SOIL SURVEY OF NANCE COUNTY, NEBRASKA

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DESCRIPTION OF THE AREA

Nance County is in east-central Nebraska. Fullerton, the county seat, situated near the center of the county, is about 100 miles west of Omaha. The county is roughly rectangular; the northern and southern boundaries are somewhat irregular. It is approximately 30 miles long east and west, has an average width of about 15 miles, and includes an area of 440 square miles, or 281,600 acres.

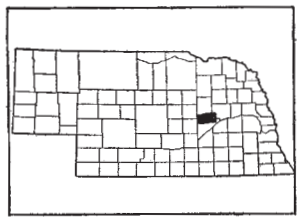

FIG. 7.—Sketch map showing location of the Nance County area, Nebraska

The county forms a part of a plain, upon which minor relief has been produced chiefly by erosion. Physiographically the county may be separated into two main divisions—the eroded plains, which occupy the northern two-thirds and comprise the entire upland, and a lower lying flat to gently undulating and in places hummocky valley, known in the Nebraska surveys as the Platte Plain, which forms the remaining third. The boundary between these two divisions is well defined, except where minor stream valleys extend from the Platte Plain into the uplands. It crosses the county in a southwest-northeast direction, roughly parallel to the Loup River.

The eroded plains, or uplands, present a variety of topographic features. The general surface is that of an almost level to steeply rolling or hilly plain, modified by many strips of flat alluvial land extending southward along the larger streams. The plain represents a remnant of an upland surface which originally comprised the whole area within the existing county boundaries, but it has been so modified by erosion that only the high hill crests and broader divides approach the former level.

The comparatively flat areas in the upland are not extensive. They occupy the highest positions in the county and occur chiefly in the north-central and northeastern parts upon the high divides between major drainage ways.

The alluvial lands throughout the eroded loess plains have a flat to very gently undulating relief. They include the terraces and flood plains along the larger streams and occur in belts varying in width from a few rods to about 1½ miles. Those on Cedar River in the north-central and on Beaver Creek in the northeastern parts of the county are the most conspicuous. The terraces, which include about 90 per cent of the alluvial lands, lie 10 to 25 feet above the first bottom lands and from 50 to 100 feet below the higher uplands.

The slopes to the uplands in most places are moderate; although in many places they are blufflike to precipitous. The first bottoms or flood plains lie from 3 to 5 feet above the normal flow of the streams. The transition from flood plain to terrace is usually marked by a short, rather steep slope.

The most uniformly hilly and dissected part of the uplands is in the region between the Cedar River and the western county line. Here erosion has produced an intricate system of small steep-sided drainage ways separated by narrow crestlike divides. The alluvial areas in this section are extremely narrow, except along Timber Creek in the northwestern part of the county, where in places they attain a width of 1¼ miles.

The Platte Plain, which occupies the southern third of the county, has been formed by the intrenchment of streams into the plain that once covered the entire region, thereby creating a broad lowland belt or valley now occupied by the flood plains of both the Platte and Loup Rivers. During the early stages of development stream intrenchment ceased and the valley was filled to the level of the highest terraces. Later intrenchment and valley filling produced lower terraces and the present bottom lands and separated the Loup from the Platte. That part of the Platte Plain lying within Nance County is roughly triangular in shape, being bounded on the north by the southern border of the eroded loess plains and on the south and east by the county lines. The Platte River, which has been the most important factor in producing the lowland belt, flows near the southeastern corner of the county within a mile of the boundary. The Loup River, however, its largest tributary, flows northeastward in a broad, shallow channel, diagonally across the county near the northern edge of the Platte Plain.

The general surface of the Platte Plain is flat to gently undulating, modified in places by shallow stream channels, depressions, and old cut-offs, and by extensive deposits of wind-blown sand, which have produced a billowy to hummocky relief.

The terraces or second bottoms occupy about 80 per cent of the Platte Plain. The older parts have been greatly modified by wind action and water erosion, leaving their form poorly defined in places. The highest remnants appear on the north side of the Loup River, between Cottonwood and Mare Creeks. They lie from 40 to 60 feet above the present channel of the stream and from 100 to 130 feet below the general level of the adjoining uplands. The other terraces in the Platte Plain vary from 10 to 30 feet below the level of the high ones. The transition to the uplands is marked by a rather steep and in places dissected slope, while that to the flood plains is quite gradual. The surface of the lower terrace lands is prevailingly flat, except where it has been cut by drainage ways or modified by wind action. The most extensive areas showing the result of wind action lie along the southern county line in the vicinity of the Liberty Knoll School and in the southeastern part of the county between the Loup River and Prairie Creek.

The first bottoms or flood lands throughout the Platte Plain occupy the lowest positions in the county. They occur as narrow, broken strips, varying in width from a few rods to about 1½ miles, along both sides of the Loup River and Prairie Creek, the widest and most continuous developments being along the latter stream.

The land lies only a few feet above the normal flow of the channels and is in many places subject to overflow during flood stages of the streams. The surface is flat, though modified by depressions and overflow channels.

Nance County has an average altitude of 1,780 feet above sea level, with a range from approximately 1,540 feet where the Loup River crosses the eastern county line to about 2,020 feet along the western boundary. The average elevation of the eroded loess plain is about 1,800 feet and that of the Platte Plain or valley 1,650 feet above sea level. The elevation of Belgrade is 1,707 feet; Fullerton, 1,630; Woodville, 1,643; Merchiston, 1,612; Kent, 1,585; and Genoa, 1,580 feet above sea level. The general slope of the county is to the southeast.

The entire county is drained by the Loup River and its tributaries, with the exception of a small area in the southeast corner, which is tributary to Prairie Creek, an affluent of the Platte River. The drainage on the south side of the Loup River is chiefly underground.

The first permanent settlement in this territory was made about 8 miles above the mouth of Cedar River in 1876. In 1879 the original boundaries of Nance County were established by an act of the Nebraska Legislature and were defined to include all that part of Nebraska lying within the Pawnee Reservation. Later an area of unorganized territory lying west of the reserve was added to the county. The early settlers came largely from eastern States. According to the 1920 census, the population of the county is 8,712. It is all classed as rural, as there are no cities having 2,500 or more inhabitants. The density is 19.5 persons per square mile. Settlement is quite evenly distributed, but is thickest along the railroads and in the vicinity of the towns.

Fullerton, the county seat and principal town, situated in the south-central part of the county, has a population of 1,595. Genoa with 1,069, situated in the northeastern part, has a large Government school for Indians. Belgrade, in the north-central part of the county, has 493 inhabitants. Merchiston, Kent, and Woodville are small hamlets located in the east-central or northeastern parts of the county.

The transportation facilities of Nance County are good. The railroads within the area are all branch lines, but furnish good connections with Omaha. The Union Pacific Railroad from Columbus crosses the eastern county line near Genoa. From this town one branch extends northwest along Beaver Valley to Albion in Boone County, where it connects with the Chicago & North Western Railway. Woodville station is on this line. Another branch extends southwestward along the north side of the Loup River to Fullerton. From this point it follows the Cedar River to Spaulding in Greeley County. Kent, Merchiston, Fullerton, and Belgrade are on this branch. The main line of the Union Pacific Railroad across Nebraska passes within a mile of the southeast corner of the county and a branch of the Chicago, Burlington & Quincy lies but a few miles from the southwestern corner.

The public roads in Nance County are all of earth construction. The more important ones, including those between the several towns, are dragged as soon after each rain as the ground permits and are kept in good repair. There are three bridges across the Loup River

within the county and cement culverts or bridges are quite common even on the minor roads. Telephones and rural delivery mail routes reach all sections.

The surplus farm products, consisting of grain, hay, cattle, and hogs, are usually marketed outside the county. The wheat, alfalfa, and livestock are shipped to Omaha. Most of the grain is handled in local elevators, where it may be sold at once or stored until the price is satisfactory. There is a flour mill at Fullerton which absorbs a part of the local wheat.

CLIMATE

The climate of Nance County is favorable for the growing of hay crops, vegetables, fruit, grain, and the raising of livestock. The rainfall is moderate, the humidity relatively low, and the rate of evaporation rather high. The winters are fairly long and the summers rather warm; the spring usually is cool, with considerable precipitation. The fall season is long, with moderate temperatures and occasional periods of rainy weather. There is not sufficient variation in surface characteristics to cause any appreciable differences in climate within the county.

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

Normal monthly, seasonal, and annual temperature and precipitation at Genoa

[Elevation 1,584 feet]

Month	Temperature			Precipitation		
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1894)	Total amount for the wettest year (1900)
	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*
December	24.7	68	−28	0.88	0.97	0.28
January	20.2	69	−31	.64	.59	.04
February	23.3	73	−32	.76	.54	.58
Winter	22.7	73	−32	2.28	2.10	.90
March	35.2	89	−11	1.12	.60	.58
April	49.7	98	12	2.82	1.93	5.87
May	60.1	101	25	4.16	1.86	3.18
Spring	48.3	101	−11	8.10	4.39	9.63
June	70.0	105	38	4.22	4.80	1.95
July	75.1	109	40	3.90	1.00	5.32
August	73.2	109	40	2.98	1.04	6.94
Summer	72.8	109	38	11.10	6.84	14.21
September	64.7	106	25	3.07	.46	10.45
October	51.3	96	9	1.73	1.48	4.76
November	36.3	81	−11	.81	.10	.22
Fall	50.8	106	−11	5.61	2.04	15.43
Year	48.6	109	−32	27.09	15.37	40.17

The mean annual precipitation is 27.09 inches. The greater part of the rainfall occurs during May, June, July, August, and September, in the form of local thundershowers. The mean annual precipi-

tation for November, December, January, and February is less than 1 inch per month. The annual precipitation when normally distributed is sufficient for successful farming without irrigation or rigid adherence to dry-farming methods. In May and June it is usually well distributed and periods of drought are almost unknown. In July the distribution is less favorable, and during August and September long periods of drought sometimes cause reduced yields. There is rarely an excess of rainfall. The precipitation in the wettest year on record, 1900, was 40.17 inches, of which 22.71 inches fell during July, August, and September. In the driest year (1894) the precipitation was only 15.37 inches. The average annual snowfall is 27 inches.

The mean annual temperature is 48.6° F. The mean for the summer months is 72.8° F. July is the warmest month, with a mean of 75.1° F., and January the coldest, with a mean of 20.2° F. The lowest temperature recorded was −32° F. in February and the highest 109° F. in both July and August.

The average date of the last killing frost in the spring is May 3 and that of the first in the fall, September 28. This gives an average growing season of 147 days, which is ample for the maturing of corn and all other crops commonly grown. In the 20 years from 1895 to 1914 there were three seasons during which the time between killing frosts was 15 or more days less than the average. Killing frosts have been recorded as late in the spring as May 27 and as early in the fall as September 2.

During most of the year the prevailing winds are from the north and west, but in June, July, and August the winds are mainly from the south and southeast. The proportion of clear sunshiny days is relatively high.

AGRICULTURE

Prior to 1857 the area now included in Nance County was unorganized territory. During that year it was ceded to the Pawnee Indians for a reserve. The Indians lived in the area until 1875, when the Government removed them to the Indian Territory and in 1886 offered the land for sale to home seekers. The lowest price was $2.50 an acre and the highest $5. The proceeds were given to the Indians. The first permanent settlers bought land along Cedar River in the latter part of 1876. The early crops were sod corn and garden vegetables, which, with game and pork, formed the chief foods. Later settlement slowly spread throughout the valleys and uplands, and wheat, corn, oats, and rye were grown. The early agricultural development was considerably retarded by the inability of most home seekers to buy the land and many went farther west, where free homesteads were available. Those who settled within the county, however, were better able to cope with the hardships and reverses which beset the pioneers in a new territory, as they had more capital. They were very industrious and soon had farming operations on a stable basis. During the early years little attention could be given to the production of grain and livestock on a commercial scale. Most farmers confined themselves to the production of only a sufficient amount of grain and livestock for home requirements, with a small surplus for sale in the community.

The agriculture of Nance County at present consists of diversified farming, including the production of grain and hay and the raising of livestock for market. According to the last census, the principal farm crops are corn, wheat, oats, alfalfa, wild hay, rye, and barley, ranking in acreage in the order named.

The table below, compiled from the reports of the Federal census, shows the trend of agriculture in Nance County:

Acreage and production of principal crops in 1879, 1889, 1899, 1909, and 1919

Crop	1879		1889		1899		1909		1919	
	Acres	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*
Corn	1,223	30,600	53,409	2,284,369	100,475	3,458,760	77,402	2,256,805	77,148	2,105,339
Oats	197	3,570	14,579	357,587	20,588	620,050	18,815	318,737	20,803	645,753
Wheat	1,045	9,807	3,604	43,088	16,371	181,840	39,476	751,715	33,923	417,328
Rye	22	130	384	6,496	2,769	35,840	98	929	2,152	26,007
Barley			93	1,449	886	20,510	146	2,369	1,258	28,692
Buckwheat			257	3,784	3	30	3	32		
Emmer and spelt							227	4,354	1	16
Mixed crops									403	13,919
Beans		5		354	21	214			3	21
Flaxseed			3,119	23,192	64	630	5	10		
Potatoes		2,034	506	41,789	615	71,911	599	46,712	646	30,937
All other vegetables					290		210		7	
Strawberries					2	77	7	205	4	63
		Tons		*Tons*		*Tons*		*Tons*		*Tons*
Timothy							1,219	1,493	283	371
Timothy and clover							3,127	3,553	433	426
Clover					116	142	212	277	103	140
Alfalfa					421	903	8,445	18,277	16,364	25,046
Millet and Hungarian grass					3,628	8,501	1,405	3,101		
Wild, salt, or prairie grasses	6,956	7,094	23,705	31,956	15,241	18,644	11,902	15,909	9,516	9,902
Coarse forage					1,275	2,884	77	258	2,800	7,042
	Trees	*Bushels*	*Trees*	*Bushels*	*Trees*	*Bushels*	*Trees*	*Bushels*	*Trees*	*Bushels*
Apples			1,696	143	23,791	2,492	22,504	17,271	12,342	4,877
Peaches			2		8,194	2	6,019	340	73	1
Pears							448	29	212	29
Plums							2,574	152	481	32
Cherries							5,932	1,072	3,925	1,841
					Vines	*Pounds*	*Vines*	*Pounds*	*Vines*	*Pounds*
Grapes					4,522	600	2,985	17,775	556	1,905

The type of farming practiced is fairly uniform throughout the county, although the relative importance of the different crops or products differs with the sections. The proportion of land used for grazing and hay production is much greater throughout the rougher parts of the uplands and the poorly drained bottom lands than elsewhere in the county. A large percentage of the better drained "hard" terrace soils is used for alfalfa, on account of the more favorable moisture conditions here than in the uplands.

