county is composed of 16 townships and comprises an area of 574 square miles, or 367,360 acres.

The county occupies a portion of the loess plain sloping gently toward the southeast. It has two broad divisions as regards relief—the upland and the lowland—the latter including the first bottoms or river flood plains, subject to overflow, and the second bottoms or terraces. The upland covers the entire county except where interrupted by the comparatively narrow lowlands. Two kinds of surface sculpture have been developed over the upland, the result of erosion of materials that offer different degrees of resistance. The drift-covered area, which occupies, along the eastern border, about one-fifth of the area of the county, has a destructional topography and is entirely reduced to slopes. It is in that stage of erosion where the effect of roughening the surface by cutting out valleys and leaving ridges and hills has been practically accomplished. The drainage is intricate and numerous gullies with laterals occur. The profile is rounded, the upper slopes less, the lower more steep, but the surface differs from that of the loess region, which is practically undissected. The range in elevation between the valleys and the tops of divides is about 320 feet. There are no steep slopes or cliffs.

The loess plains occupy most of the county west of the drift hills. The divide between the Salt Creek and Big Blue River systems marks the boundary between the two land forms. These loess plains are higher in elevation and have a constructional topography

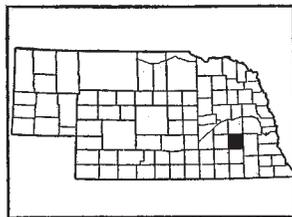


FIG. 58.—Sketch map showing location of the Seward County area, Nebraska.

in contrast with the destructional topography of the drift hills. In general the surface is that of a smooth or flat plain, but in detail there are numerous sags, shallow depressions, and a few very low knolls.

The streams are few, and there are sections in the county which are not tapped by any drainage way. Drainage is quite well developed, except on the broad divides in the western part of the county. Here much of the surface contains only sags and incipient drainage ways. The largest area without natural drainage development is in the immediate vicinity of Utica, covering approximately 8 square miles. As a rule the drainage ways are shallow, with sharply cut, distinctly U-shaped valleys. Above the heads of the sharply cut drainage ways the drainage is effected through broad, flat sags which seem to be a feature of the constructional surface. Only along the main streams is the region reduced to slopes, and it is in these places that a gently rolling to rolling topography exists.

First bottoms, or alluvial flood plains, follow all the streams, but they are invariably narrow, as stream action has been directed more toward deepening than toward widening the valleys. The surface of the higher bottom land, or terraces, is flat, but is slightly modified in places by old channels, depressions, and cut-offs. The lower first bottom is ridgy, on a miniature scale, because of erosion by the frequent overflows. The terraces in small, discontinuous areas along the main streams of the county stand at two general elevations representing two stages and ages of development. In both positions they are almost flat, except locally, where incoming streams have cut narrow valleys. The slope between the upland and terrace is usually gently rolling, while between the terrace and the bottom land it varies from gentle to blufflike where the streams cut against the terrace bank.

The lowest elevation in the county, 1,240 feet above sea level, is about $1\frac{1}{2}$ miles northeast of Pleasantdale, and the highest, 1,600 feet, is in the western part of the county, making a total range of 360 feet.

Seward County lies in the Salt Creek and Big Blue River drainage areas. The eastern part of the county, or the drift hills, is drained by the headwaters of Oak and Middle Creeks, branches of Salt Creek. The remainder of the county, in the loess-plains area, is drained largely by the Big Blue River. On the loess plains the general direction of streams is to the southeast and in the drift hills to the east. As a rule the streams are now degrading or making the stream channels deeper. The Big Blue River develops water power at Seward and Milford.

The first settlement in Seward County was made in 1859 in the vicinity of Milford. It was not until 1863-1865 that many settlers entered. The county was a part of Lancaster County until its or-

ganization in 1865. It was first called Green County, but later was named Seward. The first settlers were mainly from Illinois, Iowa, Indiana, Ohio, New York, Pennsylvania, Wisconsin, and Michigan. Subsequently there has been an influx of Germans, Danes, Swedes, Bohemians, and Russian Amish. The Germans settled largely in the eastern part of the county, the Danes and Swedes in the northern part, the Bohemians in the northeastern, and the Russian Amish in the southern part. At present the German element ranks first in population.

According to the United States census reports of 1910, the population of Seward County is 15,895. There are 27.7 persons to the square mile. In 1890 the census reports 16,140 and in 1900, 15,690. Thus there was a slight decrease from 1890 to 1900 and an increase since then.

Seward, the county seat, is situated at the junction of the Chicago, Burlington & Quincy Railroad and the Chicago & North Western Railway, about 3 miles northeast of the geographical center of the county. It has a population of 2,106 and is an important distributing point for agricultural implements and supplies. A brickyard, a creamery, a flour mill, an alfalfa mill, and three grain elevators are located in this city. Milford, the second largest town in the county, with a population of 716, is situated in the southeastern part on the Big Blue River. It is noted for its soldiers' home. It has mineral springs, bottling works, a cereal mill, and three elevators. Beaver Crossing, Utica, Staplehurst, Germantown, Cordova, Goehner, Tamora, Bee, and Pleasantdale are other railroad points.

Seward County is well supplied with railroads, no locality being more than 9 miles from a station. The Chicago, Burlington & Quincy Railroad, the Lincoln and Columbus line of the same system, and the Chicago & North Western Railway (Superior Line) cross the county.

The main public roads are usually kept in good condition, though very little attention is given to the less important roads. Practically all are dirt roads and follow section lines. The practice of dragging the roads as soon as possible after rains in order to keep them in a smooth condition is followed rather generally. Practically all streams and drainage ways are bridged.

The direct railroad connection with Lincoln and Omaha gives Seward County good marketing facilities. In Omaha and Lincoln there is a demand for practically all the live stock, dairy, and other farm products of the county. Owing to the small urban population the home demand is very small.

All communities are reached by rural free delivery of mail, and the telephone is in common use among the farmers.

CLIMATE.

The climate of Seward County is continental, with the pronounced monthly and seasonal ranges typical of the prairie States. The absolute range is 135° F. The average annual humidity is about 70 per cent. The year shows about 180 clear days, 84 cloudy days, and the remainder partly cloudy.

The following table is compiled from the records of the Weather Bureau station at Lincoln, and the data are applicable to Seward County:

Normal monthly, seasonal, and annual temperature and precipitation at Lincoln, Lancaster County.

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.
	° F.	° F.	° F.	Inches.	Inches.	Inches.
December.....	29.6	71	-18	0.70	0.32	1.06
January.....	22.6	66	-29	.66	.86	1.02
February.....	23.7	79	-26	.95	.06	.14
Winter.....	25.3			2.31	1.24	3.12
March.....	37.2	91	-11	1.23	.72	.37
April.....	51.3	95	17	2.60	.33	.67
May.....	61.8	98	26	4.49	3.43	3.65
Spring.....	50.1			8.32	4.48	4.69
June.....	71.2	103	43	4.61	3.14	8.83
July.....	75.8	106	49	4.31	1.72	11.35
August.....	74.8	102	43	3.48	1.84	4.35
Summer.....	73.9			12.40	6.70	24.53
September.....	66.6	101	27	2.53	.98	4.10
October.....	54.8	92	15	2.08	1.11	2.81
November.....	39.2	80	-15	.79	.61	1.97
Fall.....	53.5			5.40	2.70	8.88
Year.....	50.7	106	-29	28.43	15.12	41.22

The mean annual temperature is 50.7° F. January and February are the coldest months, with a mean temperature of about 23°, and July is the warmest, with a mean temperature of 75.8°, though the average temperature for August is only 1° lower. There is a difference in the average of temperature of the coldest and warmest months of about 53°.

The average date of the last killing frost in the spring is May 4, and of the first in the fall October 4. The date of the latest recorded

killing frost in the spring is May 26 and that of the earliest in the fall is September 11. Thus the county has an average growing season of 153 days, which is long enough to mature all the ordinary farm crops of this region.

The rainfall is very favorably distributed for farming purposes, almost half the year's total occurring within the months of May, June, and July. It is lightest in winter, with a mean for December, January, and February of about 2.3 inches.

In the summer the greater part of the precipitation occurs as local thunderstorms. The rainfall of May and June is well distributed, periods of drought being practically unknown. In July the distribution is less favorable, and in August and September the rainfall is much lighter, so that droughts occasionally occur in these three months. In general there is sufficient rainfall within the growing season to supply the needs of the crops where the moisture is properly conserved. Entire crop failures do not occur, although corn may be occasionally damaged by drought or by hot winds.

The snowfall averages about 23 inches annually. From October 1 to April 1 the prevailing wind is from the northwest and from April 1 to October 1 from a southerly direction. Strong winds are common, though tornadoes are rare.

AGRICULTURE.

The earliest settlements in Seward County were made in the narrow strips of timber along streams, where there was an abundant supply of water and fuel. Owing to the great distance from market, the first settlers had to produce most of their supplies. Agriculture dates back to 1863, although some crops scarcely worthy of mention were grown by a few settlers earlier than this. Flax, barley, corn, wheat, and oats were the first field crops. Flax was sowed on the newly broken prairie and followed by barley. After the second crop flax failed to do well and, as there was no great demand for barley, neither crop became very important. Wheat and corn gradually became the chief cash crops, and oats were grown chiefly for feed.

The completion of the first railroad in Seward County in 1873 gave a great impetus to agricultural development. The acreage of both corn and wheat was greatly extended, and in 1880 the census reports 57,226 acres in wheat with a production of 573,951 bushels, and 56,242 acres in corn, producing 2,499,888 bushels. Oats and barley were grown to some extent, 7,601 acres of the former producing 214,494 bushels, and 4,589 acres of the latter giving 64,788 bushels. The production of flax had practically ceased in 1880. Some rye was grown in the county, a production of 6,046 bushels being obtained from 513 acres. Ninety-four acres were in buckwheat and returned 1,190 bushels. About 2,346 bushels of dry beans, 82,983 bushels of

potatoes, 159 bushels of sweet potatoes, and 5,607 gallons of sorghum molasses are minor products included in the 1880 census. The total production of all hay was 16,900 tons from 12,299 acres.