According to the Federal census, the value of all cereals produced in Nance County in 1919 was $4,305,692. The total value of all domestic animals was $3,279,266. Dairy products were produced to the value of $215,343 and poultry and eggs to the value of $144,430.

Corn is the leading cereal crop and, on farms where it is not fed to livestock, the chief cash crop. The last census reports 77,148 acres in corn and a production of 2,105,339 bushels. The Nebraska Department of Agriculture reports 84,806 acres in corn in 1922 and

a production of 2,628,986 bushels, or an average of 31 bushels per acre. On farms operated by owners most of the corn is fed to hogs, beef cattle, and work stock; on tenant farms more corn is sold. There are 20 silos in the county, and on farms where these occur from 15 to 20 acres of corn are cut each year for silage. It is a common practice to husk the corn from the standing stalks in the fall and pasture the cattle and horses in the fields during the winter. Many farmers fence off a few acres of unhusked corn for hog range and a few husk only enough to supply their work stock, allowing the cattle for market to feed in the fields until fattened. A small acreage is cut annually for fodder. The less progressive farmers grow corn on the same land several consecutive years. Much better yields are obtained, however, where it is grown in rotation with small grains and alfalfa. In recent years some attention has been given to the improvement of the seed corn, but seed selection is not generally practiced. Most of the corn is of the dent varieties, though little attention is given to keeping the strains pure. Hogue Yellow Dent and Reid Yellow Dent are probably the chief varieties. Some white corn, chiefly St. Charles White and Iowa Silvermine, is grown south of the Loup River. Corn is grown on all the soils of the county, except the poorly drained flood plains, the more eroded parts of the uplands, and the sandier members of the Valentine series. It does best on the finer textured, well-drained terrace lands and the flat to gently undulating parts of the eroded loess plains.

Wheat ranks second in acreage among the cereal crops. Winter wheat is grown exclusively. The census reports 33,923 acres in wheat, yielding 417,328 bushels in 1919. The Nebraska Department of Agriculture reports 29,864 acres in 1922, with a production of 537,552 bushels, or an average of 18 bushels per acre. The reduced acreage is due chiefly to the less stable market since the war. Turkey is the principal variety grown, although since the introduction of Kanred, a rather hardy winter wheat, considerable acreage has been devoted to this variety. The strains are kept pure by the more progressive farmers, but on many tenant farms they have been mixed.

Wheat is planted throughout the more nearly level uplands and upon the heavier textured terrace soils. It is a "hard land" crop and is seldom grown on the more sandy soils. A binder ordinarily is used in harvesting the crop. In exceptionally dry seasons, however, the straw is often too short for binding and the grain is headed. The grain is shocked or stacked in the field for threshing. Most of the crop is sold direct from the threshing machine, but a few farmers hold for an advance in price. Some of the grain is sold to the flour mill at Fullerton.

There were 20,803 acres devoted to oats in 1919, and the production was 645,753 bushels, according to the Federal census. In 1922 the Nebraska Department of Agriculture reports 23,610 acres in oats, yielding 566,640 bushels, or an average of 24 bushels per acre. Kherson is the leading variety, although some Nebraska No. 21 is grown. Little effort is made to control smut, and the disease sometimes impairs the yield in wet seasons. The crop is usually cut with a binder and either shocked or stacked for threshing. The grain is used largely as feed for horses and other stock and some is sold. The

straw is usually left in the field and stock given access to the stacks. A little of the straw is baled. Some farmers procure seed from other sections. Most of them, however, simply clean a sufficient quantity of the preceding crop for seed. Oats are grown on all but the sandier, rougher, and more poorly drained soils of the county. They do best upon those soils producing the highest yields of wheat.

Among the grain crops rye ranks next to oats in acreage. The 1920 census reports 2,152 acres in rye and a total yield of 26,007 bushels. In 1922, according to the Nebraska Department of Agriculture, the acreage had increased to 3,101 acres, yielding 49,616 bushels, or an average of 16 bushels per acre. The crop is grown chiefly upon the heavier upland and terrace soils. It is more drought resistant than wheat and will flourish on soils of a more impoverished nature. The crop is generally grown for the grain, but also to some extent for hay and pasture. In harvesting either a binder or header is used, depending upon the length of the stems. The grain is threshed from the shocks or stacks, the latter method being used when the crop is headed. Most of the rye is fed to stock on the farms. Many farmers plant a small patch of rye for pasture early in the fall.

The Federal census reports 1,258 acres in barley in 1919, and a production of 28,692 bushels. In 1922 the acreage had fallen to 961, according to the report of the Nebraska Department of Agriculture. The total production in that year was 19,229 bushels, or an average of 20 bushels per acre. The crop is grown locally upon the uplands, terraces, and first bottoms for feed. It prefers a rather moist though not wet soil, and does exceptionally well upon the better-drained parts of the flood plains. It is cut with a binder and later threshed. The straw usually remains in the field as left by the thresher and stock is allowed to feed upon the stacks.

Among the hay crops alfalfa is the most important. Alfalfa ranks next to oats in acreage. The Federal census reports 16,364 acres of alfalfa in 1919 and a production of 25,046 tons of hay. In 1922 the area in this crop is reported as 16,958 acres by the Nebraska Department of Agriculture and the production as 32,220 tons, or an average of 1.9 tons per acre. During favorable seasons yields of 2.5 to 3.5 tons per acre are common on well-managed fields. Alfalfa does well on all the soils of the county, excepting those of the sandy Valentine and O'Neill series, where the lime content is insufficient, and the more poorly drained or alkali soils of the first bottoms. It does exceptionally well on the well-drained terraces, and is well adapted to the eroded highly calcareous shallow phase of the Marshall series. The yields, however, in the eroded sections are somewhat lower than the average, owing to the unfavorable moisture conditions. Three cuttings are usually obtained during the season. The crop is generally stacked in the field and hauled to the feed lots as needed. It is used as feed for cattle and hogs. A few farmers bale a part of the hay for shipment. Hogs are often allowed to run in the fields during the summer, though cattle are seldom grazed on green alfalfa on account of the danger of bloating. The crop is an excellent one for preventing erosion and for building up depleted soils. It is often used in rotations. It is not in favor for short

rotations, however, as most farmers prefer to keep the stand for several seasons before changing to other crops.

Wild hay was cut from 9,516 acres in 1919, yielding 9,902 tons. In 1922 the acreage had decreased to 8,044, although the yield was 9,653 tons or an average of 1.2 tons per acre. Hay is cut chiefly upon the poorly drained bottom-land soils of the county. The yields are higher than those obtained on the upland soils, although the dry-land hay is of better quality. It grows less rank, is finer in texture, and has a higher feeding value. Hay is stacked in the field and either baled for market or hauled to the feed lots as needed. It is used as feed for work stock and cattle.

Among the minor crops, potatoes, timothy, clover, sorghum, Sudan grass, and millet are the most important. These crops are grown chiefly for feed and home consumption. Watermelons and cantaloupes are grown by a few farmers on the sandy terrace soils. They are sold mostly in the surrounding towns.

Most farms have a small fruit orchard. The trees, however, are usually in poor condition, as little attention is given to pruning and spraying. The demand for fruit is not supplied, and it would seem that fruit production, especially on the heavier terrace soils, could be profitably extended. Trees usually do not do so well upon the uplands on account of the lack of moisture; on the terraces the position of the water table improves the moisture conditions. Apples, cherries, plums, peaches, and pears are among the tree fruits that have been grown in the county. Of the wild fruits, plums and grapes are more or less plentiful along the larger streams throughout the county.

Livestock and livestock products are important sources of income in Nance County. Cattle raising is the leading branch of the industry. According to the 1920 census, there were 25,014 cattle in the county, of which 19,690 were beef animals. The latter are valued at $1,133,142. Most of the beef herds are of grade stock headed by a purebred bull, although there are a few purebred herds in the county. The quality of the beef cattle in general is very good. The principal breeds are Hereford and Shorthorn. The range cattle are mostly native stock. There are 61,789 acres of pasture land in the county, which affords excellent grazing during the summer season. The range cattle are either sold to local buyers for winter fattening or shipped to the Omaha market as feeders. Many farmers ship in cattle for winter feeding.

There are six purebred Holstein dairy herds in the county and nearly every farmer milks a few cows chiefly of beef breeds. The surplus dairy products are sold in the several towns. Most of the cream is purchased by the local creamery at Fullerton. The census reports 5,324 dairy cattle valued at $304,607 in the county in 1919.

Hog raising is an important branch of the livestock industry. Hogs are raised on nearly all farms, although the industry is practiced most extensively upon the terrace lands where there is an abundance of alfalfa for summer range. The Federal census reports 41,051 hogs valued at $944,412 in the county in 1919. Duroc-Jersey, Hampshire, spotted Poland-China, and Chester White are the principal breeds. Many farmers have purebred herds, but most of the herds consist of select grade stock. Some animals are annually sold

out of the county for breeding purposes. It is common practice to fatten hogs on corn either in feeding yards or by turning them into the cornfields in the fall. Alfalfa usually is added to the ration and during the summer months the pigs are often allowed to run in the alfalfa fields until the third crop is ready to cut. In the past many herds have been greatly reduced or wiped out by hog cholera. Much attention is now given to vaccination and sanitation in combating the disease and it is much less destructive than formerly.

Horse raising is confined chiefly to the breeding of work mares. Most farmers raise two or three colts each year for sale. The horses are of heavy-draft types, ranging in weight from 1,300 to 1,500 pounds. The stallions are purebred, but the majority of the mares are grades. The Percheron is the most popular breed. Some mules are raised. According to the census there were 8,588 horses, valued at $736,415, and 972 mules, valued at $124,979, in the county in 1919.

Sheep raising receives little attention. Increased interest is being displayed in small breeding flocks. Some farmers import a carload or two each fall, fatten the animals on corn and alfalfa, and ship them to Omaha when the market is favorable.

Poultry constitutes an important source of farm income. A small flock of chickens is raised on nearly every farm. There is a good local demand for poultry products. Plymouth Rocks, White Leghorn, and Rhode Island Red are the principal breeds. Ducks, geese, turkeys, and guinea fowls are raised to a small extent. The census reports 104,562 chickens and 3,509 other poultry in the county in 1919. The total value of all poultry for that year is reported to be $95,231.

The adaptation of certain soils to particular crops is observed to some extent by the farmers. It is recognized that alfalfa is not suited to the sandy Valentine and O'Neill soils on account of their low lime content and unstable nature. The crop does best on the heavier textured terrace or bench lands and is well suited to the highly calcareous soils in the eroded parts of the Marshall series, preventing erosion and increasing the content of organic matter which is naturally low. It is recognized that corn is better suited to the sandy soils of the Valentine, O'Neill, and Sioux series than small grain, on account of its deeper rooting system, but that all other crops usually do best on the heavier and deeper soils. Small grain is poorly adapted to sandy land, on account of the tendency of the soil to drift, thus exposing the shallow root system. No farming is done on the eroded slopes in the rougher sections of the county where the land is suitable only for grazing. The wet bottom lands are recognized to be best suited for use as pasture and the production of hay.

Systematic crop rotation is not practiced, although many farmers have evolved systems which they use upon their lands. A rotation which appears to have merit consists of 2 years of corn, 1 year of oats, rye, or barley, 1 or 2 years of wheat, and 4 to 6 years of alfalfa. Another system which includes no legume consists of corn 3 years, wheat 2 years, oats 1 year, and back to corn. Some of the less progressive farmers grow corn on the same land several consecutive years. When alfalfa sod is broken the land usually is planted to corn for 2 years, oats 1 year, wheat 1 year, and back to corn. Corn is probably better adapted to recently broken alfalfa land than

small grain, on account of its deeper rooting system, but even this crop is subject to drought during dry seasons as the alfalfa plant requires considerable moisture and leaves the ground in a comparatively dry condition.

The importance of proper cultural methods and soil fertilization is not appreciated. Wheat stubble is frequently disked regardless of a rank growth of weeds, and land is usually plowed late in summer, just before seeding, so that there is little time for proper aeration and mellowing of the soil. The more progressive farmers take advantage of heavy rains to plow deep and mulch with a harrow to retain moisture, after which wheat is planted in the fall or corn is listed in the spring. Small grain usually is planted with a press drill. Some wheat is drilled between the corn rows in the fall, but where small grain follows corn the land is more often plowed, disked, and harrowed before planting. Some farmers disk corn land a number of times and then drag the fields before drilling small grain. Most of the corn is listed in, a one-row lister commonly being used. The crop is cultivated three to five times. When corn follows a crop of corn that was not cut for fodder or silage, the stalks are cut with a disk, or if heavy a stalk cutter is used before disking. Alfalfa usually does well when sown immediately after the first good rain in August, as the ground is then sufficiently moist to insure germination. Some farmers seed alfalfa with oats as a nurse crop, which plan has given good results.

Oats, rye, and barley are sown in the same manner as wheat, except they are usually seeded in early spring, as soon as possible after the frost is out of the ground. Some rye is planted in the late fall.

As a whole, the farm improvements are good and the buildings well kept. In general, the tenant houses are smaller and less substantial than those occupied by landowners, although they are fairly comfortable. The farms are all fenced and cross fenced, mostly with barbed wire, though considerable woven wire is used around the feed lots. Modern implements are used in all farm operations. The Nebraska Department of Agriculture reports modern heating systems on 63 farms, modern lighting systems on 88, and modern water systems on 76, in 1922. According to the same report there are 375 gas engines, 81 tractors, 39 trucks, and 883 automobiles on the farms. The tractors are used on the more level lands.

No commercial fertilizer is used. Barnyard manure is applied to the land when available, but the supply is usually insufficient to increase noticeably the yields. The land in the immediate vicinity of the barnyards usually receives the most manure, especially on the rented farms.

Farm laborers are not easily obtained, especially during the harvest season. Wages range from $25 to $50 a month, with board and room. Day laborers receive $1.75 to $2.50 a day. Harvest hands were paid as high as $4 a day during the last season (1922). Corn shuckers receive from 4 to 5 cents a bushel. Wheat is threshed for 6 cents and oats 8 cents a bushel. Most of the laborers are native. A few farmers hire help by the year in order to insure against lack of labor at critical periods.

According to the Federal census, the number of farms in the county was 185 in 1879, 1,092 in 1889, 1,142 in 1899, 1,067 in 1909,

and 1,102 in 1919. The percentage of the county in farms increased from 18.6 in 1879 to 90.1 in 1919. The average size of the farms in 1919 is reported as 233.3 acres. The proportion of improved land in farms was 85.3 per cent in 1879. In 1899 it was 72.5 per cent, and in 1919, 76.2 per cent. The farms vary greatly in size, but most of them contain between 160 and 320 acres. According to the Nebraska Department of Agriculture 161,438 acres of farm land was under cultivation in 1922.

The average value of all farm property per farm, including land, buildings, machinery, and domestic animals, was $2,213 in 1879, $4,821 in 1889, $7,433 in 1899, $17,773 in 1909, and $41,652 in 1919.

In the last 40 years the proportion of the farms operated by owners has greatly decreased. In 1879, 95.7 per cent of the total number and in 1919 only 49.2 per cent of the farms were operated by the owners. The owners occupied 542 farms, tenants were on 546 farms, and 14 farms were operated by managers during 1919.

The share system of leasing farm lands predominates in Nance County. Under this system the tenant furnishes all equipment, labor, and seed, and receives three-fifths of the crops. He delivers the owner's share to the nearest elevator. On many farms the renter is allowed free use of a small pasture for his stock.

Land values range from about $40 to $200 an acre. The farms throughout the eroded loess plains sell for $50 to $150 an acre. The heavier terrace soils command $150 to $200 and those of a sandy nature, $80 to $125. The sandy soils of the Valentine series sell for $50 to $100 an acre. The price of all land varies according to the distance from market, the topography, soil, drainage, and improvements.

SOILS

Nance County lies in the plains region of the United States, where the topography and climatic conditions have favored a heavy grass vegetation over the greater part of the area. The native forest, which occurs only in belts along the larger streams, is not sufficiently dense to have any appreciable influence upon the character of the soils. The influence of the grass vegetation, however, is decidedly apparent in the characteristic dark color of all the soils except the more recent sand deposits.

The mantle rock from which the mineral portion of most of the soils is derived is known in the Nebraska surveys as the plains loess. It was laid down over the entire region during glacial times forming a broad, smooth plain, the deposit varying in thickness from a mere veneer to over 100 feet. The surface of this plain in Nance County has been considerably modified by stream or wind erosion and deposition, producing a varied relief. In a few places the loessial deposit has been entirely removed, exposing the underlying bedrock. In its unweathered condition the material consists very largely of silt, with a small percentage of very fine sand and some clay. It has a loose fine texture and floury character, varies in color from pale yellow to yellow or light gray, and contains a rather high percentage of lime carbonate. Parts of the eroded loess mantle in the Platte Valley have been greatly modified and in places entirely covered by stream and wind transported sand from the vast sandhill region to the west.

The surface layer of this loess deposit, consisting of finely divided mineral matter, has, through continued weathering, become intimately mixed with the organic matter resulting from the growth and decay of grass vegetation, changing it from its raw state into its present stage of development as productive soil. Variations in the character of the mantle rock, together with the degree and manner of its weathering, have caused variations in the soils and given them certain broad characteristics.

The soils which have weathered from loessial deposits, either directly over the underlying parent formation or from loessial material which has been transported and reassorted by streams, are of fine texture throughout and have been classed with the hard-land group. They include the Marshall, Waukesha, Lamoure, and Wabash soils.

The most mature soils of the county are most of those of the Marshall series and all those of the Waukesha series. The former occupy the greater part of the level to rolling uplands and the latter occur upon the well-drained terraces. The soils have been developed under conditions especially favorable for deep soil weathering and the accumulation of large quantities of organic matter. The surface layer is dark brown to almost black and 8 to 12 inches deep. The upper subsoil is a friable smooth silt loam of brown color and slightly more compact structure than the surface soil. The brownish shade of this horizon is due in part to the downward leaching of organic matter and in part to the oxidation of its mineral constituents. The lower subsoil is a light-brown friable silt to silty clay which grades at about 30 inches into the light-gray silt of the parent loess. Prolonged weathering has leached the carbonates from the surface soil and upper subsoil, although they occur abundantly below 30 or 36 inches.

Associated with the typical Marshall soils throughout the uplands are extensive areas in which the weathering of the parent loess has been greatly retarded by erosion. The dark-colored surface layer has been removed almost as fast as formed, so that the upper layer is much thinner and lighter colored than that of the Marshall and Waukesha soils. In many places this surface layer lies directly upon the light-gray material of the parent loess and locally has been entirely removed, exposing the highly calcareous loess. The soil having these characteristics has been included as the shallow phase of the Marshall silt loam and represents the least mature stage of development in the loessial upland soils.

The Lamoure and Wabash soils represent loessial material which has developed under conditions of restricted drainage. They occur chiefly within the flood plains of Prairie Creek in the southeastern part of the county. The surface soils are black and 12 to 15 inches deep and contain large quantities of organic matter derived from the growth and decay of rank vegetation. The subsoils are usually heavier than the surface layers and of a slightly more compact nature.

The soils which have weathered from sandy material are classed with the sandy or soft-land group. They are of coarser texture than the hard-land soils. They include the Valentine, Plainfield, O'Neill, Sioux, Cass, and Sarpy series. The sand of which these soils are so

largely composed consists of the fine to medium grades. It has been transported chiefly from the sand-hill region by the streams and deposited upon the valley floors throughout the Platte Plain. Wind action has also played an important part in the final assortment and distribution of the sand particles.

The Valentine and Plainfield soils have been developed under conditions unfavorable to the accumulation of large quantities of organic matter. The profile is immature, the surface soil consisting of sand slightly darkened by accumulated organic matter. The subsurface layer and often the soil itself may have a slightly loamy character, probably due to the presence of a small percentage of colloidal clay. This clay may have been produced partly by the weathering of the sand grains, particularly those of feldspathic composition, and partly through addition of wind-blown materials from the loessial soils.

The soils of the O'Neill and Sioux series have been subject to undisturbed weathering since the time of their deposition. They occupy flat, well-drained terrace positions where conditions have been favorable for the growth and decay of plant life. The surface layer is dark brown to black and 6 to 8 inches deep. The upper subsoil has a uniform brown color and friable structure. The lower subsoil contains little organic matter and consists largely of the unweathered sandy deposits from which the soils have been derived.

The sandy or "soft-land" soils which occupy the flood plains and depressions of the county have been developed under conditions of restricted drainage and present a variety of characteristics. The Cass and Sarpy members have free underdrainage through the underlying gravelly subsoil, but on account of their low position the water table lies quite near the surface. The Cass surface soils have accumulated large quantities of black organic matter, but the Sarpy soils are not so well supplied and have a lighter color.

The foregoing differentiation into broad groups has been based on the effects of the more important soil forming agencies and processes. In the following pages the soil groups are further differentiated into series on the basis of minor details in the soil profile including color, structure, drainage, and chemical composition of the soil horizons, and on the basis of the source and character of the parent material.

The Marshall series includes types having dark-brown soils and a brown or yellowish-brown subsoil slightly heavier than the surface layer. The lower subsoil is usually highly calcareous, except upon the flatter areas where the carbonates have been leached below the 3-foot depth. The topography is flat to rolling and drainage is usually good. The series in this county occupies the greater part of the uplands on the north side of the Loup River. Three types, the Marshall silt loam, very fine sandy loam, and fine sandy loam, together with a flat phase and shallow phase of the silt loam type, are recognized in this area.

The Valentine series consists of types having brown to dark-brown soils underlain by a lighter brown loose sandy subsoil grading at about 24 inches into a gray incoherent sand. The Valentine soils occupy valley slopes, stream valleys, and basins in the semiarid region. They have been formed by the partial weathering of wind-laid or colluvial sands originally derived from sandy deposits of

Tertiary age. Both soils and subsoil are deficient in lime. Drainage is everywhere good and in the more sandy types may be excessive, owing to the loose, porous nature of the subsoil. The topography varies from nearly level to dunelike, depending upon the extent of wind action. In Nance County the surface is rolling to hummocky and the soils differ from those of the Plainfield series chiefly in their greater relief. The Valentine sand and loamy sand are recognized.

The types of the Waukesha series are characterized by dark-brown to black surface soils underlain by a brown to yellow subsoil. The subsoil is heavier in texture than the soils, but is not compact and impervious. The material is only moderately calcareous, as the carbonates normally have been leached below the 3-foot depth. The soils are derived from transported and reworked loessial material, carried down by streams from the uplands and deposited upon the valley terraces. The topography is flat to very gently undulating. Drainage is good though not excessive. The soils of this series differ from those of the Marshall types chiefly in the mode of their formation, more generally level topography, and lower position. In Nance County three types, the Waukesha silt loam, very fine sandy loam, and fine sandy loam, are mapped.

The soils of the O'Neill series consist essentially of dark-gray to dark-brown or nearly black surface layers underlain by a light-brown sandy subsoil resting upon a substratum of gray sand and gravel. The areas occupy terrace positions and the topography varies from nearly level to gently undulating. The surface of the more sandy types is often modified by wind-blown material. Drainage is good and in many places excessive, owing to the loose porous nature of the subsoil. The soils are derived by weathering from sandy alluvial deposits. Neither the soil nor subsoil contains sufficient lime to effervesce with dilute hydrochloric acid. In Nance County two types, the O'Neill loamy sand and fine sandy loam, are recognized.

The types in the Sioux series are characterized by dark-brown to black surface soils underlain by a lighter colored sandy subsoil. The lower strata often contain coarse sand and gravel, which sometimes have a marked effect upon the drainage and cause crops to suffer in times of drought. The topography is flat to gently undulating. The soils of this series have been derived through the weathering of sandy alluvial deposits and occupy flat to gently undulating terrace positions. The subsoil and often the soil itself is highly calcareous. The soils of this series differ from those of the Waukesha series in the more sandy and porous nature of their subsoil and from the O'Neill series in their higher lime content. One type, the Sioux fine sandy loam, is mapped in this area.

The Plainfield series includes types with light-brown to brown surface soils and a light-brown to yellow or gray sandy subsoil. They are formed by the partial weathering of stream-deposited sands and occupy flat to gently undulating terrace positions. Drainage is thorough and in most places excessive, owing to the porous nature of the subsoil. Neither the soil nor subsoil is noticeably calcareous. The types of this series differ from those of the O'Neill in the lower organic content and lighter color of their surface layers

and from the Valentine soils in the manner of their accumulation and more generally level topography. The Plainfield sand is the only type of the series recognized in Nance County.

The Cass series includes types with dark-brown to black soils and a sandy subsoil lighter in texture than the soil, passing in many places within the 3-foot section into coarse sand and gravel of light-gray color. Both soil and subsoil contain enough lime carbonate to effervesce with acid. The series occupies first-bottom or flood-plain positions along the larger streams throughout the Platte Valley. The soils are derived by weathering from sandy alluvial deposits. The topography is flat and drainage is variable. Much of the land is subject to overflow during periods of high water, but the water drains off rapidly when the floods have subsided. The soils of this series differ from those of the Sioux series in their lower topographic positions and less adequate drainage, and from those of the Sarpy series in the darker color of the surface soil. Three types, the Cass very fine sandy loam, fine sandy loam, and loamy fine sand, are mapped in Nance County.

The soils of the Sarpy series have brown to light-brown surface layers, underlain by a light-colored sandy subsoil. The lower strata in many places include coarse sand and gravel. The soil material commonly contains lime carbonate throughout the 3-foot depth. The types of this series represent a less mature stage of weathering than the Cass soils and have not accumulated such large quantities of organic matter in their surface layers. They are very similar to the Plainfield series in textural characteristics, although they occupy lower positions, are more poorly drained, and usually have a higher lime content. In Nance County a single type is recognized—the Sarpy sand.

The Wabash series includes types with dark-brown to black surface soils high in organic matter, underlain by a dark-drab to gray or light-brown heavy subsoil. Both soil and subsoil have a low lime carbonate content. The types of this series occupy first-bottom or flood-plain positions along the larger streams in the loessial parts of the uplands. The soils are weathered from alluvial deposits washed from loess areas. The topography is flat and the soils are subject to overflow during high water. The types of this series have a finer textured and more compact subsoil than those of the Cass and Sarpy series. They differ from the Lamoure soils chiefly in their lower lime content. The Wabash silt loam is the only member mapped in this area.

The surface soils of the types composing the Lamoure series are dark grayish brown to black. The subsoil varies from yellowish brown to gray or dark drab and is in many places mottled gray and brown. It is usually heavier in texture than the soil though both may have about the same texture. The soils of this series are derived through the weathering of calcareous alluvium. The soils occupy poorly drained flood-plain positions and are frequently subject to overflow. Local accumulations of alkali may occur on the surface. The soils closely resemble those of the Wabash series, except for their high lime content. Two types, the Lamoure very fine sandy loam and fine sandy loam, are mapped.

Two miscellaneous soils which belong to no definite series, i. e., Rough broken land and Riverwash, occur in Nance County. The

former occupies the more eroded parts of the loessial uplands, where stream erosion has created deep narrow valleys and sharp divides, producing an extremely rough and harsh relief. The areas of Riverwash occur as sand bars, islands, and sand flats in and along streams.

The soil series described above have been separated into types upon the basis of texture, or the percentages of soil particles of different sizes in their surface layers. The 10 series include 21 types and phases of types, exclusive of Rough broken land and Riverwash.