Grain production is still the chief type of farming followed in Seward County, though increasing attention is being directed to dairying and the raising of hogs and other live stock. The type of farming is remarkably uniform over the county, except in the eastern part, on drift hills, where more land is devoted to hay and pasture. Corn, wheat, oats, timothy and clover mixed, wild hay, alfalfa, timothy, and clover are the chief crops, named in the order of their importance. The present tendency is to produce less corn and more wheat and alfalfa.

The acreage of corn is greater than that of any other crop and about 32 per cent of the total improved land in farms is devoted to it. Most of the corn is grown in the northern part of the county. The acreage decreased between 1900 and 1910. A production of 3,446,144 bushels from 114,980 acres is reported in the 1910 census. The average yield for the county is about 30 bushels per acre. White and yellow dent are the types of corn generally grown. Reids Yellow Dent, Leaming, Boone County White, Iowa Silver Mine, and Nebraska Gold Mine are the favorite varieties. Many farmers practice careful field selection of seed.

On tenant farms corn is a cash crop and little is fed. On farms operated by the owners most of the corn is fed to hogs. Recently silos have been introduced into the county, mostly in the vicinity of Seward. On farms with silos about 10 to 15 acres of corn are cut for ensilage. Where silos are not used the ears are removed and the corn land is used for fall and winter pasture. None of the corn is cut except that used for winter feed.

Corn usually follows wheat in rotations and generally occupies the land for 2 years. On many farms corn is grown in the same field 4 or 5 years in succession, and in some fields it has been grown for as many as 16 successive years or more. Good results are obtained where a rotation of 2 years of corn, 1 year of oats, and 2 years of wheat, followed by some leguminous crop, is practiced.

Wheat is the second most important crop in the county, and is grown on about 21 per cent of the improved land in farms. Wheat is grown largely in the southern part of the county. According to the census, 1,568,056 bushels were produced from 70,092 acres in 1909. In 1880 wheat was slightly ahead of corn in acreage. About 1885 the yields of spring wheat began to decline and corn became a more profitable crop.

At present the Turkey Red variety of wheat is grown almost exclusively. Only a few farmers are growing soft winter wheat varieties.

The Turkey Red has almost entirely taken the place of spring varieties because it is a better yielder, can be sowed in the fall when work is lighter, and withstands drought better, as it matures before the dry weather and hot winds occur.

Wheat is usually sowed in the same field two years in succession and follows oats in the crop rotation. Wheat is strictly a cash crop, and is generally sold from the thrashing machine. A few farmers have granaries. After a number of dry years there is a tendency to grow more wheat, and after a number of wet years more corn. Prices also regulate the acreage of the different crops.

Oats have decreased considerably in acreage, being superseded by wheat and hay crops. For 1899 the census reports 66,323 acres of oats, producing 2,411,680 bushels, as compared with 38,909 acres, returning 973,790 bushels, in 1909. Approximately 11 per cent of the improved land in farms is in oats. This is not considered a very profitable crop, and wheat is being substituted as far as practicable. Oats follow corn in the rotation, and are seldom sowed two years in succession in the same field. Most of the crop is fed to horses and the surplus marketed. Kherson and Swedish Select are the chief pure strains of oats produced.

Clover and timothy form the chief hay crop in Seward County. In 1909 a total of 12,681 acres was cut, producing 18,243 tons. The average yield was about $1\frac{1}{2}$ tons per acre. Owing to the dry weather of the last four or five years some difficulty has been experienced in getting a catch, and the production has decreased considerably. As a rule the rainfall between the middle of July and the middle of September is not sufficient to enable the delicate clover plants to withstand the extremely hot winds and the occasional long droughts which occur after the nurse crop has been removed. Oats and barley are used as nurse crops; the latter has given the best results. Clover and timothy are sowed together in the proportion of 1 to 2 or 3. Practically all the crop is fed to cattle and horses. Timothy and clover are also sowed alone, and a part of the timothy is grown for seed, which yields 5 to 8 bushels per acre. A small acreage is devoted to millet and Hungarian grasses, usually in 1 or 2 acre patches. The census of 1910 reports 2,577 acres in timothy alone, 984 acres in clover, 194 in millet or Hungarian grasses, and 350 acres in other cultivated grasses.

The acreage of wild hay is rather small, and is chiefly confined to the Carrington loam and bottom-land soils. Only small areas of wild hay are found on the other soil types of the county, as practically all of the prairie land of the county has been broken. For 1909 the census reports 10,099 acres, yielding 13,023 tons. Most of the hay is stacked in the field and hauled to the farm lots as needed.

A few farmers who have a large acreage of wild hay rent a portion of it to neighboring farmers. Practically all of the hay is fed to live stock.

Alfalfa has become an important crop in Seward County. At the present rate of increase in production it will soon surpass all other hay crops. It is largely taking the place of wild hay on the uplands and of clover and timothy, which are often difficult to start. From 5,298 acres in 1909 the total production was 14,956 tons, or, on an average, about 3 tons per acre. Three cuttings a season are ordinarily obtained and sometimes as high as four or five, with a total yield ranging from 2 to 6 tons per acre. Most of the alfalfa is fed as hay to cattle and horses, some is used as pasturage for hogs, and some is sold to the alfalfa mill located at Seward. Some seed is produced, and a large proportion of that sowed is home grown. Alfalfa is usually sowed after wheat and the stand maintained from 5 to 7 years, and in some cases for 15 years. Where the crop is left longer than 5 or 7 years the field is disked in the spring to rejuvenate the plant and kill weeds. This legume requires a good seed bed and does best where it is sowed immediately after the first rain in August. Fifteen pounds of seed per acre is considered sufficient to insure a good stand.

Only a few acres are devoted to the production of kafir and sorghum. Kafir is used as feed for horses and cattle, and the seed as feed for other stock and for poultry. Sorghum is chiefly grown for cattle feed and only to a small extent for sirup.

Scarcely any vegetables are grown on a commercial scale, except around the towns. Almost every farmer grows some vegetables for home use and occasionally a small quantity for marketing. Not enough potatoes are grown for home use, and quite a number of the farmers must buy an additional supply. The census of 1910 reports 1,180 acres in potatoes, with a production of 90,078 bushels, and 359 acres in other vegetables.

There are no commercial fruit orchards in Seward County. Nearly every farmer has a small orchard, including apples and peaches and occasionally cherries, plums, and pears. Apples do not do very well on the smooth land of the Grundy silt loam unless carefully cultivated, and are better adapted to the slopes along the larger drainage ways and to the Carrington soils. As a rule the farm orchards are given very little attention as to cultivation, pruning, and spraying. In farm orchards the Grimes, Early Harvest, Wealthy, Maiden Blush, Jonathan, Minkler, and Arkansas are popular varieties. Some grapes are grown, and they do well where the slope and the air drainage are favorable. Raspberries, blackberries, dewberries, and strawberries are grown, but not extensively enough to supply even the home demand. The value of all

orchard products, including small fruits and nuts, is given by the census as \$54,622 in 1909.

The dairy industry is beginning to receive more attention. There is scarcely any purebred stock in the county. Most of the dairy cows are Shorthorn grades of no definite type, although the Holstein is gradually coming into favor. There are a number of purebred herds of Holstein and a few of Guernsey and Jersey blood. The number of cows kept per farm varies widely, the average being about 5 or 6 head. Some farmers merely keep enough to supply the home demand with dairy products, while others make it a point to keep enough cows to have a surplus of milk. There are only a few silos in the county, but the number is gradually increasing. The value of all dairy products in 1909, excluding those used at home, was \$160,809.

Most of the milk is separated at home and the cream sent either to local creameries or to central stations, direct or through the cream stations scattered throughout the county. There are two creameries in the county, at Seward and Germantown. About one-half of the dairy products of the county are manufactured at home. Milk is shipped to Omaha and Lincoln, and many farmers retail either milk or butter in their home towns. In summer the average price paid for cream is 23 cents a pound for butter fat and in winter about 30 cents. Where sold on a basis of butter fat the average price for milk is 35 cents per pound of butter fat in summer and 45 cents in winter. Where the milk is sold by weight the price ranges from \$1 to \$1.50 a hundredweight. A small quantity of buttermilk for feed is obtained by farmers from the creameries for 1 cent a gallon.

Many farmers feed a few head of beef cattle. Most of them are grade shorthorn, with some Angus, Red Poll, and Hereford herds. Only a few sheep are kept in the county. Some are shipped in from the west for feeding.

Draft horses and mules are raised in the county. Nearly every farmer raises 1 or 2 colts a year, and some raise many. The popular breeds of horses are Percheron and Belgian.

Hog raising is second in importance to grain production. A large part of the corn is used in the production of pork. The average farmer keeps 30 or 40 hogs, and a few as many as 100 or more. Most of the hogs are on farms operated by the owner. The same is true of other live stock. The leading breeds of hogs are Duroc Jersey and Poland China, but very few herds are purebred. Most of the hogs are marketed in Omaha. Hog cholera has been more or less a hindrance to the development of the industry, since it occasionally happens that entire herds are wiped out by the disease.

Poultry is a valuable asset on most farms, and on many farms includes, besides chickens, also turkeys, ducks, geese, and guinea fowl.

The adaptation of crops to soils is not given general attention. The common crops are grown on all the important soil types, and no effort is usually made to find the most profitable crop for the particular type. In general, most of the Thurston sandy loam and Carrington loam is used for pasture and hay land. The Sarpy very fine sandy loam is best suited to grazing, as it is subject to frequent inundations.

Corn is grown most extensively on the silt loams of both the uplands and the bottoms. Wheat is grown principally in the southern part of the county on silt loams of the Grundy, Waukesha, and Carrington series. Oats also do best on these soils. All varieties are apt to lodge on the bottom soils except the Kherson, a short, stiff-strawed variety, which has given good results. Alfalfa does best on the Grundy silt loam, but it is grown to some extent on the Carrington, Waukesha, and Wabash silt loams.

Definite crop rotation is practiced only by a few farmers. The general tendency is to keep the same field in corn for 2 to 4 years, in oats 1 year, and in wheat 2 to 4 years. A few farmers follow wheat with clover and timothy for 2 or 3 years every second or third rotation. The last year the crop is usually pastured. As it is difficult to get a stand of clover, alfalfa is gradually taking its place and occupies the same position in the rotation. It is usually left for 5 or 7 years in the same field, and in some fields for 15 years. A good rotation followed is 2 years corn, 1 year oats, 2 years wheat, and once in every second or third rotation 2 or 3 years clover, if a stand can be obtained. Most of the tenant farmers and some owners sow the same crop in the same field year after year and do not grow any hay crops. It is not uncommon to find a field which has been in corn or wheat for 10 years or more.

Owing to the extensive type of farming, the tillage operations are naturally not very thorough. Shallow plowing, about 4 inches, is the general rule, and in many places a plowsole has been formed by constant plowing to the same depth. Deeper plowing has been resorted to on the highly improved farms until the soil is stirred to a depth of 8 inches. The 4-horse hitch is used in practically all farm operations. Stubble is generally plowed in the fall, either for winter wheat or corn. Corn land is usually listed and sometimes double-listed if on land in corn the year before. A small part of the crop is checkrowed. If oats follow corn, the land is either double-disked and the oats drilled or they are sowed broadcast and disked or cultivated in. A large number of farmers are beginning to plow the land in preparing the seed bed for this crop, and in normal years this has given better results.

Very little barnyard manure and scarcely any commercial fertilizer is used. Only a small quantity of manure is produced, and

a large portion of that is wasted. The manure is usually applied to the less productive land on the farm. The plowing under of green crops is practiced by only a few of the best farmers. According to the census reports, the expenditure for fertilizers in 1909, four farmers reporting, was but \$341.

The most troublesome weed pests are cocklebur, quack grass, and Canada thistle.

In general the farm buildings are substantial and give the impression of thrift and prosperity. Most of the fences are of barbed wire, although woven wire is also used, and there are some Osage-orange hedges along farm lanes. Labor-saving machinery is in general use.

At present there is plenty of farm labor, except for a short time during the wheat harvest. On many farms all the labor is performed by the family. Where hired help is employed the wage ranges from \$25 to \$35 a month for the busiest 8 or 9 months. A few farmers keep help the year round at \$25 to \$30 a month with board and washing. Some of the large landowners hire families to do the work. In such case the family is furnished a home, cow, chickens, and a small plot for a garden, in addition to a salary of \$300 to \$400 a year. During wheat harvest many transient laborers are hired at a wage of \$2 to \$3 a day. The 1910 census reports a total expenditure of \$204,102 for labor in 1909.

There are approximately 354,434 acres in farms in Seward County, of which 326,499 acres are improved. The average size of farms is 163.3 acres. Since 1880 the average size has increased 23.3 acres, and 51.4 per cent of the farms are operated by owners, 48 per cent by tenants, and 0.6 per cent by managers. The cash and share systems and a combination of the two are practiced, but the share system is the most common. Cash rent ranges from \$2 to \$5 an acre for general farming, depending on the soil. In the case of share renting two-fifths of the product goes to the owner and all implements and stock must be furnished by the renter. Where the land is rented on "half shares," the owner furnishes all the tools and the work stock, except where the land is especially desirable, when the tools and all the work stock are furnished by the tenant. In the combination system of cash and share renting the permanent pasture and woodlots are rented for cash and the grain and hay land on shares. In each system of renting the tenant is required to deliver the grain to the elevator. Alfalfa land rents for \$6 to \$10 an acre, depending on the stand.

In 1900 the average value of all farms and improvements, except buildings, in the county was \$27.68 per acre, and by 1910 it had risen to \$88.04. Of the total value of all farm property, 80.8 per cent is represented by the land, 9.6 by the buildings, 2.1 by implements, and

7.5 per cent by domestic animals. At present farm values range from \$20 to \$200 an acre, depending on the soil, improvements, and location.

SOILS.

The upland soils of Seward County are derived by weathering from superficial deposits of drift and loess.¹ To understand the relative positions of these materials, it is necessary to know their geologic history. At the beginning of the present era of soil formation the entire area was covered by two superimposed layers of transported material, loess, or drift. The upper covering of loess, although thinned and partly removed by erosion, is still the most extensive soil-forming material, covering nearly three-fourths of the surface.

The loess in its original unweathered condition consists of a loosely consolidated material having a texture ranging from a silt loam to a heavy silt loam. It varies in color from brownish yellow, yellow or pale yellow to light gray or almost white. A moderate lime content characterizes the material, and the presence of iron is indicated by rusty blotches and streaks. The basal member of the deposit was a thin layer of sand.

This material has, through weathering, formed a dark-brown or black soil of silty texture with a brown, heavy subsoil. It is the Grundy silt loam.

Underlying the loess and resting upon the bedrock formations of the region are beds of glacial drift deposited during three different invasions by ice sheets. The newest of these, known as the Kansan drift, is composed of two layers. The upper was principally composed of silt or material that weathered into silt, and glacial boulders and gravel in many places are entirely absent. Over the greater portion of the drift-covered area the soil types are of the Carrington series. Weathering and oxidation have produced from the silty upper layer of the Kansan drift soils very similar to the weathered products of the loess. The boundary line between the Grundy silt loam derived from the loess and the Carrington silt loam derived from the drift is in many places purely arbitrary.

The coarser phase of the Kansan drift underlies the silty material, and there is a sharp line of demarcation in color and texture between the two. This lower sheet is distinctly till and consists of a heterogeneous mass of sand, silt, clay, gravel, and boulders. Exposure of this material has weathered to produce the Carrington loam. It occurs on slopes where erosion has removed the silt deposits. The Kansan drift sheet thins out toward the western part of the county.

¹ The geological data on which this section was based were obtained from G. E. Condra and N. A. Bengston, of the University of Nebraska.

Below the Kansan drift lies the Aftonian material, which consists largely of stratified sand and gravel, with a few boulders. It crops out along drainage ways, chiefly along the West Fork Big Blue River and its tributaries and to some extent along the Big Blue River and its tributaries. This material gives rise to the Thurston sandy loam. This type in the western part of the county includes some sand, the origin of which has not been determined.

The lowermost drift sheet, the Nebraskan, underlying the Aftonian, consists of a blue clay containing numerous small pebbles and a considerable number of boulders. It is exposed only in deep-cut banks. It is thickest in the eastern part of the county and thins out toward the western border.

The bedrock belongs to the Cretaceous age and the uppermost division exposed is the Benton, which consists of the Carlile shale, Greenhorn limestone, and Graneros shale. The Carlile shale is concealed by mantle rock. The Greenhorn limestone is exposed southeast of Germantown and along the Big Blue River in the vicinity of Milford, where it forms the base of the stream channel. The formation consists of several thin layers of limestone interbedded with shale and full of fossil shells. The Graneros shale is not exposed and rests on the well-known Dakota formation. The latter forms the bedrock in the eastern part of the county, and occurs as small exposures in the vicinity of Pleasantdale. The Dakota formation consists mainly of sandstone, clay, and shale. Its economic importance is in its water supply. Several artesian wells derive water from this source.

The soils on the first and second terraces do not differ very widely in composition. The second terrace is of later age than that of the loess plains, while the first terrace is of still more recent origin. The surface covering of the terraces consists of fluvial silts which are very similar to the plains loess. The thickness varies from 20 to 40 feet, and it is thought that the material is underlain by sand. This terrace material, termed valley loess by the Nebraska State survey, weathers into the Waukesha silt loam and Waukesha silty clay loam.

The bottom-land soils are very nearly uniform in texture and color and consist largely of silts and very fine sand, with an admixture of clay. They are largely derived from the wash of the Grundy and Carrington series and are only slightly influenced by sediments from the other types. The largest portion of the alluvium consists of silt of a dark-brown color, giving rise to the Wabash silt loam. Where the clay content is higher the bottom land is mapped as Wabash silty clay loam. Along the channels of the larger streams there is a narrow lower first bottom where the alluvial deposits are largely very fine sand with only a small percentage of silt and clay and other soil constituents. This soil is recognized as the Sarpy very

fine sandy loam, which is lighter in color than the Wabash series and has a light-textured subsoil. The Wabash soils are seldom overflowed, while the Sarpy series is subject to frequent inundation.

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

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Grundy silt loam.....	226,048	61.5	Thurston sandy loam.....	2,048	0.6
Wabash silt loam.....	45,120	12.3	Wabash silty clay loam.....	896	.2
Carrington silt loam.....	31,296	8.5	Scott silty clay loam.....	704	.2
Carrington loam.....	30,592	8.3	Waukesha silty clay loam....	256	.1
Waukesha silt loam.....	15,616	4.3			
Scott silt loam.....	11,392	3.1	Total.....	367,360	.....
Sarpy very fine sandy loam...	3,392	.9			

GRUNDY SERIES.

The soils of the Grundy series are dark brown, occasionally black. The subsurface is lighter in color than the soil and upper subsoil, being usually brown, but it may be grayish, the texture being usually slightly heavier than that of the soil. The predominant color of the upper subsoil is dark drab, followed in importance by yellowish brown. The deeper subsoil is lighter in color and more friable in structure than the upper subsoil, the predominant color being yellow, though gray may be noticeable, especially as a mottling.