In the following pages the soil types of Nance County are described in detail and their relation to agriculture discussed. The accompanying map shows their distribution, and the following table gives their actual and relative extent in the county:

Areas of different soils

Soil	Acres	Per cent	Soil	Acres	Per cent
Marshall silt loam	114,432		Wabash silt loam	3,712	1.3
Shallow phase	25,792	54.9	Waukesha fine sandy loam	3,648	1.3
Flat phase	14,208		Sarpy sand	3,520	1.3
O'Neill loamy sand	22,848	8.1	Sioux fine sandy loam	3,136	1.1
Waukesha silt loam	19,840	7.0	Marshall fine sandy loam	2,176	.8
Cass loamy fine sand	12,608	4.5	Plainfield sand	1,536	.5
Waukesha very fine sandy loam	10,880	3.9	Cass very fine sandy loam	1,408	.5
O'Neill fine sandy loam	10,496	3.7	Lamoure fine sandy loam	1,216	.4
Rough broken land	6,016	2.1	Marshall very fine sandy loam	1,216	.4
Valentine sand	5,888	2.1	Riverwash	128	.1
Lamoure very fine sandy loam	5,824	2.1			
Cass fine sandy loam	5,696	2.0	Total	281,600	
Valentine loamy sand	5,376	1.9			

MARSHALL FINE SANDY LOAM

The surface soil of the Marshall fine sandy loam is a dark grayish brown fine sandy loam, 8 to 10 inches deep. The subsoil is a light-brown very fine sandy loam of slightly more compact nature than the surface soil. Below an average depth of 30 inches, it becomes gradually lighter in color and more silty in texture, until it merges into the light-gray calcareous silt of the underlying loess. This silty material usually lies at 34 to 40 inches below the surface. The surface soil is loose and friable in structure. It contains a large proportion of silt and considerable organic matter. In a few places, however, these materials are insufficient to prevent the soil from drifting slightly when intensive cultivation is practiced. The organic matter content throughout the type gradually decreases with depth, and only faint traces of the material are found in the lower subsoil. The type is usually slightly calcareous within the 3-foot section, and below 40 to 44 inches lime carbonate is abundant in both the powdered form and as scattered angular concretions from one-sixteenth to one-eighth inch in diameter.

In the more level areas, where conditions have especially favored extensive weathering and the accumulation of organic matter, the surface soil is in many places 15 to 18 inches deep. In the more exposed situations, however, such as ridge crests, hilltops, and the steeper slopes, stream and wind erosion have removed the weathered surface material almost as fast as formed, and the surface soil is relatively shallow, or in a few places absent, the lighter colored sub-

soil material being at the surface. In these localities the white calcareous loess of the parent formation lies within 12 to 20 inches of the surface. The principal variation in surface texture is toward a loamy fine sand and small areas of Marshall loamy fine sand are included with this type.

The soil is of local occurrence in Nance County. Its total area does not exceed 3½ square miles. It occurs in a few isolated bodies, chiefly along the west side of Ash Creek and the east side of Cedar River in T. 17 N., R. 6 W. A small area lies west of Merchiston on the north side of the Loup River. A quite uniform and typical development may be seen in section 8, T. 17 N., R. 6 W.

The type has been derived from weathered loessial material, the surface texture of which has been greatly modified by wind-blown sands.

The topography ranges from almost flat to sharply rolling, with the greater part gently rolling. Much of the type occupies the lower parts of long gradual slopes between the areas of Marshall silt loam and the terrace lands. The sharply rolling areas are of local occurrence and seldom exceed 100 acres in extent. The type is well drained. Surface drainage is not well established in the more nearly level areas, but the surplus moisture is readily absorbed in the loose porous soil and subsoil. In the sharply rolling sections the run-off is in places excessive and erosion severe.

The Marshall fine sandy loam is not an important agricultural soil in this county on account of its small extent. It is quite retentive of moisture, and where carefully managed to prevent drifting is almost as productive as the Marshall silt loam or very fine sandy loam. About 90 per cent of it is under cultivation. The rest is used for grazing and hay land. The native vegetation consists chiefly of bluestem, sand grass, needle grass, and grama grass. Beef cattle are grazed on those areas not under cultivation. Cattle feeding is practiced on a few farms and hogs are raised in large numbers. Corn, oats, and alfalfa are the principal cultivated crops. Wheat is grown only in a small way as the soil is too sandy for best results.

Crop yields vary widely from year to year, depending upon the rainfall. The average yield of corn is about 30 bushels, oats 25 to 30 bushels, and alfalfa 2½ tons per acre from three cuttings. Native hay yields one-half to three-fourths ton per acre. The grasses on this type will support 50 to 60 head of cattle per quarter section, or 160 acres, during the summer grazing season.

The land is handled in the same manner as that of the silt loam and very fine sandy loam types. Practically all the corn is listed, as the ridges tend to retard the drifting of the soil. Land of this type can be cultivated under almost any moisture conditions without injury. Less power and lighter machinery is needed than on the heavier soils of the county.

Land of this type sells for $75 to $125 an acre, depending upon improvements, topography, and location.

MARSHALL VERY FINE SANDY LOAM

The surface soil of the Marshall very fine sandy loam is a dark grayish brown very fine sandy loam, 8 to 12 inches deep. The upper subsoil is a brown silt loam to silty clay loam slightly heavier and

more compact than the surface layer. This material continues to about 24 inches, where it gradually becomes lighter in color and more friable in texture until, at 30 to 36 inches, it merges into the yellowish-gray loose floury silt of the parent loess. The surface soil and upper subsoil are rich in organic matter, but the proportion of this constituent gradually decreases with depth and below 30 inches is in most places negligible. The lower subsoil is prevailingly calcareous, though not necessarily so. The substratum below 40 inches contains an abundance of lime, both in the finely divided form and as small irregular concretions, from one-sixteenth to one-fourth inch in diameter.

A few variations from this typical description occur. The depth of the surface soil varies considerably with its topographic position. It is deepest on the more nearly level areas and gradual slopes, where conditions have especially favored the accumulation of organic matter. In the more rolling areas, where erosion is extensive, the surface soil seldom exceeds 8 inches in depth and is underlain by a gray friable silt loam which becomes lighter in color and texture with depth, merging at about 24 inches into the highly calcareous white floury silt of the parent loess. Around the margins of the type where it borders areas of Marshall silt loam or fine sandy loam, the texture of the surface soil changes gradually, and in many places it is necessary to draw arbitrary boundary lines.

The Marshall very fine sandy loam is of small extent in Nance County. It occurs as a few isolated areas, chiefly on the east side of Cedar River. Its total area does not exceed 2 square miles. The largest body, comprising about 500 acres, lies 2 miles southeast of Belgrade, in T. 17 N., R. 6 W. A smaller though quite typical area borders Belgrade on the east side. A small body lies west of Plum Creek in the southwest corner of T. 17 N., R. 5 W. The type has been derived, through weathering, from the loess deposit that once covered the greater part of the region. Wind-blown material from the more sandy formations has produced the very fine sandy loam texture of its surface soil. The topography ranges from gently undulating to sharply rolling. The type, as a rule, occupies the upper part of the slopes leading from the Marshall silt loam areas to the lower lying terrace soils. Drainage is everywhere good. The more nearly level areas all have sufficient slope to carry off the surplus moisture. In the sharply rolling sections drainage is sometimes excessive, and erosion has become a serious factor.

On account of its small extent, the type is not an important agricultural soil in Nance County. It is naturally strong and fertile, retentive of moisture, and well adapted to general farming. About 85 per cent of it is used for crop production and the rest, including the rougher areas, is included in pasture and hay land. The native vegetation consists chiefly of bluestem, grama grass, and buffalo grass. Corn, wheat, oats, and alfalfa are the most important cultivated crops. Yields are about the same as on the Marshall silt loam. A few farmers feed cattle during the winter, although the industry is not practiced so extensively as on the Marshall silt loam. The grazing of beef cattle is an important industry in the rougher sections. Hogs are raised for market on nearly every farm. All the livestock is of good breeding.

The selling price of the Marshall very fine sandy loam ranges from $75 to $125 an acre, depending upon topography, improvements, and location with respect to markets.

The methods of maintaining and increasing the soil fertility and preventing erosion recommended for the Marshall silt loam will apply admirably on this type.

MARSHALL SILT LOAM

The surface soil of the Marshall silt loam is a dark-brown to dark grayish brown moderately heavy silt loam. The depth depends largely on the topographic position. On the smoother divides and slopes it is 8 to 10 inches deep, usually becoming slightly deeper toward the base of the slope. On sharp divides and the shoulders of hills it seldom exceeds 7 inches. The soil is high in organic matter, has a smooth and velvety feel, and breaks down into a fine powder. The upper subsoil is a brownish-gray slightly heavier silt loam which continues to an average depth of 24 inches. The lower subsoil is an ashy-gray slightly compact silt to silty clay loam which becomes gradually lighter in color and looser in structure until it merges at about 30 inches into the yellowish-gray or almost white loose floury silt of the parent loess. The lower subsoil is highly calcareous. The lime exists chiefly in finely divided form, although small angular concretions are often encountered below 30 inches. The soil and upper subsoil contain insufficient lime to effervesce with dilute hydrochloric acid, although there is no evidence of a deficiency. The transition between the soil and subsoil is very gradual both in color and texture. The structure of the upper subsoil is granular while that of the lower portion is columnar.

A few variations occur. Locally upon the shoulders of hills and along gullies where erosion has been severe, the dark-colored surface layer has been greatly thinned or entirely removed, often exposing the light-colored calcareous subsoil. Where these areas were of sufficient size to warrant mapping they were included with the Marshall silt loam, shallow phase. The progress of erosion tends to increase the extent of the latter phase at the expense of the typical Marshall silt loam. In a few places the surface soil of the Marshall silt loam contains such a large percentage of very fine sand as to approach a very fine sandy loam in texture and it is possible that small patches of Marshall very fine sandy loam are included. Narrow strips of colluvial and alluvial material along the intermittent streams also are mapped as the silt loam. In these situations the dark-colored surface material often extends below 24 inches, and is underlain by a brown slightly compact silt loam which continues to depths greater than 3 feet. The material is not noticeably calcareous within the 3-foot section. The above variations are of such small extent and so unimportant as not to warrant mapping.

The Marshall silt loam is the most extensive soil type in Nance County. It is the dominant soil in the uplands, and with the exception of the Marshall silt loam, flat phase, occupies the highest stratigraphic positions. The soil is of residual origin and has been formed through the weathering of the loess deposit which originally covered the entire county.

The topography varies from hilly or steeply rolling to undulating. Along many of the drainage ways, deep, narrow V-shaped valleys, with steep and in places precipitous slopes, have devoloped. The divides are for the most part rounded. The greatest relief occurs west of Fullerton, along the bluff line bordering the Loup and Cedar River bottoms, and in the vicinity of Belgrade on the east side of Cedar River. In these localities the slopes are steep to precipitous and the divides narrow and crestlike. In general the rolling to undulating topography occupies that part of the uplands lying east of Cedar River, while the more hilly country occurs west of this stream.

Surface drainage on the Marshall silt loam is everywhere adequate and in most places excessive. Erosion has become a serious factor on many farms in this type. The soil retains moisture well, owing to its high organic matter content, friable structure, and silty texture. It withstands drought over protracted periods. Little moisture is lost through subterranean drainage.

The type is the most important farming soil of Nance County. It was originally covered with a thick growth of prairie grasses, with narrow belts of forest along the larger streams. The native grasses consisted largely of big and little bluestem, grama grass, and buffalo grass, while the forest, which was fairly dense, consisted chiefly of elm, ash, boxelder, and cottonwood.

During recent years most of the prairie sod has been broken and much of the forest cut for firewood and post material. At present about 85 per cent of the type is used for crop production and the rest, including the rougher areas, is used for grazing and hay land.

Of the cultivated crops, corn occupies by far the greatest area, followed by wheat, oats, and alfalfa, ranking in acreage in the order named. Small fields of rye, barley, millet, and sorghum are grown for feed on many farms. All garden vegetables and fruits common to the region do well on this soil and are grown for home consumption. The type is recognized as one of the best upland corn soils of the Mississippi Basin, and in this county the area of the type devoted to corn is but slightly less than that of all other cultivated crops combined. Most of the corn, oats, and alfalfa is stored and fed to livestock on the farms where produced. Wheat, however, is the chief cash crop, and most of the grain is sold soon after harvest.

On the rougher parts of the soil the grazing of beef cattle is practiced extensively. The animals are sold either to local feeders or shipped to the Omaha market when 2 or 3 years old. Most of the stock is native and chiefly Hereford or Shorthorn grades. A few farmers ship in grade stock for summer grazing. The fattening of beef cattle for market is an important industry throughout this type, and many farmers ship in stock for winter feeding, the animals being fattened on corn and alfalfa and returned to the Omaha market.

Hog raising is an important branch of the livestock industry. A few hogs are raised on nearly every farm and many farmers have large herds. All the animals are of good stock, and purebred herds are quite numerous. Duroc-Jersey and Hampshire are the principal breeds. Hogs are fattened on corn and alfalfa. On those farms where cattle feeding is practiced hogs are allowed to follow cattle in the feed lots.

Crop yields vary widely from year to year, depending upon the rainfall. Good yields are obtained in normal years, and during dry years the yields will probably be higher than the average for eastern Nebraska, on account of the high water-holding power of the soil. The average yield of corn is about 35 bushels per acre, although 50 to 65 bushels are common during favorable seasons. Wheat yields 18 bushels per acre, and the average yield of oats, which is grown for feed on nearly every farm, is about the same as of corn. Alfalfa yields 3 to 3½ tons per acre from three cuttings, and in long seasons a fourth cutting is sometimes obtained. This crop is well adapted to the land, as it increases the organic matter and nitrogen content of the soil and prevents destructive erosion. The rotation of crops is not practiced systematically, but most farmers change their crops with reasonable regularity and grow considerable alfalfa. The fields are usually planted to corn two seasons, followed by a year of oats, one of wheat, and either back to corn or to alfalfa. A few of the less progressive farmers grow the same grain crop continuously for several years.

Farm improvements throughout this type are generally good. The houses and barns are well built, painted, and usually kept in good repair. The most modern farm machinery is used. Horses are used for most of the farm work, the 4-horse hitch prevailing. On the more level areas tractors are sometimes used for plowing, but the uneven topography over the greater part of the type prevents their extensive use.

No commercial fertilizer is used on the Marshall silt loam, but barnyard manure, when available, is applied to the more eroded areas where the surface soil is rather shallow.

The soil of this type sells for $85 to $150 an acre, depending upon topography, improvements, and location with respect to markets.

The type is naturally very fertile and should be carefully managed to maintain its high producing power. The growing of a leguminous crop such as alfalfa or clover at least once in every four years would be very beneficial. Where livestock is not kept in considerable numbers, sweet clover should be plowed under as green manure.

The yields of winter wheat are materially increased by early and deep plowing. Most farmers realize the superiority of thorough seed bed preparation for corn over the method of listing the crop.

The control of erosion is an important problem on the more steeply rolling areas of the type. With the gradual depletion of organic matter and the continued washing away of the surface material, the soil is left in a much less productive condition and the land is gullied and rendered uncultivable. The tendency to wash may be opposed by deep cultivation to facilitate the absorption of water and by having the rows, especially of listed corn, follow contour lines on the steeper slopes. Alfalfa is also very beneficial where erosion is becoming severe.