The upper subsoil is plastic as a rule; the transition from layer to layer is in all cases gradual. The topography is smooth and the derivation is from silty material overlying drift, usually the Kansan. The lime content of the subsoil is moderate to low, though lime concretions may occur. Only the silt loam type is mapped in Seward County.

GRUNDY SILT LOAM.

The Grundy silt loam is a moderately heavy, dark-brown to black silt loam, 6 to 15 inches deep, with an average depth of about 8 inches. The minimum depth occurs on the more rolling areas and the maximum on the flatter areas. The prevailing color is dark brown rather than black. The soil passes gradually through a thin layer of brown, varying from 2 to 4 inches in thickness, into a yellowish-brown, very compact silty clay loam. At 30 inches the color changes to yellow or pale yellow, and not infrequently the lower portion of the subsoil is yellow mottled with light gray. Below 24 to 30 inches the material is faintly marked with yellowish, rusty-brown, or brownish iron stains, which become very pronounced at a greater depth.

The soil is rather high in organic matter and has a very smooth and velvety feel as a result of the high silt content. When dry the subsoil has a granular structure and is rather hard, though when wet it is more friable. Deep cuts show that below the 3-foot section the material is lighter in texture, being a heavy silt loam, and is of a light-gray color, more or less marked with iron stains. The deeper subsoil and sometimes the lower portion of the 3-foot section are highly calcareous, the lime occurring chiefly in the form of concretions.

As a whole the Grundy silt loam is remarkably uniform, though there are minor variations worthy of mention. Where the soil grades into the Scott series the subsoil is darker in color and more plastic. It is dark drab, faintly mottled with yellow and brown. On flat areas there is a tendency to a sharp boundary line between soil and subsoil, and the upper subsoil is a very dark brown to black, tough, granular, silty clay which usually passes into a lighter textured material at 24 to 30 inches.

Along the slopes of the major streams and their important branches the loess is very shallow, and occasional glacial pebbles are found. There are only a few exposures of pure drift, and these have a distinct reddish cast. The subsoil seems to have a higher percentage of clay. In general the subsoil of the Grundy silt loam becomes heavier as the main body of the Carrington soils is reached. This condition also holds true of the three tongues of Grundy silt loam extending into Seward County from Butler County, northeast of Bee. On the lower slopes of the important drainage ways Aftonian sand is frequently mixed with the soil, giving rise to small areas of loam and sandy loam.

The Grundy silt loam is the most extensive soil in the county, covering 61.5 per cent of the total area. It is more or less interspersed with small areas of the Scott silt loam and silty clay loam.

The Grundy silt loam has a smooth or almost flat to undulating topography. The streams are few and there are sections without any drainage development. As a rule the streams are shallow but sharply cut, with distinctly U-shaped valleys. These streams head in broad, flat sags.

A narrow strip along the important drainage ways is reduced to slopes and has a rolling topography. In the southeast quarter of section 25, D precinct, and the southwest quarter of section 30, C precinct, a lower lying area, resembling a moderately eroded terrace, is included in this type. The soil is similar to the typical soil.

The characteristic feature of the Grundy silt loam is the numerous marshy depressions, sags, and shallow inclosed basins. The deeper basins have standing water in them during parts of the year. As a whole the type is well drained except in local flat areas or sags. As

a rule where there are no streams the depressions or basinlike areas serve as catch basins. Erosion is not a serious factor except along the larger streams. The type withstands drought well, owing to the higher organic-matter content and silty texture. Where there is a sharp boundary between soil and subsoil it is more droughty.

The Grundy silt loam is derived from the loess plains proper and to a small extent from the eroded part of this formation. The type was originally covered with a thick growth of prairie grasses, but only a few scattered patches remain.

Practically all of the Grundy silt loam is under cultivation. Grain growing is the chief type of farming followed, though quite a little live stock is kept. Corn is the predominating crop and the chief source of income. In normal seasons the cereal does well and yields 35 to 40 bushels per acre. Where intensive cultivation and proper rotation are practiced the yield is frequently 50 bushels or more. Wheat is the chief cash crop and is becoming a more important crop each year. In dry years it is preferable to corn, because it matures before the usual hot winds occur. Wheat yields 20 to 30 bushels per acre. Oats are not a very profitable crop, but are desirable for horse feed. Yields range from 30 to 50 bushels per acre. Clover and timothy do well in fairly wet seasons and yield $1\frac{1}{2}$ to $2\frac{1}{2}$ tons per acre, but, owing to the uncertainty of getting a stand, this combination is being replaced by alfalfa, which is a more certain crop. This type is admirably adapted to alfalfa. Three or four tons of hay per acre are obtained from as many cuttings. A few farmers have put most of their land in this legume and sell the hay to the alfalfa mill at Seward or to other farmers. Millet is grown on this type and yields 2 to 4 tons per acre. Scarcely enough potatoes are grown to supply the home demand. The tendency on this type is to produce less corn, more wheat and alfalfa, and about the same quantity of oats. Farmers report average acreages in the principal crops about as follows: Corn, 70 acres; wheat, 35 acres; oats, 26 acres; alfalfa, 20 acres; and pasture, 10 acres.

The general practice is to keep the land 2 or 3 years in corn, 1 year in oats, and 2 years in wheat, then returning to corn. Occasionally clover and timothy or alfalfa follow wheat in the rotation. Clover and timothy are usually left 2 or 3 years and alfalfa is usually left 5 to 7 years and sometimes as long as 15 years. As alfalfa is a more certain crop it usually takes the place of clover and timothy in the rotation. On tenant farms not much thought is given to crop rotation, as the object is to procure the largest possible immediate returns. It is not uncommon, even on farms operated by owners, to find corn or wheat in the same field for 4 or 5 years.

This type is somewhat easier to handle than the Carrington silt loam, owing to its lighter texture. It can be cultivated under a rather

wide range of moisture conditions, and does not check or crack badly. The soil is silty, friable, and stone free. The 4-horse hitch is commonly used for all farm operations. Only small quantities of manure are applied, and usually to places where the soil is deficient. No commercial fertilizers are used.

The value of the Grundy silt loam ranges from \$125 to \$175 an acre, depending on improvements and location.

CARRINGTON SERIES.

The Carrington soils are dark brown to black in color. The subsoils are brown, faintly yellowish brown, or faintly reddish brown in color and silty or clayey in texture, usually heavier than the soil, but with a low sand content and usually an absence of lime concretions. The lime content of the subsoil, however, ranges from moderate to low. Effervescence in acid is rare. The topography is smooth to rolling, and the derivation is from glacial drift, usually the younger drift, though it may be from the Kansan. In Seward County the silt loam and loam types are recognized.

CARRINGTON SILT LOAM.

The surface soil of the Carrington silt loam consists of a dark-brown, heavy silt loam, extending to a depth of 6 to 8 inches, with an average depth of 10 inches. On the more nearly level areas it is darker, becoming nearly black, but is nowhere a dense black. The soil carries a rather high content of clay and as a result breaks down into angular granules. It is underlain by a brown silty clay loam to silty clay which immediately passes into yellowish-brown material of the same texture. The transition layer between the soil and subsoil varies from 2 to 4 inches in thickness and commonly forms a part of the plowsole layer. At any point between 24 and 30 inches, and sometimes directly below the soil, the color of the subsoil changes to pale yellow or grayish yellow. Frequently light-gray mottlings—never very conspicuous—and rusty-brown iron stains are encountered.

The subsoil is extremely compact, though only slightly plastic. In general the upper section of the subsoil is the heavier and breaks down into granules. With depth the subsoil becomes lighter in texture as well as in color, and the structure gradually becomes flakelike. There is a concentration of clay in the second foot of the soil and in the upper part of the third, the clay being carried down from the surface by percolating waters. The change from soil to subsoil is rather gradual. As the color indicates, the soil is high in organic matter. There are only a few boulders on this type and sand and gravel are of rare occurrence.

The depth of the soil varies considerably with the topographic position. On the nearly level divides the soil is 15 to 18 inches

deep, while on the narrow watersheds it has been greatly reduced by erosion, exposing a brownish or yellowish-brown silty clay loam or clay. The structure of the subsoil is exceedingly granular. At the foot of the slopes the soil is a dark-brown to black heavy silt loam varying in depth from 20 to 40 inches. Within the type there are also, along intermittent streams and draws, narrow strips of colluvial material which are not differentiated. Along the lower slopes and gullies drift is usually exposed, while the divides are covered with a thick mantle of silt. Where the soil has a gritty texture and is derived from the Kansan drift, it is mapped as Carrington loam, though there are a number of such areas, too small to be mapped separately, included with the silt loam.

There are numerous minor variations worthy of mention. On the nearly flat divides there are local areas where the soil is a dark-brown silt loam to a depth of about 20 inches, underlain abruptly by a dark-gray or almost black, crumbly, compact clay, with no change to the depth of 36 inches. This phase is very similar to the smooth areas of Carrington silt loam in Gage County. On the lower slopes this type occasionally has a reddish-brown or reddish-yellow subsoil—not a color of oxidation, but of material.

North of Success a shallow phase of Carrington silt loam is encountered. The soil is typical and is underlain by a brown, compact silty clay loam, whose color, at any point from 20 to 24 inches, passes into a reddish yellow. This phase is more or less developed throughout the drift-hill region.

The Carrington silt loam is the third most extensive type in the county. It is confined entirely to the eastern part of the county, largely in the eastern tier of townships. This type is more or less interspersed with the Carrington loam, with which it is closely associated. As a rule, the Carrington silt loam occupies the divides and upper slopes and only occasionally the lower slopes along the drainage ways, which are typically occupied by Carrington loam. The surface configuration of the divides varies from nearly flat to convex, though it is seldom sharp. The upper slopes are usually moderate, though the cutting back of gullies into the type has produced some unevenness. The lower slopes when occupied by this type are usually gentle. In general this type has moderate relief, though occasionally the slopes are rather steep.

The Carrington silt loam is derived from the weathered phase of the Kansan drift.

The type is well drained and on the steeper slopes erosion is serious. For this reason the steep slopes and gullied areas are best kept in permanent pasture. When properly tilled, owing to its rather high organic-matter and clay content, it is very retentive of moisture.

The soil profiles of the Carrington and Grundy silt loams are very similar. The soil section of the Carrington silt loam is heavy in texture and the soil does not stand up well in banks. The Carrington also has a small content of bowlders, sand, and gravel. The Grundy silt loam has a smooth or nearly flat topography, while that of the Carrington is mostly reduced to gentle or moderate slopes. The former has a constructional, while the latter has a destructional topography.

Originally the Carrington silt loam was covered with native prairie grasses, of which only a few small patches remain. About 93 per cent of this type is in cultivation, the remainder being in permanent pasture, farm lots, and public roads. Corn is by far the most important crop and when used in rotations and properly tilled does well on this type. It yields 30 to 40 bushels per acre and under favorable conditions 60 bushels are obtained. Wheat is the chief cash crop and its acreage is being gradually extended. It yields 20 to 30 bushels an acre. Oats are well adapted to this type, but, nevertheless, are not a very profitable crop. Yields range from 25 to 40 bushels an acre in normal seasons. Very little land is devoted to the production of hay crops. Only a small acreage remains in virgin prairie. Owing to the difficulty of getting a stand of clover, it has been largely abandoned in favor of alfalfa. The latter promises to become an important hay crop on this soil. As a rule, three cuttings are obtained, and sometimes four, with an average yield of 3 tons per acre.

Most farmers plant a few potatoes, but it is not uncommon for them to buy an additional supply for home use. As a rule, potatoes are not well cared for and as a result the yields are low.

No definite rotation is followed, except by a few who operate their own farms. The general tendency is to keep the land 2 to 4 years in corn, 1 year in oats, and 2 years in wheat, returning then to corn. Occasionally the land is seeded to clover or alfalfa. When seeded to the former it is usually left for 2 or 3 years and when seeded to the latter, 5 to 7 years or more. On tenant farms, especially, it is not uncommon for farmers to report that they have had a certain field in corn or wheat for 5 years or more.

Fall plowing is general, though many farmers disfavor it because the soil is apt to drift. The Carrington silt loam is somewhat harder to handle than the Grundy silt loam, and, owing to the higher clay content, it can not be cultivated under quite so wide a range of moisture conditions. When plowed too wet it cakes and forms clods, which are rather difficult to break. The 4-horse hitch is commonly used for farm operations. In general it is rather easy to obtain a deep, mellow seed bed. As very little live stock is kept on this type, the quantity of barnyard manure is small. An appli-

cation of manure is usually applied to land that has been in wheat before putting it to corn. Where manure is used as a top dressing on winter wheat, materially increased yields are obtained.

The value of farm land on the Carrington silt loam ranges from \$100 to \$150 an acre, depending on location and improvements.

CARRINGTON LOAM.

The soil of the Carrington loam is a medium-brown to dark-brown loam to silty loam containing a considerable quantity of fine sand. The soil ranges in depth from 6 to 14 inches, having an average depth of 8 inches. The subsoil consists of a brownish or yellowish-brown, gritty clay loam to clay. The subsoil becomes tougher and more compact with depth, while the color becomes lighter. Below 24 inches the subsoil becomes mottled with yellow, brown, and gray, and has numerous streaks and blotches of rusty-brown or reddish-yellow iron stains. Boulders, gravel, and sand are common on this type, but are seldom too plentiful to permit cultivation. Occasionally the subsoil is so gravelly as to be impenetrable with a soil auger.

Black iron-oxide concretions are common in the subsoil. The subsoil is highly calcareous, the lime existing chiefly in the form of marly pockets and concretions. Cuts in this type show that the lime is concentrated in streaks, as are also the iron oxides. The texture of the drift is not uniform, and pockets of sand are often found in the clay. The content of organic matter in the soil is moderately large.

On the lower slopes of the Carrington loam a distinct reddish tinge in the subsoil is frequently found. This is believed to be the color of the drift itself and not due to oxidation. Along gullies and steep slopes the subsoil is frequently exposed and appears as a yellowish-brown or reddish-brown clay. Such spots also occur in the Carrington silt loam and are spoken of by farmers as "gumbo" spots.

Surrounding and adjoining the areas of Carrington loam east of Seward and near the southeast corner of the county a phase with a friable subsoil is encountered. This phase is a dark-brown loam, 8 to 12 inches deep, underlain by a brownish-yellow heavy though friable loam. This stratum in turn rests on a yellow loam mottled with light gray, somewhat lighter in texture and of a very friable structure. The subsoil is highly calcareous and gives the lower soil section a whitish tinge. It is also more or less streaked with rusty-brown iron stains. It is different from the typical soil mainly in having a very friable subsoil instead of a tough, tenacious one.

There is a sandy phase northeast of Pleasantdale in secs. 25 and 26, T. 10 N., R. 4 E., along the stream slope. It is derived from a small outcrop of Dakota sandstone intimately mixed with drift débris. The soil is a brownish light-textured loam to fine sandy loam about

8 inches deep, which rests on a brownish-yellow loam to sandy clay. The subsoil becomes more compact with depth. There is a considerable quantity of fine sand in the soil section. The type also includes small areas of silt loam and colluvial material along intermittent streams and draws.

The Carrington loam differs from the Carrington silt loam in having a high stone content. This soil also has more sand, and the subsoil is gritty and tenacious. The dissected topography and the sand, gravel, and stone content are distinguishing features of the Carrington loam.

The Carrington loam is the fourth most extensive type in Seward County. It occurs entirely in the eastern tier of townships and is closely associated with the Carrington silt loam. It occurs along drainage ways between the higher lying Carrington silt loam and Wabash silt loam and the lower lying divides. The slopes are fairly steep and the divides rather sharp. The drainage system is intricate and so thoroughly developed that the type is excessively drained. There are local wet spots along lower slopes, due to seepage water. On account of the large proportion of clay in the subsoil, the type retains moisture remarkably well, though not so well as the silt loam.

The Carrington loam is subject to destructive erosion, and gullies, 10 to 15 feet deep, with numerous branching laterals, are very common.

This type was originally prairie, except along the drainage ways, where a narrow strip was timbered, mainly with bur oak. Considerable timber is left, and in places where it is not disturbed it is becoming more extensive.

About 35 to 40 per cent of this type is under cultivation and the remainder is largely in permanent pasture and hay land. A large portion is still in native prairie grasses, which produce 1 ton to $1\frac{1}{2}$ tons per acre. Where the slopes are moderate and the fields are not too much dissected by gullies, this type is fairly well adapted to the general farm crops. Corn yields 15 to 35 bushels per acre, oats 20 to 30 bushels, wheat 15 to 20 bushels, and alfalfa $2\frac{1}{2}$ to $3\frac{1}{2}$ tons per acre. Alfalfa does well and is taking the place of the other hay crops. Not enough potatoes are grown to supply the home demand.

The farmers, as a rule, do not follow any definite crop rotation. The methods of farming are about the same as on the Carrington silt loam.

Owing to the large quantity of stony material and the deeply dissected topography, this soil is less desirable for farming than the Carrington silt loam. A heavy farm equipment is required to cultivate this type. The soil checks and cracks to some extent. Liberal

quantities of manure are applied once in every 7 or 8 years, and no commercial fertilizers are used.

Land values on this type range from \$50 to \$90 an acre, depending on the topography and location.

A few small areas of a light-colored soil, with a yellowish-brown sandy clay subsoil, occurring in the midst of the Carrington soils, have been included in the Carrington loam. Four of them lie south-east of Germantown and 8 lie in the extreme southeastern corner of the county. These are areas of Lindley loam, too small to show on the map.

THURSTON SERIES.

The soils of the Thurston series range in color from brown to dark brown and in rare cases to almost black, and the subsoils from yellow to light brown, with sometimes a reddish tinge. The soils have a considerable range in texture, but coarse sand and fine gravel are usually present. The subsoils consist of a mass of loose sand and gravel with low water-holding capacity. The soils of this series are derived from sandy and gravelly glacial materials, usually of the Aftonian glaciation, and occur where these beds are exposed on stream slopes. The gravel is noncalcareous. In Seward County only the sandy loam type occurs.

THURSTON SANDY LOAM.

The surface soil of the Thurston sandy loam is a light-brown to brown coarse sandy loam to sandy loam with an average depth of 8 inches. It is underlain by a reddish-brown, gritty clay loam, which immediately passes into a reddish-yellow coarse sand having enough clay cementing material to give it a decidedly sticky feel when wet. When dry the subsoil is loose and incoherent. The soil contains much coarse sand and some fine gravel. The soil varies considerably with the topographic position. Adjoining the Grundy silt loam the soil is a brown to dark-brown silt loam, and as the area of the typical soil is approached the surface soil becomes more sandy and the sand bed closer to the surface. Considerable silt has been mixed with the sand stratum during the process of erosion. In places the sand is exposed and the original soil has been entirely washed off. In the bottoms of draws and at the foot of slopes the soil is darker and has a greater admixture of silt. The type includes a very fine sandy loam, a fine sandy loam, and a gravelly sandy loam texture.