Marshall silt loam, flat phase.—The surface soil of the Marshall silt loam, flat phase, is a very dark grayish brown heavy silt loam, 8 to 12 inches deep. It contains a relatively small proportion of clay and practically no material coarser than very fine sand. The soil is high in organic matter and when wet appears black. The

upper subsoil is a brown to grayish-brown, slightly compact silty clay which continues to 18 or 20 inches, where it is underlain by a more compact silty clay of light yellowish brown or buff color which continues downward to an average depth of 30 inches. Below 34 to 36 inches this material merges gradually into the loose floury silt or silty clay of the parent loess. Where exposed in banks and road cuts the upper 30 inches normally is granular; below that a vertical flakelike structure exists. The transition between the several soil layers is commonly marked by a gradual change both in color and structure. The subsoil is not noticeably calcareous within the 3-foot section, but below an average depth of 4 feet it in most places effervesces with dilute hydrochloric acid.

The phase merges gradually into the typical Marshall silt loam, in such a way that it is difficult to establish the position of the boundary lines. The phase differs from the typical soil in the slightly more compact nature and lower lime content of its subsoil and in its more even topography. It is also less subject to erosion than the typical Marshall silt loam.

The Marshall silt loam, flat phase, is of moderate extent in Nance County. It occurs as numerous elongated bodies of irregular outline upon the higher and more level divides throughout the areas of Marshall silt loam. The areas vary in length from one-half to about 8 miles and have an average width of one-half mile. One of the largest developments occupies the flat crest of the high divide between the Cedar River and Plum Creek. Another large body lies between Plum Creek and Skedee Creek. Small isolated areas occupy the higher divides throughout the uplands. The phase has been derived in the same manner as the soil of the typical Marshall silt loam. The topography, however, has been especially favorable for deep soil weathering and the accumulation of organic matter. The surface is prevailingly flat and much of the rainfall percolates down through the soil and subsoil, a condition which has been largely responsible for the removal of the lime to below the 3-foot depth. The phase occupies the highest positions in the county and there is usually sufficient slope to prevent surface moisture accumulation even on the flatter areas, but in a few shallow depressions, seldom exceeding 2 acres in size, water stands for a considerable period after heavy rains.

The total area of the phase in Nance County is not large and for this reason it is not so important agriculturally as many of the other types. It is probably better adapted to general farming, however, than any of the upland soils on account of its high fertility and level topography. Practically all of it is under cultivation. The principal crops are corn, wheat, oats, and alfalfa, ranking in acreage in the order named. Cattle raising is not practiced extensively, on account of the small areas of pasture land on the farms, but the fattening of beef cattle is practiced by many farmers. Most of the cattle are raised on the surrounding soils though a few are shipped in. The cattle are fed corn and alfalfa for three or four months and shipped to the Omaha market. Every farmer keeps a few cows to supply his needs for milk and butter. Hogs are raised on every farm. They are fattened on corn and alfalfa.

The average yield of corn is about 35 bushels per acre, oats 30 to 35 bushels, wheat 20 bushels, and alfalfa 3 to 3½ tons from three cuttings.

The soil of this phase considering its heavy silty texture can be handled under a rather wide range of moisture conditions. When plowed wet the land has a tendency to clod, but the clods are easily reduced. Corn is usually planted in checkrows though many farmers prefer listing. Wheat is usually drilled on old corn or stubble ground after thorough plowing and harrowing. Oats are planted with a press drill as early in the spring as the condition of the soil will permit. Alfalfa is sown broadcast on well-prepared stubble land. The crop ordinarily occupies the land for six or seven years.

The selling price of the Marshall silt loam, flat phase, ranges from $125 to $200 an acre, depending upon improvements and location.

Marshall silt loam, shallow phase.—The surface soil of the Marshall silt loam, shallow phase, is a grayish-brown to dark grayish brown heavy silt loam, 6 to 8 inches deep. The upper subsoil is a light-gray, slightly more compact silt loam that continues to about 20 inches, and this is underlain by a light-gray to white loose floury silt or silty clay that extends to depths greater than 3 feet. The subsoil and often the soil itself is highly calcareous, the lime existing both in finely divided form and as numerous small concretions from one-sixteenth to one-fourth inch in diameter. Reddish-yellow iron stains are often encountered below 30 inches. In the surface 4 to 6 inches the content of organic matter is high, but there is a gradual decrease in the proportion of this constituent with depth and below 24 inches it is almost entirely absent. The soil has a pronounced open and columnar structure.

Although the soil profile previously described is characteristic of the greater part of the phase, there are a few variations that should be noted. These are governed largely by the extent to which erosion has advanced. In many places upon the round shoulders of hills, crests of ridges, and steep slopes, the dark-colored surface soil has been greatly thinned and often entirely removed exposing in many places the white, floury silt of the parent loess. These individual light-colored spots are usually of small extent, but cover a large total area. On the broader divides and more moderate slopes where conditions have been more favorable for the accumulation of organic matter the soil is often deeper and darker then normal, resembling that of the true Marshall silt loam. In general the phase differs from the typical soil chiefly in the lower organic-matter content, and consequently in the lighter color of its surface soil, and also in its more uneven topography. It is simply a phase that has resulted from erosion, and thus where favorable conditions exist for the accumulation of soil and organic matter the phase approaches the typical Marshall silt loam in physical characteristics.

The Marshall silt loam, shallow phase, is rather extensive in Nance County. It occurs throughout the uplands wherever erosion has thinned or entirely removed the dark-colored surface soil of the Marshall silt loam. The largest and most uniform development is in the western part of the county south of Timber Creek and throughout the drainage area of Cottonwood Creek. In this region

the phase is the dominant soil between Timber Creek and the Loup River. It is fairly uniform throughout this area, although it includes numerous bodies of Marshall silt loam, Marshall silt loam, flat phase, and narrow strips of Wabash and Waukesha soils.

The topography is sharply rolling to hilly, with local areas having a gently rolling to rolling relief. Drainage is excessive. The phase is thoroughly dissected by small intermittent drainage ways and erosion is a serious factor. The areas of this phase are gradually increasing at the expense of the typical Marshall silt loam.

The agricultural importance of this phase in Nance County is greatly impaired by its unfavorable topography and low organic-matter content. It is very productive, however, and about 50 per cent of it, including the smoother areas, is under cultivation. The virgin areas, which are used for pasture land, support a good growth of bluestem, grama grass, and buffalo grass, except where erosion has been especially severe and vegetation unable to thrive for this reason.

Of the cultivated crops, corn, wheat, oats, and alfalfa are the most important, followed by rye and barley. Small patches of kafir and millet are occasionally grown. Orchard fruits do well in favorable seasons. The yields of crops are controlled largely by moisture conditions, the state of improvement of the soil, and the care used in cultivation. The general crop yields are a little lower than those obtained on the typical Marshall silt loam. Corn yields 18 to 40 bushels per acre averaging about 25 bushels; wheat yields 15 to 30 bushels, with an average of about 18 bushels; and oats about 25 bushels per acre. Alfalfa yields 2½ to 3 tons per acre from three cuttings. This soil is exceptionally well adapted to alfalfa, on account of its high lime content. The average yield of rye is about 20 bushels, and of barley about 25 bushels per acre. Cattle are grazed on the rougher areas.

The selling price ranges from $25 to $100 an acre, depending upon improvements, topography, and distance from markets.

It is advisable to use every possible means to conserve and increase the supply of organic matter in this phase and to prevent erosion as far as practicable. In its virgin state the land is naturally productive, but its topography is unfavorable for an accumulation of organic matter when used for crop production. Alfalfa is a very valuable crop for the land of this phase and should be used in the rotation as often as possible. It prevents washing and at the same time adds nitrogen and organic matter. Sweet clover is also a good crop for this land. The straw in old stacks should be spread upon the land instead of being left to decay or burned. The construction of brush or stone dams where small gullies have been formed would materially aid in preventing the land from becoming uncultivable.

VALENTINE SAND

The Valentine sand consists of a light-brown or yellowish-brown loose sand which changes little in texture or color to a depth of 3 feet. The surface 8 inches contains a small quantity of organic matter, which gives it a slightly darker brown color, but this material is never sufficient to prevent the soil from drifting when the protective vegetation is removed. The type contains a relatively large

percentage of fine and very fine sand and barely sufficient silt and clay to render the mass slightly coherent when wet. The material is not noticeably calcareous within the 3-foot depth.

The type is not extensive in Nance County. It occurs chiefly along the southern county line in a belt about 6½ miles long and three-fourths mile wide and represents the northern edge of a large body lying mostly in Merrick County. Smaller developments occur upon the terraces between the Loup River and Prairie Creek.

The exact origin of the Valentine sand has not been definitely established, but it probably represents wind-blown material originating in the disintegrated Tertiary rocks of western Nebraska. It has been so shifted by wind and water, redeposited, and subsequently weathered that it is difficult to make any positive statement in regard to its origin. Most of the material in this county appears to have been blown from the sandy deposits in the channel of the Loup River.

The topography varies from flat to hummocky and is in places dunelike. The greater part has a gently rolling relief. Drainage is entirely subterranean through the loose porous sand, which affords an ample outlet for all surplus water.

Land of this type is used mainly for pasture, probably not over 15 per cent of it being under cultivation. It supports an excellent growth of sand grasses, stipa or needle grass, and bluestem. From 40 to 50 cattle can be pastured on a quarter section during the summer grazing season. The pastured animals are either shipped to Omaha as feeders or fed on near-by farms during the winter. When cut for hay the native grasses yield one-half to three-fourths ton per acre, depending upon the rainfall. Some of the more favorably situated land is farmed, especially in the lower depressions where crops can get moisture through seepage. Corn is the most important crop. Small grain does not seem to do well on account of the loose porous nature of the seed bed. Alfalfa yields well under the most favorable conditions, but it is extremely difficult to obtain a good stand and the stand seldom lasts longer than three or four years, on account of the low lime content of the soil.

The type appears to withstand drought as well as the Valentine loamy sand, but it is less stable and blows badly when not protected by vegetation. Coarse manure and straw spread over the land have proved beneficial in preventing excessive drifting. Corn is usually deeply listed.

Land of the Valentine sand sells for $30 to $70 an acre, depending upon improvements and topography. The higher price applies to land best suited for crop production.

It is doubtful if the native sod should be broken on this soil, as the soil drifts when the land is under cultivation and if farmed the land should be carefully managed to keep a protective covering on the surface as much of the time as possible.

VALENTINE LOAMY SAND

The surface soil of the Valentine loamy sand is a brown sand containing sufficient organic matter to give it a loamy texture. It differs from the Valentine sand only in the larger humus content of its surface soil and the resulting darker color. In places where con-

ditions have especially favored the growth and decay of plant life, the surface soil, to a depth of 8 inches, is a dark-brown to almost black loamy sand. The subsoil beginning at an average depth of 10 inches is a light-brown to yellowish-brown, loose, incoherent sand. The type is composed of about equal proportions of the fine, very fine, and medium grades of sand, with barely sufficient silt and clay to give it a slightly sticky nature when wet. Neither the soil nor subsoil is noticeably calcareous.

The type is not extensive in Nance County. It is closely associated with the Valentine sand and occurs chiefly upon the terraces between Prairie Creek and the Loup River. The largest body occupies an area of about 5 square miles. It is an irregular, elongated strip, extending roughly parallel to the Loup River for a distance of about 5 miles along its course in the southeastern part of the county. Another irregular body, comprising about 2½ square miles, lies 2 miles southeast of Merchiston. The remaining bodies are few and small, seldom exceeding 80 acres in size.

The original source of the sand that makes up the parent material of the Valentine loamy sand is difficult to determine. The type is derived from the same parent material as the Valentine sand and has probably been acted upon by the same agencies but for a longer time.

The topography is flat to gently undulating. The surface has fewer irregularities than occur upon the Valentine sand. Drainage is entirely subterranean as the loose porous sand affords ample outlet for all surplus water.

The type is a better farming soil than the Valentine sand, on account of its higher organic-matter content and more stable nature. It requires careful management, however, to prevent drifting, and for this reason is not so well adapted to crop production as the heavier soils of the county. Nevertheless about 70 per cent of it is under cultivation. The rest is used for grazing or the production of wild hay. A quarter section will support 50 to 60 head of cattle during the summer season, or when cut for hay will yield 80 to 100 tons.

Of the cultivated crops corn is the most important, with alfalfa ranking next in acreage. Alfalfa does a little better than on the Valentine sand, but is not nearly so well adapted to the soil as corn. Small grain does not do well on account of the loose sandy nature of the seed bed and the impaired stand due to exposure of the roots of the plants by drifting.

Crop yields vary greatly from year to year, being largely dependent upon the rainfall. The average yield of corn is about 20 bushels per acre and of alfalfa 2 to 2½ tons from three cuttings. Alfalfa is seldom profitable after the third or fourth year as the lime in the soil does not seem to be sufficient to maintain a full stand.

The selling price of the Valentine loamy sand ranges from $50 to $100 an acre, depending upon location, topographic position, and improvements.

WAUKESHA FINE SANDY LOAM

The surface soil of the Waukesha fine sandy loam is a dark-brown fine sandy loam, 8 to 12 inches deep. The sand content is relatively high, and in places the soil approaches a loamy fine sand in texture.

The upper subsoil is a brown fine sandy loam extending to an average depth of 20 inches. The lower subsoil is a light-brown to gray material composed largely of fine sand, silt, and clay which continues to below the 3-foot section. The surface soil contains considerable organic matter which gives it its dark color, but this material gradually decreases with depth and in most areas is negligible below 30 inches. Neither the soil nor the subsoil is noticeably calcareous, but at depths greater than 4 feet the substratum is high in lime and consists of a loose floury silt to very fine sand. The transition between the different soil horizons is very gradual throughout the 3-foot section. The subsoil has a plastic gritty feel when wet but becomes brittle and crumbles easily upon drying.

Over local areas the subsoil changes abruptly at about 30 inches into a light-gray loose silt having a high lime content. Around the margins of the type, where it borders areas of Waukesha very fine sandy loam, the surface textures of the two types merge gradually into each other, and it is often necessary to draw arbitrary lines separating them. These variations, however, are of very small extent and local importance only.