The type is unimportant in extent. The largest areas occur south-east of Beaver Crossing and northeast of Seward. Other small areas are found along Lincoln, Indian, Johnson, and Beaver Creeks, and Big Blue and West Fork Big Blue Rivers. It occurs on slopes along the major drainage ways between the Grundy silt loam and the

Wabash or Waukesha silt loams. The slopes are rather steep and uneven owing to the destructive erosion. The soil is very unretentive of moisture and leachy.

The soil is derived from the Aftonian sands. Whether any of the areas are derived from Western sands underlying the loess is not known. The Aftonian sand lies in layers and is cross-bedded. Quartzite and feldspathic sand and fine gravel make up the bulk of the deposit.

A large part of this type is still in native prairie sod. Areas included in fields with the Grundy silt loam have been broken up. It is only the latter areas that are cultivated and used for crop production. Owing to the sandy, porous condition of the soil, the crop yields are low, and as no fields consist entirely of this soil it is difficult to determine actual crop yields. Most of the type is used for pasturage. It provides fairly good pasturage in the spring, but with the approach of hot weather grasses turn brown. A large part of the type is almost bare, with only a scattering growth of grasses in bunches.

The Thurston sandy loam ranges in price from \$20 to \$30 an acre.

Results of mechanical analyses of samples of the soil and subsoil of the Thurston sandy loam follow:

Mechanical analyses of Thurston sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
371518.....	Soil.....	5.4	18.4	11.6	19.6	11.6	22.4	10.7
371519.....	Subsoil.....	16.4	34.4	15.7	20.0	1.8	4.9	6.7

SCOTT SERIES.

The soils of the Scott series are dark brown to drab. The upper subsoils are lighter in color than the soil, usually gray, and range in thickness up to 6 inches. They are underlain by a tough, plastic clay layer, dark drab and brown mottled, ranging in thickness from 5 to 15 inches. At about 30 inches there is a gradual change to a lighter colored, friable, somewhat lighter textured layer extending to the bottom of the 3-foot section. The members of this series are derived from lake-laid material eroded from higher lying loessial soils and deposited by sheet surface waters or intermittent streams in shallow waters of temporary lakes or ponds occupying local, undrained, sinklike depressions in upland plains. The soils are poorly drained, and in places are subject to overflow. In this county the Scott series is represented by the silt loam and silty clay loam members.

SCOTT SILT LOAM.

The surface soil of the Scott silt loam varies in depth from 3 to 14 inches and is a dark-gray, dark-brown or almost black, smooth, friable silt loam. It is underlain by a light-gray or ashen-gray pulverulent, floury silt which varies in thickness from 4 to 14 inches and passes abruptly into a tough, plastic, moderately crumbly, very dark drab to black silty clay to clay slightly mottled with brown. Occasionally the lower subsoil is slightly lighter in color, but usually the dense black color extends to the depth of 3 feet. The upper layer of the subsoil is very loose, while the lower layer is very compact, plastic, and impervious. The light-colored layer is sometimes absent and the surface soil rests directly on the heavy substratum, but in such cases the surface soil is almost always considerably deeper.

Owing to the marshy condition of this type a large quantity of organic matter has accumulated in the surface soil. Where the subsoil is exposed it is seen to be calcareous and the heavy subsoil to have a distinctly granular structure. Where the type approaches the Scott silty clay loam it has a subsoil similar to the latter.

The type differs from the Scott silty clay loam mainly in having a light-colored layer between the soil and subsoil and a black instead of dark-drab or grayish and red mottled subsoil. The two types are closely associated, and both are poorly drained. In cultivated fields the decided grayish tinge of the surface soil readily distinguishes the Scott silt loam from the surrounding soils.

The type occurs mainly as depressions, sags, and shallow basin-like areas in the Grundy silt loam, with the exception of four areas west of Beaver Crossing and one small area 2 miles southeast of Ruby, which lie on terraces. The soil in the latter positions is identical with the typical soil, except in the larger area west of Beaver Crossing, which has scarcely any of the light-colored intermediate layers. The largest areas of Scott silt loam are found near Utica, Tamora, and Goehner. A few of them cover approximately 1 square mile. Numerous small areas are scattered throughout the loess plains region, although east of the Big Blue River they are much less abundant. The bottoms of the basins are usually flat and the drainage very deficient. Where the areas occur at the heads of streams or along streams, natural drainage is fairly good. In many places it is supplemented by drainage ditches. In depressed positions with high surrounding land artificial drainage is difficult and expensive.

The upper section of this soil is apparently derived from silt washed in from the surrounding higher land and deposited on an older soil, which now constitutes the lower subsoil. The lower stratum, which is high in organic matter, is apparently a very old soil formed by the sifting in of clay and silts from standing water.

The native vegetation consists of sedge, wild marsh grasses, and other water-loving plants. Frequently the center of a depression is almost barren of vegetation.

About half of the type is under cultivation. When the areas are small they are farmed with the surrounding types. Of the larger areas about half is in crops. The yields are considerably lower than on the Grundy silt loam, owing to the fact that the crops are partly drowned out in wet years and nearly burned up in dry years. Where artificial drainage has been provided or the drainage is naturally good, corn, oats, and wheat do about as well as on the Grundy silt loam. Timothy does well on the type as a rule and yields 1 ton to 2 tons per acre. About half of the type is pasture land, to which it is best adapted unless artificially drained. Land values on this type range from \$40 to \$60 an acre.

The following table gives the results of mechanical analyses of samples of the soil, subsoil, and lower subsoil of the Scott silt loam:

Mechanical analyses of Scott silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
371505.....	Soil.....	0.0	0.2	0.2	0.4	15.2	60.3	23.8
371506.....	Subsoil.....	.0	.0	.1	.2	14.8	68.0	16.9
371507.....	Lower subsoil.....	.0	.1	.1	.4	9.7	49.3	40.1

SCOTT SILTY CLAY LOAM.

The soil of the Scott silty clay loam is a dark-brown to almost black mucky silt loam varying from 1 inch to 6 inches in thickness. The surface soil is rich in organic matter. It changes rather abruptly to a subsoil of dark-drab, tough, plastic silty clay, mottled with bright reddish yellow and reddish brown. The mottlings become fainter with depth and change to a pale-yellow color and finally disappear. With increase in depth the subsoil becomes lighter in color, and somewhere between 24 and 30 inches passes into a solid-gray plastic silty clay somewhat lighter in texture than the upper subsoil.

This type is different from the Scott silt loam in not having a light-gray layer between the soil and subsoil.

The Scott silty clay loam, which is inextensive, is confined to 9 areas, 3 northwest of Goehner, 5 in the vicinity of Utica, and 1 south of Tamora. It occupies the lowest parts of basins and is very poorly drained. An area 3 miles northwest of Utica covers the entire basin, which is about 4 to 8 feet lower than the imme-

diately surrounding country. Old residents report that these basins were occupied by lakes when the county was first settled. Even now water stands on these areas during a part of the year.

This soil is derived from clay and silt deposited in standing water. The mucky layer is the result of the accumulation of decaying remains of sedges and marsh grasses which grew in the shallow lake beds.

None of the Scott silty clay loam is under cultivation except the area south of Tamora. In 1914 it was put into corn, but the crop was a total failure. The type is almost entirely devoted to pasturage. With good drainage this type should prove a valuable soil. The land is now valued at \$20 to \$30 an acre.

Mechanical analyses of samples of the soil and subsoil gave the following results:

Mechanical analyses of Scott silty clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
371508.....	Soil.....	0.2	0.4	0.3	0.6	13.0	57.5	28.3
371509.....	Subsoil.....	.0	.1	.1	.2	9.6	46.5	42.9

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 undulating. Drainage is good. In Seward County the Waukesha silt loam and silty clay loam types are recognized.

WAUKESHA SILT LOAM.

The surface soil of the Waukesha silt loam consists of a dark-brown, rather heavy silt loam, 8 to 12 inches deep. It is underlain by a thin layer of brown silty clay loam which varies in thickness from 2 to 4 inches. This stratum is in turn underlain by yellowish-brown silty clay loam. At any point from 24 to 30 inches the color of the subsoil changes to pale yellow or grayish yellow mottled slightly with light gray. Some rusty-brown and reddish iron stains are common in the lower portion.

The lower subsoil or deep subsoil is slightly carcareous. The lime content increases with depth. The subsoil is extremely compact, but only slightly plastic. There is a slight concentration of clay in the upper portion of the subsoil. In general, the color of the subsoil, as well as the texture, becomes lighter with depth. In the flatter areas

there is a tendency toward a sharp boundary between the soil and subsoil. The upper 10 or 12 inches of the subsoil is a black silty clay of a tough and moderately crumbly structure. The lower subsoil is the same as in the typical soil.

Where the Waukesha silt loam is on a low terrace and the slope between it and the Wabash silt loam is long and gradual, the boundary is drawn rather arbitrarily, owing to the gradual transition. In such cases the soil with the yellowish-brown or brown subsoil was included with the Waukesha silt loam. Sometimes the lower terrace seems to be a long, gradual slope from the Wabash level to the upland or higher terrace.

On the lower bench of this type there are numerous alkali spots too small to indicate. They are seldom more than 20 feet in diameter and usually much less. Occasionally they occur as narrow strips along slight rises. There are none of these spots on the higher terrace. The alkali areas are easily recognized by their barren, whitish veneering of silty material over the surface soil. The soil of this variation is a dark-brown, heavy silt loam, passing abruptly at any point from 2 to 3 inches into a tough, crumbly silty clay of the same color as the surface soil. At 8 to 12 inches a yellowish-brown silty clay with a high percentage of salt crystals embedded between the granules is encountered. The salt seems to disappear at about 24 inches and the subsoil changes to a yellow, mottled with light-gray, silty clay loam to heavy silt loam. The third foot of the subsoil is conspicuously mottled with rusty-brown iron stains, and there are a few above this depth. The upper part of the subsoil is more or less cemented, probably with the soluble salts. The surface soil appears as if the soil particles had run together. These areas are termed "alkali" by the farmers. They occur on the areas of Waukesha silt loam southeast of Beaver Crossing, south of the West Fork Big Blue River, and west of the Big Blue River between Staplehurst and Milford. They are especially numerous on the area southwest of Ruby. Where they are numerous the crop yields are about a third lower. A sample of the soil from an alkali area in this county showed the presence of an excess of alkali salts.