The type is not extensive in Nance County. It occurs chiefly as irregular broken strips upon the terraces along Ash Creek and the Cedar River and as local bodies upon the Loup River bench or terrace lands. One of the largest areas lies along Ash Creek in the north-central part of the county. A large and fairly typical development may be seen about 3 miles southeast of Fullerton, in T. 16 N., R. 5 W. A small body borders the west side of the Cedar River in the vicinity of Belgrade. The type is locally developed along Beaver Creek east of Woodville.

The Waukesha fine sandy loam has been formed in the same manner as the other members of the Waukesha series. It represents terrace or bench material deposited by the streams when they were flowing at higher levels. Wind-blown materials from the sandier soils have assisted materially in its formation.

The topography is flat to very gently undulating. The type lies from 8 to 20 feet above the first bottoms and drainage is everywhere good. Surface channels are not well established, but the porous soil and subsoil absorb all the surplus moisture.

The type is only of local agricultural importance in Nance County on account of its small extent. It is a good corn and alfalfa soil, however, and practically all of it is under cultivation. The type is not considered so well adapted to small grain as the heavier terrace lands because of the sandy nature of the surface soil which prevents the preparation of a compact seed bed. Cattle feeding is practiced by several farmers on this type and hogs are raised in large numbers.

The average yield of corn is about 30 bushels per acre and of alfalfa 3 to 3½ tons per acre, from three cuttings.

The soil is handled in the same manner as the Marshall silt loam, but it can be cultivated under a wider range of moisture conditions and with lighter machinery and draft animals than that type. The topography is also more favorable for cultivation. Barnyard manure is applied to the land when available, although the supply is usually insufficient for best results. Crop rotation is not systemati-

cally practiced. The extension of alfalfa growing tends to maintain the high producing power of the soil.

The land of the Waukesha fine sandy loam sells for $75 to $150 an acre, depending largely upon location and improvements.

WAUKESHA VERY FINE SANDY LOAM

The soil of the Waukesha very fine sandy loam is a dark grayish brown very fine sandy loam, 10 to 14 inches deep. It is loose and friable in structure, and contains a high percentage of organic matter. The subsoil is a rather heavy and compact silt loam to silty clay loam containing a small percentage of very fine sand, brown to grayish brown in color, and in many places slightly mottled with light-gray splotches and scattering iron stains. This material usually continues to depths below 3 feet, with little change in color or structure. In a wet condition the subsoil is quite sticky and plastic, but it becomes hard and brittle upon drying. This type is seldom calcareous within the 3-foot section, although lime is quite abundant below 4 feet, existing in both the powdered form and as small angular concretions.

There are a few notable variations in this type. Locally the rather compact brown to grayish-brown subsoil is underlain at 28 to 30 inches by a light-gray, loose, floury silt containing a large quantity of lime. This is unusual, however, and occurs only in scattered small patches too small to warrant separate mapping. Around the outer margins of the type, where it borders the upland, colluvial wash from the higher levels has greatly thickened the surface soil and increased its silt content. In these situations the soil has an average depth of 24 inches and over small areas extends to depths of 3 feet or more, with little change in color or texture. The surface soils of the Waukesha silt loam and very fine sandy loam merge gradually and in many places it is difficult to separate the two, so that areas of silt loam may have been included with the Waukesha very fine sandy loam and vice versa.

The type is not extensively developed in Nance County, although it occupies numerous small bodies and strips throughout the terrace lands of the Platte Plain and throughout the eroded loessial uplands. One of the largest bodies, comprising about 3 square miles, lies southeast of Fullerton on the south side of the Loup River. A smaller though quite typical area is mapped west and northwest of Belgrade on the west side of the Cedar River. Uniform developments may be seen in the vicinity of Fullerton, Merchiston, and Belgrade. Small bodies and narrow strips are scattered over the Loup River, Cedar River, Plum Creek, and Beaver Creek terraces.

The soil has developed on weathered alluvial material deposited by the streams when they were flowing at higher levels. The topography is flat, with a gentle slope down the valley and toward the stream channels. Drainage is good, the surface lying from 15 to 30 feet above the present flood plains. Even the flatter areas have sufficient slope to carry off all surplus moisture.

Owing to its rather small extent, the type is not an important agricultural soil in Nance County. It is naturally strong and fertile, however, and is considered equal to the Waukesha silt loam for

general farming. Practically all of it is under cultivation. Corn, alfalfa, wheat, oats, and rye are the leading crops. The winter feeding of cattle and the raising of hogs is practiced extensively on this soil. Most of the cattle are native stock, raised on surrounding types, where pasture land is available. A few cattle are annually shipped in for winter fattening.

The crop yields on this type are about the same as those obtained on the Waukesha silt loam and the land is handled in the same manner as the Marshall silt loam of the upland.

Barnyard manure is the only fertilizer used. The supply is seldom sufficient to produce a noticeable increase in the total yields. The need of fertilizers has not been felt. The land receives considerable organic matter through surface wash from the uplands, which tends to maintain it in a productive condition.

Systematic crop rotation is not practiced. Alfalfa is grown on most farms, and this crop aids in maintaining the high fertility of the soil, the stands being allowed to remain six or seven years before again putting the land in grain.

The selling price of the Waukesha very fine sandy loam ranges from $125 to $225 an acre, depending upon location and improvements. The higher price applies to well-improved land in the immediate vicinity of the larger towns.

WAUKESHA SILT LOAM

The surface soil of the Waukesha silt loam is a dark grayish brown friable silt loam, 12 to 15 inches deep. It contains a large amount of organic matter and in a moist condition appears black. There is present in many places a considerable quantity of very fine sand, though practically no material of a coarser nature. The subsoil is a brown to yellowish-brown moderately compact silty clay that becomes slightly lighter in color and more friable with depth. Over large areas, however, the subsoil shows little change either in color or texture within 3 feet of the surface. It is hard and tough when dry and becomes sticky and plastic when wet. It is occasionally mottled with gray splotches and rusty iron stains. The change from soil to subsoil is rather abrupt both in color and structure. Lime concretions occur in places in the lower subsoil, although their presence is not characteristic and the type as a whole is not calcareous within the 3-foot section.

In many places the material below 30 inches is a light-gray or yellowish-brown smooth, floury silt loam, much resembling the lower subsoil of the Marshall silt loam. Such a condition is best developed upon the terraces bordering Beaver, Plum, and Timber Creeks. Upon the lower terraces the surface soil is usually somewhat deeper and darker than on the high terraces. The subsoil is also less compact, as a rule, and slightly darker in color. Along the contact of the terraces and the uplands the dark-colored surface soil has been greatly thickened by the addition of colluvial wash from the higher slopes. In these situations, the material is often 24 inches thick and locally extends below the 3-foot depth, with little change in texture, although the lower 12 inches normally has a brown to light-brown color.

The soil profile of this type resembles that of the Marshall silt loam. The subsoil, however, is usually more compact, especially in the upper part. The deeper cuts along streams show a profile similar to that of the loess underlying the upland.

The Waukesha silt loam is quite extensively developed in Nance County. It occurs chiefly in a broad belt on the north side of the Loup River southwest of Fullerton and as narrow elongated bodies along all the larger streams in their courses through the loessial upland region. The largest area lies in the southwestern part of the county, where it is the dominant terrace soil between the uplands and the Loup River. Typical developments are mapped along Beaver, Skedee, Plum, and Timber Creeks. The type does not occur south of the Loup River, as most of the soils here are of a sandy nature.

This type is derived from alluvial sediments carried down and deposited by the streams when they were flowing at higher levels. Surface wash from the adjoining uplands has also contributed largely to the material, especially near the foot of the steeper slopes. Prolonged weathering and the accumulation of organic matter has changed the original deposits into the present soil.

The topography is almost level to very gently undulating. The higher and older terraces are in places somewhat eroded by streams, and over local areas have a strongly undulating relief, but the crests of the low, rounded divides lie at a uniform level and are 40 to 60 feet above the stream channels. The remaining terraces have a flat surface sloping gently down the valleys and toward the streams, and lie from 10 to 25 feet above the first bottoms or flood plains. The transition between the different terrace levels is commonly marked by a short steep slope, although in some places the slopes are long and gradual.

The Waukesha silt loam is well drained. There is usually sufficient slope even on the flatter areas to carry off the surplus water. After heavy rains water sometimes accumulates in isolated shallow depressions, but the total extent of poorly drained land is negligible.

The Waukesha silt loam is an important agricultural soil and constitutes some of the most valuable land in the county. Originally it supported a dense growth of prairie grasses, but practically all of it is now under cultivation. Corn occupies the largest acreage followed by alfalfa, wheat, oats, and rye, ranking in acreage in the order named. The winter feeding of cattle is practiced extensively. Most of the animals are raised on other soil types where more pasture land is available. Hogs are raised on every farm and many farmers have large herds. The livestock is all of good breeding and many farmers have herds of purebred hogs.

Crop yields average somewhat higher than on the Marshall silt loam, owing to the slightly more favorable moisture conditions. Corn returns 40 to 50 bushels per acre, wheat 15 to 25 bushels, oats 35 to 45 bushels, rye 18 to 30 bushels, and alfalfa 3 to 4 tons per acre from three cuttings. Wheat is the chief cash crop and the grain is usually hauled to market soon after threshing. Some corn is shipped outside the county, although most of the corn, oats, rye, and alfalfa is fed on the farms where produced or sold to local feeders.

The soil is handled and the crops managed in the same manner as on the Marshall silt loam. No commercial fertilizer is used, although barnyard manure is applied when available. The fertility of the soil is not being noticeably impaired by cropping, as the type receives considerable organic matter in the wash from higher levels.

The selling price of the Waukesha silt loam ranges from $125 to $225 an acre, depending largely upon improvements and location.

O'NEILL LOAMY SAND

The surface soil of the O'Neill loamy sand is a brown to dark grayish brown, loose, incoherent loamy sand, 8 to 10 inches deep. The surface 6 inches is considerably darker than the lower part, owing to a higher content of organic matter. The sand of which the soil is so largely composed is made up of nearly all grades, but the medium and coarse grades predominate. There is usually sufficient organic matter to give the surface soil a loamy character, but the quantity in most areas is insufficient to prevent the soil from drifting when intensively cultivated. The subsoil is a gray loose sand containing little or no organic matter. The change in color between the soil and subsoil is usually rather abrupt. In some areas small gravel appears throughout the soil and subsoil. The type is not noticeably calcareous within the 3-foot profile.

In small areas a layer of coarse sand and fine gravel is encountered below 30 inches. Locally the surface and subsoil layers are separated by an intermediate layer, from 4 to 6 inches thick, in which the material represents a gradation in color between the soil and subsoil. Included with this type are a few bodies of O'Neill fine sandy loam and Gannett loamy sand. The latter type was originally separated on the soil map, but on account of its small extent, less than 100 acres, it was later combined with this soil. It occupies local depressions in section 18, T. 16 N., R. 3 W. and sections 11, 12, and 13 in T. 16 N., R. 4 W. This soil differs from the O'Neill loamy sand in its lower position, larger content of organic matter and restricted drainage. The surface soil is a dark-brown to black loamy sand, 10 to 12 inches deep, underlain by a gray porous sand to a depth greater than 3 feet. Drainage is poor. The type occupies depressional areas and water sometimes stands on the surface for short periods after heavy rains. Areas in which the above variations occur are small and unimportant.

The O'Neill loamy sand is rather extensively developed in Nance County. It is the dominant terrace soil on the south side of the Loup River, forming a continuous irregular belt from one-fourth to 3 miles wide almost across the county. It is fairly uniform throughout the area of its occurrence. Small isolated bodies and narrow strips lie in the Platte Plain on both sides of the Loup River and locally upon the Cedar River and Ash Creek terraces.

The type has been developed upon sandy alluvial sediments deposited by the streams when flowing at higher levels. Later intrenchment has left the material as terrace or bench forms, somewhat above the present flood plains. Surface wash from the higher levels and wind-blown materials from the surrounding types have also contributed to its formation.

In general the topography is flat to slightly undulating. Some areas have a surface so modified by wind action as to be slightly hummocky. Drainage is generally good and over much of the type excessive. Surface channels are not well established, but the surplus moisture is readily absorbed by the loose porous subsoil and most of the drainage is subterranean. The soil has a low water-retaining power, and in dry years crops sometimes suffer from lack of moisture.

The O'Neill loamy sand is a fairly important agricultural soil in Nance County. Its even topography favors cultivation, and when carefully managed to prevent soil blowing the type produces fair yields of corn and alfalfa. About 80 per cent of it is under cultivation. The virgin areas are utilized as grazing and hay land. The native vegetation consists of a fairly dense growth of big bluestem, little bluestem, grama, sand, and needle grasses, and will support 50 to 60 head of cattle on each quarter section during the grazing season or yield about one-half ton of hay per acre. Most of the cattle are native stock, largely Hereford and Shorthorn grades. They are usually sold as feeders when 2 or 3 years old to a local buyer or outside markets. Very few cattle are winter fattened on this type. Hogs are raised on most farms.

The average yield of corn is about 20 bushels per acre. Alfalfa produces 2 to 2½ tons per acre from three cuttings, the yields of both crops depending upon the rainfall. Alfalfa makes a good growth, but the stands are rarely as thick as on the Waukesha silt loam, owing probably to the lower lime content of the O'Neill soil.

The land is handled in much the same manner as the heavier textured terrace and upland soils. Corn usually is listed deeply, as it is thought to withstand drought better than where surface planted, nor is it so likely to suffer injury by the wind during the seedling stage of development. Alfalfa is sown broadcast on plowed or double-disked and harrowed stubble ground.

The selling price of the O'Neill loamy sand ranges from $60 to $100 an acre, depending largely upon improvements.

The chief need of this soil is organic matter to increase its stability. Heavy applications of barnyard manure and straw should prove beneficial. The land should not be stirred more than is absolutely necessary to destroy the weeds. The growing of alfalfa or sweetclover should be practiced extensively, in order to increase the naturally low organic-matter content.

O'NEILL FINE SANDY LOAM

The surface soil of the O'Neill fine sandy loam is a brown to dark grayish brown fine sandy loam, 8 to 12 inches deep. It is composed largely of the finer grades of sand, with sufficient silt, clay, and organic matter to give it a loamy character. The soil passes abruptly into a subsoil consisting of incoherent light-brown to grayish-brown almost pure sand, containing little or no organic matter. The subsoil in many places contains scattering small pebbles and coarse sand and fine gravel are encountered below 30 inches. The sand is composed largely of quartz grains; there is very little feldspar present.