The Waukesha silt loam occurs as narrow, discontinuous first and second benches, with adjoining alluvial fans above the Wabash silt loam, mainly along the West Fork Big Blue and Big Blue Rivers and Lincoln Creek. The only area not found along the larger streams is in sec. 11, T. 12 N., R. 4 E. The higher terrace is about 20 to 30 feet above the Wabash silt loam and the lower 10 to 15 feet. The topography is nearly flat and the areas are dissected by only a few streams which usually rise in the upland. The upper terrace is well drained and most of the lower has fairly good drainage, but there are numer-

ous local spots that are poorly drained. The soil is very drought resistant.

The type is derived from old colluvial and alluvial silts, more or less modified by wind action. The material is loesslike and has been described as a valley form of loess in Nebraska.¹

This type was originally in prairie sod, and the same grasses are native to this soil as to the upland soils. Approximately 90 per cent of the type is under cultivation and devoted to the staple crops commonly grown in the county. The type of agriculture is practically the same as that on the Grundy silt loam. Corn yields 30 to 45 bushels per acre, wheat 20 to 30 bushels, and oats 30 to 40 bushels. Corn is the main crop and is well suited to this type of soil. Clover does well when there is sufficient moisture in the ground, but it frequently suffers from drought. It is being dropped from the crop rotation, and alfalfa seems to be taking its place. The latter legume does well, and three or four cuttings are obtained in a season. The average total yield is about 4 tons per acre, though higher yields have been obtained. Only a very small part of this type, in addition to the poorly drained areas, is devoted to pasture. Potatoes are grown, but the quantity is not sufficient to supply home demands. The tendency is to grow less corn and more wheat and alfalfa, with no change in the area devoted to oats. This system involves the keeping of more live stock.

No definite crop rotation is practiced on this type, but the general tendency is the same as on the Grundy silt loam.

Owing to its stone-free nature, smooth surface, silty texture, and granular structure, this soil is easily handled. The alkali spots, however, are very difficult to handle. In dry weather they become hard and impossible to cultivate. When too wet the soil puddles and care must be taken to cultivate it under the best moisture conditions. A small quantity of barnyard manure is occasionally applied.

The Waukesha silt loam is valued at \$125 to \$150 an acre, depending on the improvements and location. Where alkali spots are very numerous the land has a lower value.

WAUKESHA SILTY CLAY LOAM.

The Waukesha silty clay loam is a dark-brown, light-textured silty clay loam, 8 to 12 inches deep, underlain by a yellowish-brown silty clay loam to silty clay. At any level from 20 to 24 inches a pale-yellow clay loam to silty clay, mottled with light gray or grayish yellow, is encountered. The lower portion of the subsoil becomes lighter in texture and looser. The upper part is very compact and slightly plastic, though these are not characteristic features. The

¹ Unpublished manuscript by G. E. Condra.

change from soil to subsoil is gradual, and usually a brown intermediate layer is encountered. Below 24 inches the soil is high in lime concretions, and there are some rusty iron stains.

The portion of the type adjoining the Grundy silt loam and the flatter areas is considerably heavier. Here there is a dark-brown silty clay loam passing abruptly into a tough, crumbly, almost black silty clay. This layer is commonly spoken of as the hardpan layer. It is very dense, and water soaks through it very slowly. Alkali spots similar to those on the Waukesha silt loam are found on the latter areas.

The Waukesha silty clay loam covers only 256 acres. It is confined entirely to sec. 33, T. 9 N., R. 3 E., in this county and extends into Saline County. The type occupies a terrace about 15 to 20 feet above the level of the Wabash silt loam. It is practically flat and well drained, except for the heavy subsoil phase. The soil resists drought well. It is similar to the Waukesha silt loam except that it is slightly heavier in texture.

The type is derived from old alluvium deposited at a time when the streams were flowing at a higher level than at present. The surface of the fluvial silt may have been modified by wind action. The type was originally covered with native prairie grass and is high in organic-matter content.

The poorly drained part of this type is in pasture and the remainder in general farm crops. The crops grown on this type and their yields compare closely with those grown on the Waukesha silt loam. The tendency is to grow less corn and more wheat and hay crops.

Owing to its higher clay content, this soil is not so easily handled as the Waukesha silt loam. More care must be exercised to cultivate the soil under the right moisture conditions. When it is plowed too wet large lumps are apt to form. A small quantity of barnyard manure is occasionally applied.

The Waukesha silty clay loam is valued at \$100 to \$125 an acre.

Below are given the results of mechanical analyses of samples of the soil and subsoil of this type:

Mechanical analyses of Waukesha silty clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
371520	Soil.....	0.0	0.3	0.3	0.9	14.6	56.0	28.2
371521	Subsoil .....	.6	.7	.3	.8	11.7	61.9	23.9

WABASH SERIES.

The Wabash soils are prevailing black, ranging to dark brown, and contain a high percentage of organic matter. The subsoils are gray or brownish 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 principally from the loessial and associated soils of the region. The Wabash areas have a flat topography. In Seward County the silt loam and silty clay loam types are identified.

WABASH SILT LOAM.

The Wabash silt loam consists of a dark-brown to black, heavy, smooth silt loam, having an average depth of 18 inches. The soil is very high in organic matter and ranges in depth from 10 to 24 inches. The subsoil is a dark grayish brown, slightly heavier and more compact silt loam, which frequently becomes slightly mottled with brown and light gray in the lower part. It is not uncommon to find little difference in color or texture within the 3-foot section. Occasionally the subsoil is a light silty clay loam in texture. The change from soil to subsoil is almost imperceptible.

There are local spots, termed "gumbo" by farmers, which have a heavy, black silty clay subsoil. In places where the type is poorly drained light gray is the predominant color of the subsoil. In general the area west of the Big Blue River between Seward and Milford is heavier in texture than the average of the type in the county. The surface soil here is a heavy silt loam, 12 to 15 inches deep, underlain by an almost black silty clay loam. Below 24 inches the subsoil is lighter in color, being dark brown, and lighter in texture, approaching a heavy silt loam. There is a concentration of clay in the second foot, resulting from the washing down of clay particles.

Along the Big Blue River and its old channels and cut-offs a lighter textured phase is encountered. The soil here is a dark grayish brown, coarse silt loam to very fine sandy loam, underlain by a lighter colored very fine sandy loam. Even in the typical Wabash silt loam, strips of very fine sandy loam are common close to large drainage ways.

Between the upland and bottom land and along streams where there has been considerable sidehill wash a colluvial phase of this type has developed. As there is very little difference in color, texture, and structure within the 3-foot section, this is included with the typical Wabash silt loam. The soil of this phase is generally dark brown in color and about 24 inches deep. The texture is a friable, mellow silt loam, not so dense as the typical soil. The subsoil is practically the same as the surface soil, except that it is some-

what more compact. This variation has an appreciable slope and is well drained.

The Wabash silt loam adjoining the Thurston sandy loam or Carrington loam usually has a high admixture of sand, giving rise to a sandy loam or loam soil. Such areas are, however, too small to indicate on a map of the scale used. Some alkali spots occur on this type, and on such land crops are yellow and unhealthy in appearance.

The Wabash silt loam is the most important bottom-land soil in the county, covering 70.5 square miles. It occurs on bottoms which, owing to the degrading activities of the streams, have developed into low terraces about 10 to 15 feet above the stream channel. Strips of lower lying bottom land are found along practically all the streams. Only along the larger streams are the areas wide enough to be shown on the map.

The type has a flat topography and is only slightly dissected by old cut-offs and branch streams entering the larger water courses. The stream channels are deep and only the lower land is subject to annual overflow. According to reports from old settlers, the type is overflowed about once in every 10 or 15 years. Sometimes, however, portions of the type are inundated by branch streams, and considerable damage is done to crops. As a whole the type is fairly well drained, though there are numerous spots adjoining the terrace or upland where seepage water from the underlying sands keeps the soil moist the year round. In such localities ditches or tiles could be installed to intercept the seepage water and carry it directly to the main ditch. A large part of the type would be benefited by additional ditching and tiling to carry off the excess water after heavy rains.

The material composing this type is of alluvial origin. It is derived largely from the Grundy and Carrington silt loams, and to a minor extent from other upland types.

Originally most of the type supported a forest growth of cottonwood, willow, elm, ash, black walnut, hackberry, and bitter hickory. Approximately 80 per cent of the type is under cultivation, the remainder being largely in pasture and hay land. Except in poorly drained spots, general farm crops do well. Corn is by far the most important crop in acreage and is the best suited to the type. It yields on the average 40 bushels per acre, and occasionally 60 to 80 bushels are obtained. Except where the soil has been in corn for some time, oats and wheat do not do well, as they are apt to lodge. Wheat ranges in yield from 15 to 40 bushels per acre. Kherson oats are well suited to this type and produce 30 to 40 bushels per acre, but the long-strawed varieties are apt to lodge. More of the type is being put into alfalfa and clover and timothy. Alfalfa does well on the well-drained areas and 4 to 6 tons are obtained to the acre. Clover and timothy are successful, but rather difficult to get started in dry

years. A farmer on this type reports that trials with oats and barley as nurse crops showed barley to give by far the better results. Most of the farmers sow timothy in the fall and wheat and clover the following spring. The latter method is not nearly so successful. In favorable years clover yields 2 to 2½ tons per acre. A small part of the type is in prairie grass, which yields 1 ton to 2 tons per acre. The tendency on the Wabash silt loam is to grow less corn, more wheat and alfalfa and other hay crops, with no change in the quantity of oats.

Up to the present time the one-crop system has been very prevalent. It is not uncommon for a farmer to report that a certain field has been in corn for 10 to 15 years. It is only after decrease in fertility becomes apparent that the farmer begins to rotate the corn with wheat and oats. A few farmers use the following rotation: Four years corn, 1 year oats, and 4 years wheat; and still others use 3 or 4 years corn, 1 year oats, and 2 years wheat.

The 4-horse hitch is used in practically all farm operations. Owing to its flat topography, silty texture, and friable structure, this soil is easily handled. It can be cultivated under a wide range of moisture conditions and seldom bakes or clods. The "gumbo" and alkali spots are rather difficult to cultivate, and when plowed while wet the granules coalesce and form hard, intractable clods. Most of the corn on this type is checked. The Wabash silt loam stands drought well even over protracted periods of time.

This is undoubtedly the most productive soil in the county. Only where the one-crop system of farming has been followed has the soil decreased in productiveness. Very little barnyard manure and no commercial fertilizer is used. The occasional rotation of corn with grain and leguminous crops seems to be sufficient to maintain the productiveness of the soil.

The Wabash silt loam is valued at \$80 to \$150 an acre, depending on location and drainage conditions.

WABASH SILTY CLAY LOAM.

The soil of the Wabash silty clay loam consists of a black to dark-brown, light-textured silty clay loam. At any point from 24 to 30 inches the subsoil passes into a dark-gray or dark-drab silty clay, mottled slightly with brown. The lower portion of the subsoil is considerably denser, more compact, and more sticky. Occasionally the color of the soil remains the same throughout the 3-foot section, with small gray mottlings entering into the extreme lower portion. Again the entire subsoil may be grayish, but this is rarely the case. In the lower depressions of this type the surface soil approaches a clay, but such areas were too small to indicate. In places the subsoil is similar to that of the Scott silt loam.

There are only a few small areas of this type in the county, one southeast of Beaver Crossing, and several in the vicinity of Seward.

The type is rather depressed and poorly drained. It occurs on the same level as the Wabash silt loam, but usually occupies a position adjoining the upland or terrace soils. The type receives a large quantity of seepage water from springs issuing from the upland. Water stands on much of this type for a large part of the year.

The Wabash silty clay loam is alluvial in origin and occupies a low bench included with the first-bottom group. The soil is rich in organic matter, and the subsoil contains some lime.

The original growth was largely sedge and marsh grass. Very little of the type, except small areas occurring in fields with other types, is cultivated. Most of the type is in pasture, to which it is best suited in its present condition. With the installation of a standard drainage system this type should prove a valuable corn soil.

Land values range from \$60 to \$80 an acre on this type, depending on the drainage and improvements.

Results of mechanical analyses of samples of soil and subsoil follow:

Mechanical analyses of Wabash silty clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
371510.....	Soil.....	0.0	0.1	0.2	0.7	7.8	63.1	28.1
371511.....	Subsoil.....	.0	.5	.4	.6	7.6	62.0	28.9

SARPY SERIES.

The soils of the Sarpy series range from light gray to dark brownish gray or nearly black. They differ from the Wabash and Yazoo soils in color and in having subsoils distinctly lighter in texture than the surface soils. This series is developed in the bottoms of the Mississippi and Missouri Rivers and their larger tributaries. The material is alluvial in origin. Owing to their low positions, these soils are subject to overflow, although the nature of the soil and the subsoil is such that between the flood stages of the streams drainage is good. In general the topography is flat. The very fine sandy loam type only is recognized in the present survey.

SARPY VERY FINE SANDY LOAM.

The Sarpy very fine sandy loam is to a depth of 8 to 12 inches a brownish-gray very fine sandy loam. The soil is very friable and works up into a mellow condition, even though it is low in organic matter. The subsoil consists of a gray to light-gray very fine sandy loam, with a brownish to yellowish tinge. It is lighter and slightly coarser in texture than the soil. The line of demarcation between

soil and subsoil is indistinct. Layers of silt and coarser material are not uncommon throughout the soil section. A fine sandy loam is encountered in this type on low ridges, bends of streams, and areas adjoining either the Thurston sandy loam or the Carrington loam.

The type is inextensive and occurs as narrow strips along the West Fork Big Blue River and along Big Blue River between Ruby and Milford and in a few small areas south of the latter town.

It occurs on narrow, low first bottoms below the level of the Wabash silt loam. The topography is flat, though ridgy on a miniature scale. The type is subject to frequent inundations, though excessively drained between the flood stages of the streams, owing to the loose, sandy subsoil. The type is very droughty, and during dry periods crops, especially corn, suffer much from lack of moisture. The type is alluvial in origin.

The type was originally forested with cottonwood, ash, box elder, elm, oak, and walnut. Most of the timber, except along the stream banks, has been removed.

Most of the type is not under cultivation. The average crop yields are very low. Corn is at present by far the most important crop and yields on the average 25 bushels per acre. Wheat averages about 15 bushels and oats about 25 bushels an acre. Oats do not do well and are not much grown. Buckwheat does well on this type, and yields of 35 to 55 bushels per acre are obtained. Crop failures are common. The type makes good pasturage. In wet seasons potatoes do well on this type and yield 125 to 150 bushels per acre.

No definite rotation is practiced, but the general tendency is to keep the land 3 years in corn, 1 year in oats, and 2 years in wheat. The type is very easy to handle and can be worked under any moisture conditions as long as water is not standing on the ground. Only a light application of manure is made and no commercial fertilizers are used. Farmers report that the crop-producing power of the soil has decreased considerably. As the soil washes to some extent during overflows, the tendency of the farmers is to keep this type in pasture.

Land of this character ranges in value from \$40 to \$80 an acre, depending on location, drainage conditions, etc.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Sarpy very fine sandy loam:

Mechanical analyses of Sarpy very fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
371516.....	Soil.....	0.0	0.1	0.2	8.0	33.4	46.7	11.6
371517.....	Subsoil.....	.0	.1	.2	11.2	40.0	40.9	7.5

SUMMARY.

Seward County is located in the southeastern part of Nebraska, south of the Platte River. It has an area of 574 square miles, or 367,360 acres. The topography varies from flat to hilly and deeply dissected.

The lowest elevation in the county, 1,240 feet above sea level, is about $1\frac{1}{2}$ miles northeast of Pleasantdale, and the greatest elevation, 1,600 feet, occurs in the western part of the county.

The county is drained by two important streams and their tributaries, Big Blue River and the headwaters of Salt Creek. The general direction of the drainage is toward the southeast in the loess plains region and to the east in the drift hills.

The first permanent settlement in Seward County was made in 1859, and the county was organized in 1865. The first settlers came from the Eastern States. The population was at a later date supplemented by foreigners. The population is given as 15,895 in the 1910 census.

Seward is the county seat. It is located near the geographical center of the county and has a population of 2,106.

Seward County has good railroad facilities. No point is more than 9 miles from a railroad station. All communities have rural delivery service and are well supplied with telephones.

The climate of Seward County is favorable for the production of corn, wheat, oats, alfalfa, and other forage crops. The annual precipitation averages about 29 inches, and the mean annual temperature is about 51° F.

Grain farming is the chief type of agriculture pursued, and the production of pork, beef, and dairy products is secondary.

Corn, wheat, oats, timothy and clover mixed, wild hay, alfalfa, timothy, and clover are the chief crops, and potatoes, millet or Hungarian grasses, sorghum, and kafir are less important.

No trucking is carried on, except on a very small scale around the small towns scattered through the county. Most farmers have small orchards.

In general, no definite crop rotation is followed, and the adaptation of crops to soils is not given much attention.

Eleven soil types are recognized in Seward County. They may be classified in three groups—the upland soils, terrace soils (old alluvial), and first-bottom (recent alluvial) soils.

The Grundy silt loam is the predominating type and is probably the best upland type for grain farming. Corn, oats, wheat, and alfalfa are the chief crops grown.

The Carrington silt loam is glacial in origin and occurs entirely in the eastern part of the county. It is considered a good agricultural soil and is devoted to the same crops as the Grundy silt loam.

The Carrington loam is glacial in origin, but is derived from a stratum which gives rise to a rather stony soil. It is largely used for pasturage and hay land, though where the topography is not too uneven and the stone content is low, corn, oats, and wheat do well. A small part of this type is highly calcareous.

The Thurston sandy loam is derived from the Aftonian sands. It is very inextensive and is largely used for pasturage.

The Scott silt loam occupies undrained, depressed or shallow, basinlike areas mainly in the Grundy silt loam and, to some extent, in the Waukesha silt loam type. It is used mainly for pasturage and the better drained areas for the production of corn, oats, and wheat.

The Scott silty clay loam usually occupies the lowermost positions in the Scott basins. It is very inextensive and is used entirely for pasturage.

The Waukesha silt loam is an old alluvial soil occurring as a low and high bench. It is an excellent agricultural soil and the common staple crops are grown on it.

The Waukesha silty clay loam is of very small extent. It is more difficult to handle than the Waukesha silt loam.

The Wabash silt loam is the predominant first-bottom soil of the county. It is the best corn soil of the county, though not nearly so well adapted to wheat and oats as to corn.

The Wabash silty clay loam is a very inextensive type. It is poorly drained and entirely devoted to pasture and hay land.

The Sarpy very fine sandy loam occurs as low first bottoms along the West Fork Big Blue and Big Blue Rivers. It is subject to overflow and lies lower than the Wabash silt loam. Most of it is under cultivation and is devoted to the production of corn and, to a small extent, to oats and wheat.

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