Neither the soil nor subsoil contain sufficient lime to effervesce with dilute hydrochloric acid. In many places throughout the type the surface soil carries so little organic matter and such a large proportion of medium sand as to approach a loamy sand in texture. Where these areas were of sufficient size they were mapped as O'Neill loamy sand.

The O'Neill fine sandy loam occurs quite extensively upon the terraces bordering the Loup River. The largest developments are on the south side of the stream in the south-central and southwestern parts of the county, where the type borders the outer edge of the O'Neill loamy sand. Smaller areas are scattered throughout the Platte Plain, upon the Beaver Creek terrace south of Genoa, and along Cedar River.

The type has weathered from sandy alluvial materials deposited by the streams when they were flowing at higher levels. Windblown sands from the surrounding soils also have contributed to its formation.

The topography is flat to very gently undulating, with a slight slope toward the streams. Drainage is good; the loose porous subsoil affords ample underdrainage, and the slight slope is usually sufficient to carry off all surplus surface water. Most of the drainage is subterranean.

About 80 per cent of the type is under cultivation and the rest has value as grazing and hay land. The soil is quite stable and seldom drifts badly, even during long periods of dry windy weather. Corn and alfalfa are the chief cultivated crops. Wheat, oats, and rye are grown to a small extent. The soil is better adapted to small grain than the O'Neill loamy sand, but these crops do not do so well as upon the heavier-textured terrace and upland soils, on account of the less compact seed bed.

The average yield of corn is about 25 bushels per acre, wheat 15 bushels, oats 25 bushels, rye 20 bushels, and alfalfa 2½ to 3 tons, from three cuttings. Native hay yields one-half to three-fourths ton per acre. Most of the corn, oats, and alfalfa is fed to cattle, hogs, and work stock on the farms where produced. Hog raising is practiced extensively, as the type is better adapted to corn and alfalfa than to small grains.

The land is handled in the same manner as the heavier-textured upland and terrace soils. Much of the corn is planted in check-rows, as there is little danger of drifting. No commercial fertilizers are used. Barnyard manure and straw are applied to the land when available, usually in the fall or early spring.

The selling price of the O'Neill fine sandy loam ranges from $70 to $125 an acre, depending largely upon improvements and location.

SIOUX FINE SANDY LOAM

The surface soil of the Sioux fine sandy loam is a very dark grayish brown to almost black loose, friable fine sandy loam with an average depth of 10 inches. The soil is rich in organic matter, the admixture being sufficient to give the dark color and loamy character. The upper subsoil is a grayish-brown or light-brown loose, loamy sand extending to an average depth of 20 inches. The lower sub-

soil is a light-gray loose, incoherent fine to medium sand which continues to a depth of 3 feet or more. Both soil and subsoil are highly calcareous, the lime existing chiefly in finely divided form. The organic-matter content of the material gradually decreases with depth and is usually very low below 24 inches. In the more poorly drained situations the lower subsoil is sometimes faintly mottled with rusty iron stains. The transition both in color and texture between the different soil layers is commonly very gradual, but in a few places there is a rather abrupt change between the upper and lower subsoil horizons.

The Sioux fine sandy loam occurs in a few small bodies upon the terrace lands lying south of the Loup River, the largest developments occurring about 3½ miles south of Fullerton. The remaining areas are few, and seldom exceed 160 acres in size.

The type has been derived from sandy alluvial materials deposited by the streams when they were flowing at higher levels. Subsequent to its deposition extensive weathering and the accumulation of organic matter has resulted in the present soil.

The topography is prevailingly flat, but modified in places by low rounded knolls and shallow depressions. The surface is slightly lower than the general level of the surrounding terrace soils, and is for the most part poorly drained, owing to the accumulation of seepage water. The loose porous subsoil, however, speedily absorbs the surplus moisture and water seldom remains on the surface longer than a few hours.

Owing to its small extent and uncertain drainage, the type is of little agricultural importance in this area. It is used chiefly for pasture and hay land. The native vegetation consists of a luxuriant growth of prairie and meadow grasses, including grama, bluestem, sand grass, and wire grass, which yield three-fourths to 1 ton of hay per acre, or when pastured will support a cow or steer per acre during the summer grazing season. All the hay is fed locally to cattle and work stock. Chiefly grade Hereford and Shorthorn cattle are raised. The animals are sold to local feeders or shipped to Omaha when 2 or 3 years old.

The land of the Sioux fine sandy loam sells for $25 to $80 an acre, depending largely upon location, drainage, and improvements.

The governing factor in the utilization of this soil is drainage. Small fields of corn and alfalfa located on the better drained portions do exceptionally well. The soil is strong and fertile, has a high lime content, and is well adapted to alfalfa. Artificial drainage would greatly increase the producing power of the land. Even under the present conditions the yield and quality of the hay could be greatly improved by sowing timothy and alsike among the native grasses.

PLAINFIELD SAND

The surface soil of the Plainfield sand is a light-brown to grayish-brown loose incoherent sand, 8 to 10 inches deep. The upper 6 inches is slightly darker than the lower part, owing to a small admixture of organic matter, but the proportion is too small to prevent the soil from drifting when cultivated. The sand, of which the soil is so largely composed, consists chiefly of the fine and medium grades.

The subsoil is a bright grayish brown medium sand containing small traces of organic matter in the upper part and practically none below 18 inches. It has a loose, incoherent structure. Neither the soil nor subsoil is calcareous. The type differs from the soils of the O'Neill series only in the lower organic-matter content and light color of its surface layer.

The Plainfield sand is very inextensive in Nance County, its total area not exceeding 2½ square miles. It occurs chiefly in small areas bordering the channel of the Loup River in the south-central and eastern parts of the county. The largest body, including about 1½ square miles, borders the bottom lands on the north side of Prairie Creek in the southeastern part. Small though quite typical developments lie southwest of Fullerton on both sides of the Loup River.

The type has been formed in the same manner as the soils of the O'Neill series, but the material is of more recent origin and sufficient time has not elapsed to produce the dark-colored surface soil through the growth and decay of plant life.

The topography is flat to very gently undulating, modified in a few places by low rounded sand hummocks and ridges. Drainage is good and over most of the type excessive. It is all subterranean, the loose, porous sands absorbing and carrying off the moisture as fast as it accumulates.

The Plainfield sand is not adapted to farming on account of its low organic-matter content, excessive underdrainage, and the danger of drifting when the native sod is broken. Practically all of it is used as grazing land, the chief grasses being sand grass, stipa or needle grass, bluestem, and grama grass. The land will support 50 to 60 head of stock per quarter section during the summer grazing season.

The selling price of the Plainfield sand ranges from $40 to $50 an acre depending upon location and improvements.

CASS LOAMY FINE SAND

The surface soil of the Cass loamy fine sand is a brown to dark grayish brown loose fine sand, 8 to 10 inches deep, containing sufficient well-decomposed organic matter to give the characteristic dark color and loamy character. The soil drifts during prolonged droughts, if the native vegetation is destroyed. The subsoil is a gray, loose, incoherent fine to medium sand, very deficient in organic matter. The entire soil section is normally low in lime carbonate, although in places both the surface and subsoil effervesce when dilute hydrochloric acid is applied.

A few variations occur in this type. Locally the subsoil below 30 inches is composed of coarse sand and fine gravel. Again, in the more poorly drained areas, rusty-brown mottlings appear throughout the subsoil and the material in these areas is sometimes fairly coherent, owing to the presence of small quantities of clay. The most important variations in texture of the surface soil are toward a fine sandy loam and a sand. The former develops where conditions have been especially favorable for the growth and decay of plant life and the latter in the more exposed situations where much of the organic matter has been removed by the wind. An almost

pure sand surface is encountered in a few places adjacent to the streams, where the soil is of such recent origin that sufficient organic matter has not accumulated to give it a loamy structure.

This type covers an area of 12,608 acres in Nance County. It is the dominant bottom-land soil along the Loup River, where it occurs as long fairly continuous strips bordering both sides of the channel. Large bodies lie along Prairie Creek in the southeastern part of the area, and small developments border the Cedar River.

The material consists of sandy alluvium of recent origin, lying on the present flood plains. Wind-blown sands from the stream channels also have contributed largely to its formation. Some weathering and the accumulation of organic matter subsequent to deposition has produced the present soil.

In general the surface is flat but in detail it is modified in places by many depressions, dry channels, old cut-offs, and slight elevations. Drainage is variable. Most of the type lies but a few feet above the normal flow of the streams and in wet seasons the underlying water table rises too near the surface for profitable farming. In dry years the underdrainage is excessive and crops often suffer from lack of moisture. During normal seasons, however, the moisture conditions over restricted areas are favorable for crops.

The type is not important agriculturally, on account of its unstable nature and variable drainage. About 80 per cent of it is included in grazing and hay land; the rest is used chiefly for corn production.

The native vegetation consists largely of sand grass and bluestem. Some stipa or needle grass grows on the more exposed and better drained areas. The grazing of beef cattle, mostly grade Hereford and Shorthorn, is the principal industry. Cattle feeding is not practiced extensively; most of the cattle are sold to farmers on other soils for fattening. Hogs are raised on a few farms.

The grasses on this type will support about 100 head of cattle per quarter section during the grazing season, or, when cut for hay, will yield one-half to three-fourths of a ton per acre. The hay is usually stacked in the field for winter feed. The average yield of corn is about 20 bushels per acre.

Land of this type sells for $30 to $80 an acre, depending upon drainage, improvements, and location with respect to markets.

The soil is easily handled and can be cultivated under any moisture conditions without injury. If brought under cultivation, soil of this type should be carefully managed to maintain and increase the organic-matter content. Heavy applications of barnyard manure and the growing of such crops as clover and alfalfa would tend to maintain the productive power of the land after it has been adequately drained.

CASS FINE SANDY LOAM

The Cass fine sandy loam consists of a dark-gray to dark-brown fine sandy loam, 10 to 14 inches deep, containing a relatively large quantity of organic matter. The subsoil is a gray, incoherent fine to medium sand continuing in most areas to the depth of 3 feet or more. The change in color and structure between the surface and subsoil horizons is generally very abrupt. The surface 10 inches in

many places contains sufficient lime to effervesce slightly with acid. The lower subsoil also is calcareous in places. Rusty-brown iron stains are usually encountered below 24 inches.

In a few places the two soil horizons are separated by a layer of brown to light-brown loamy fine sand, 6 to 8 inches thick. In local areas the material below 30 inches is an incoherent coarse sand and fine gravel.

The Cass fine sandy loam is of small extent in Nance County, its total area being about 9 square miles. The largest developments are along Prairie Creek in the southeastern part of the county. Small bodies and narrow strips lie along the channels of the Cedar River and Beaver Creek.

This type is formed of sandy alluvial material deposited during comparatively recent times. This material has been changed since deposition by weathering and the accumulation of organic matter, giving the present soil.

Areas of this type have a generally flat surface modified in places by slight depressions and old stream channels. They lie but a few feet above the normal flow of the streams and in places are subject to overflow during periods of high water. In wet years the water level frequently comes to within 3 feet of the surface and the soil is too moist for profitable farming. In very dry years the underdrainage is excessive and crops do not do so well as upon the types with heavier subsoils.

Owing to its small extent and uncertain drainage, the soil is used almost exclusively as pasture and hay land. A few small areas where drainage is adequate are devoted to the production of corn and alfalfa. The type is not so well adapted to small grain as the heavier soils, on account of the difficulty of preparing a firm, compact seed bed.

The native vegetation consists of a rank growth of prairie and marsh grasses. Grade Shorthorn and Hereford cattle are grazed over most of the type. The animals are sold to local feeders or shipped to the Omaha markets. Hog raising is not practiced extensively, although a few hogs are raised on those farms where alfalfa and corn can be produced.

The grasses on this type will support a cow or steer per acre during the summer grazing season or will yield three-fourths to 1¼ tons of hay per acre, the rate depending upon the season. The average yield of corn is about 30 bushels per acre and of alfalfa 3 to 3½ tons from three cuttings.

The selling price of the Cass fine sandy loam ranges from $40 to $125 an acre, depending upon location, improvements, and drainage.

The chief need of this soil is adequate drainage. It is naturally fertile, easily handled, and when drained is well adapted to both corn and alfalfa. Ditching or tiling the land would increase its producing power. Even under present conditions the quality of the native sod could be greatly improved by sowing timothy and clover seed upon it.

CASS VERY FINE SANDY LOAM

The surface soil of the Cass very fine sandy loam is a dark grayish brown very fine sandy loam, 8 to 10 inches deep, containing a relatively large proportion of silt and only a relatively small percentage

of particles coarser than fine sand. The soil is rich in organic matter, which gives it the dark color. The upper subsoil is a brownish-gray to gray very fine sand, containing considerable silt and clay. It is loose and rather incoherent in its natural condition, but becomes hard and brittle upon drying. Brownish iron stains are usually abundant. The lower subsoil, below 24 or 30 inches, is a light-gray incoherent coarse sand and fine gravel. The proportion of organic matter in the type gradually decreases with depth and is negligible below 24 inches. The upper subsoil is in most places calcareous.

In a few places the intermediate very fine sand layer is entirely absent and the surface layer rests directly upon coarse sand and fine gravel at depths of 12 to 15 inches. In other small areas the coarse material does not appear within the 3-foot depth, and the subsoil consists of a gray very fine to fine sand of loose, incoherent structure.

The type is very inextensive in Nance County, its total area not exceeding 2½ square miles. It occurs in small isolated areas upon the bottom lands along the Cedar and Loup Rivers and Prairie Creek. The areas commonly lie next to the stream channels. One of the largest, including about 400 acres, occurs 4½ miles southeast of Fullerton along a tributary to Prairie Creek. A smaller though quite uniform development lies along Cedar River at the mouth of Ash Creek.

The type has weathered from sandy alluvial materials deposited in the bottom lands along the streams during periods of high water. The high organic-matter content of the surface soil is due to the growth and decay of vegetation since deposition.

The topography is prevailingly flat, except where relieved by old stream channels, cut-offs, and low mounds or ridges. The type is poorly drained. The surface lies but a few feet above the normal flow of the streams and is often subject to overflows from the main channels. The loose porous subsoil absorbs the surplus surface moisture over the greater part of the type, but the water table is so near that the land remains in a wet condition the greater part of the year. In a few places small areas of marshy land have been developed.

The Cass very fine sandy loam is an unimportant agricultural soil in this county, on account of its small extent and poor drainage. Practically all of it is used for grazing and hay land. The native vegetation over most of the type consists of a great variety of prairie and marsh grasses, but narrow belts of scrub willow, ash, elm, and boxelder border the stream channels. The native grasses will support a cow or steer per acre during the summer grazing season or will yield three-fourths to 1¼ tons of hay per acre. All the hay is stored for winter feeding.

It is difficult to obtain land values for this soil as it seldom occupies entire farms, but it has a tendency to lower the general value of the farms in which it occurs, on account of poor drainage.

Although the yield of hay obtained on this land is quite high, it is of coarser texture and lower feeding value than that on the better drained upland and terrace soils. The type is well adapted to timothy and clover and the quality of the hay could be greatly improved by sowing mixed timothy and clover seed on the native sod.

SARPY SAND

The soil of the Sarpy sand consists of 6 to 8 inches of brown to light-brown loose fine to medium sand, with sufficient organic matter in the immediate surface to give it a slightly darker color than the lower part. The material gradually becomes lighter in color and below 10 inches is a gray to light-gray incoherent medium sand containing little or no organic matter. The lower part of the profile in some places is mottled with rusty iron stains owing to poor drainage. In a few places the material below 24 inches is a light-gray coarse sand and fine gravel. The type differs from the Cass soils in the lower organic-matter content and lighter color of the surface soil.

This soil is of small extent in Nance County. It occurs chiefly as narrow broken belts bordering the channel and upon a few of the islands of the Loup River. Small bodies are also mapped along the Cedar River and Prairie Creek. One of the largest developments, including about 320 acres, lies southwest of Belgrade on Cedar River.

The soil material is recently deposited sandy alluvium. It has not yet lain for sufficient time to have developed the dark-colored surface layer characteristic of the Cass soils. In many places the material much resembles Riverwash but it is more stable and not so greatly influenced by each slight rise of the streams.

The topography ranges from flat to slightly hummocky. The greater part of the area is characterized by shallow depressions dotted with low rounded sand hummocks and ridges 2 to 4 feet high. Drainage is generally good. The uneven surface favors ready run-off and the porous soil and subsoil permit free underdrainage. The type is subject to occasional overflow from the streams, but water seldom remains on the surface longer than a few hours.

Owing to its small extent, low organic-matter content, and incoherent structure, the soil is of low agricultural value in this county. It is all utilized as pasture and hay land. The native vegetation is quite sparse, and the type does not have a high value even for pasture. Narrow belts of forest, including a fairly dense growth of ash, elm, cottonwood, and willow, occur along the stream channels.

Accurate land values for this soil are not obtainable, as it occupies only small proportions of the farms in which it occurs.

It is doubtful if any of the type should be cultivated, as it is very unstable when the native grasses are destroyed. It is also rather droughty during years of low rainfall. The sowing of tame grasses and clover in the native sods would greatly increase the value of the pastures.

WABASH SILT LOAM

The surface soil of the Wabash silt loam is a grayish-brown to dark-brown (black when wet) heavy silt loam, high in organic matter and 8 to 10 inches deep. On much of the type a relatively large percentage of very fine sand is present in the soil. The subsoil differs little in color from the surface layer, although it is slightly more compact below 24 inches, owing to a small admixture of clay. The material is rather plastic when wet, but becomes hard and brittle and breaks down into granules upon drying. Faint brown

mottlings are often encountered below 24 inches. The material ordinarily is not calcareous within the 3-foot depth. Below 4 or 5 feet, however, as may be observed in stream banks, the substratum passes rather abruptly into a light-gray highly calcareous silt loam containing numerous lime concretions. Locally a light-colored silty material appears within 24 inches of the surface. This is not calcareous and where the areas are of sufficient size they are mapped with the Waukesha silt loam.

The Wabash silt loam is not extensively developed in Nance County. It is confined to the narrow bottom lands along creeks flowing through areas of Marshall silt loam in the upland sections of the area. The soil occurs in narrow belts, varying in width from a few rods to about one-fourth mile, along Skedee, Plum, Ash, Timber, Horse, and Cottonwood Creeks, and their larger tributaries. Some of the most typical areas are along Skedee and Timber Creeks.

The material composing this type is of alluvial origin. It has been washed from the adjoining uplands, carried by the streams, and deposited upon their flood plains. The decay of the rank vegetation developed under the moist conditions accounts for the dark color and high organic-matter content of the type. The flood plains of some of the smaller tributaries are quite narrow and in places a slight exaggeration was necessary to show the areas of this soil on the map.

Areas of this soil have a generally flat surface interrupted in places by old stream channels and shallow depressions. They lie but a few feet above the streams and are subject to overflow during periods of high water. Drainage is good, however, during the greater part of the year, as there is in most places sufficient slope to carry off the surplus moisture. In a few of the shallow depressions the underdrainage is inadequate, and in such places small patches of poorly drained land occur.

The Wabash silt loam is not an important farming soil in Nance County, on account of its small extent and the danger of loss from floods. Most of the type is used as pasture and hay lands; probably not over 30 per cent, including the higher lying parts, is under cultivation. The soil is naturally strong and fertile and withstands drought as well as any other type in the county. In other counties where it occurs extensively and is not subject to overflow, it is regarded as the best farming soil to be obtained. The type in its virgin state supports a luxuriant growth of marsh and prairie grasses, with marginal belts of timber along the stream channels. On the cultivated areas corn, oats, wheat, and alfalfa are the leading crops. The livestock industry is as well developed on this type as on any other soil in the county. It consists of hog raising, cattle grazing, and the winter fattening of steers.

Crop yields are usually somewhat higher than on the terrace and upland soils, on account of the more favorable moisture conditions. Corn yields 40 to 60 bushels per acre during average years, oats 30 to 50 bushels, wheat 20 to 25 bushels, and alfalfa 3 to 4½ tons from three cuttings. Alfalfa makes a more luxuriant growth on this type than on any other soil in the county. The native grasses will support a cow or horse on each acre during the summer grazing

season or will yield three-fourths to one and one-fourth tons of hay per acre.

Crop rotation and fertilization are given little attention, as the addition of fresh deposits tends to maintain the soil in a productive condition.

It is difficult to obtain land values for this type, as it occupies narrow strips and forms but a small part of the farms in which it is included. It has a tendency to increase the general value of the land on those farms where drainage is sufficient for crop production. The type is especially valuable to cattle feeders on account of the water supply in the streams.

LAMOURE FINE SANDY LOAM

The surface soil of the Lamoure fine sandy loam is a dark-gray friable fine sandy loam, 8 to 12 inches deep. It contains considerable very fine sand, some silt, and little material coarser than fine sand. The soil is rich in organic matter. The upper subsoil is a gray silt to silty clay of slightly compact structure. The lower subsoil, below 30 inches, is a light-gray very fine sandy clay of slightly less compact nature. Little organic matter is present in the soil or subsoil. The gradation between the soil and upper subsoil is rather abrupt both in color and texture. The surface layer is only slightly calcareous, although lime is abundant below 18 inches and small angular concretions from one-sixteenth to one-fourth inch in diameter are often encountered in the lower subsoil.

The type is confined to four small bodies on the bottom lands of Prairie Creek in the southeastern part of the county. The largest, including about 640 acres, borders the southern county line on the south side of the stream. A small area lies in sections 16 and 17, T. 15 N., R 7 W., and three others along Cedar River.

This type is alluvial in origin, but it has been modified to some extent by the addition of wind-blown sand from the areas of Cass soils. It is this that gives the surface soil its relatively loamy texture.

The topography is flat, with some slight elevations and shallow depressions. The surface lies slightly above that of the Lamoure very fine sandy loam and is, as a rule, better drained.

The Lamoure fine sandy loam is of little agricultural importance, on account of its small extent. It is quite productive and about 70 per cent of it is under cultivation to corn, oats, and alfalfa. The rest, including the more poorly drained areas, is used for pasture and the production of hay. The yields of all crops are about the same as those obtained on the better drained parts of the Lamoure very fine sandy loam.

The selling price of this soil ranges from $50 to $125 an acre, depending upon drainage and improvements.

LAMOURE VERY FINE SANDY LOAM

The surface soil of the Lamoure very fine sandy loam is a dark grayish brown to almost black very fine sandy loam, 8 to 10 inches deep. It contains a relatively large percentage of silt and clay and little material coarser than fine sand. There is an abundance of or-

ganic matter which gives the soil its dark color. The upper subsoil is a gray to light-gray very fine sandy clay of slightly more compact structure than the surface soil. This material extends to an average depth of 20 inches, and is underlain to depths below 3 feet by a dark-gray compact very fine sandy clay to silty clay. The material of the upper and lower subsoil is sticky and plastic when wet, but becomes hard and brittle upon drying. The surface soil is usually slightly calcareous and the subsoil is high in lime, which exists both in finely divided form and as small angular concretions. Small alkali spots, characterized by the efflorescence of white salts on the surface, are quite numerous throughout the type.

The principal variation in surface texture is toward a fine sandy loam. In a few places the subsoil differs from the typical in that the dark-gray lower part does not appear within the 3-foot depth and the material consists of a highly calcareous light-gray fairly compact very fine sandy clay to silty clay.

A few large areas of this soil are mapped in the southeastern part of the county, where it is the dominant bottom-land type along Prairie Creek. One of the largest areas, including about 3½ square miles, occupies the extreme southeast corner of the county. This area is separated on the west from another large though irregular area by small developments of Cass soils. The other bodies are small, and the total area is only a little more than 9 square miles.

This type has been developed from stream-laid sediments largely of fine-textured loessial material. The incorporation of organic matter has produced the dark color of the surface soil.

The topography is flat, but modified in a few places by shallow depressions and stream channels. The greater part of the type lies 8 to 10 feet above the normal level of the stream and is seldom subject to overflow. During normal years drainage is sufficient for crop production, but in wet seasons the underlying water table rises too near the surface for most crops.

Owing to its small extent, variable drainage, and local accumulations of alkali, the type is of little agricultural importance. About 50 per cent of it is under cultivation and the rest is used for pasture and for the production of wild hay. The native vegetation consists of a luxuriant growth of prairie and marsh grasses including grama, salt, and wire grass, the prairie grasses occupying the better drained situations.

Corn, wheat, oats, and alfalfa are the leading cultivated crops. Corn yields 20 to 35 bushels per acre, wheat 15 to 29 bushels, oats 20 to 25 bushels, and alfalfa 2½ to 3 tons from three cuttings. The native grasses will support 90 to 120 cattle per quarter section during the summer grazing season or will yield one-half to 1 ton per acre. The yields of the cultivated crops and of wild hay are dependent largely upon the rainfall.

The selling price of this soil ranges from $50 to $125 an acre. Drainage conditions have a marked influence on the price asked.

The primary need of this land is artificial drainage. Systems of deep drainage ditches or tiles or both would reduce the alkali in the surface soil and greatly increase the producing power of the type. When adequately drained it is as productive as any of the soils of the county. It is especially adapted to alfalfa, owing to its high lime content.

RIVERWASH

Riverwash occurs in a few small areas adjacent to and within the channel of the Loup River. Its total area in Nance County does not exceed 128 acres. The areas consist of sand bars, sand flats, and islands. Their surface lies only slightly above the normal flow of the stream and is flooded with each slight rise. Riverwash is not regarded as a permanent soil, the material changing with each flood.

ROUGH BROKEN LAND

The term Rough broken land is applied to those areas which are unsuited to farming, either on account of the rough topography or the nearness of the underlying bedrock to the surface. The topography over most of the area is extremely rough and broken. Erosion of the loessial material has produced steep slopes, canyons, and gullies. Over extensive areas the loess deposit has been entirely removed to the underlying Arikaree formation of Tertiary age. This material consists of a light-gray, soft sandstone, loosely cemented with lime. Weathering of this rock, together with the addition of colluvial wash from the higher lying loessial soils and the accumulation of organic matter through the growth and decay of plant life, has produced a thin gray to dark-gray fine-textured soil over most of the formation. The Arikaree is exposed in only a few places, but over most of the area it lies so near the surface as to hinder cultivation. The topography, while not so rough and dissected as that formed where part of the loessial material remains, is, however, quite hilly and unsuited to crop production.

Rough broken land is excessively drained. Erosion has produced an intricate system of intermittent drainage ways having steep gradients. The soil material is everywhere shallow except along stream channels and near the base of the more gradual slopes.

The areas are not extensive in Nance County. The largest body, including about 3 square miles, lies near the mouth of Timber Creek. The loessial material has been largely removed from this area and the sandstone is either exposed or thinly covered with soil. Another large area, in which the loessial deposit is entirely removed in only a few places, occurs throughout the Council Creek drainage system northwest of Kent. Other bodies are mapped near Belgrade in the northern part, and in the southwestern part of the county.

The soil is used almost exclusively for grazing cattle and horses. Except on the steeper slopes there is a good growth of grasses. The most important are grama grass, buffalo grass, bluestem, and some western wheat grass. A little corn, oats, and alfalfa are grown on some included areas of comparatively smooth surface. The land will support 30 to 40 head of cattle per quarter section during the summer grazing season.

The land, which is valued chiefly for pasture, can be bought for $40 to $80 an acre, the price depending upon location, topography, and improvements.

SUMMARY

Nance County is situated in east-central Nebraska. It contains 440 square miles, or 281,600 acres. About two-thirds of the county

consists of uplands and the rest of terraces and first bottoms. The topography of the upland ranges from rough and hilly to almost flat, while that of the bottoms and terraces is flat to gently undulating.

The county has an average elevation of about 1,780 feet above sea level. The general slope is toward the south and east. The drainage is effected through the Loup River and Prairie Creek and their tributaries. The county, as a whole, is well drained.

The first settlement in the area was made near the mouth of the Cedar River in 1876, and the county was organized in 1879. According to the 1920 census the population is 8,712, all which is classed as rural. The density is 19.5 persons per square mile. Fullerton, the county seat, has a population of 1,595.

The transportation facilities of the county are good. The railroads within the area are branch lines but furnish good connections with Omaha. Public roads reach all farming communities. Omaha is the chief market for the surplus grain and livestock.

The climate of Nance County is favorable for the growing of all crops common to the region, including corn, wheat, oats, barley, alfalfa, fruits, and vegetables. The mean annual precipitation is 27.09 inches and the mean annual temperature 48.6° F. The rainfall is usually quite favorably distributed. The average growing season is 147 days.

The agriculture of the county consists of diversified farming, including the production of grain and hay and the raising of livestock. Cattle and hogs are raised on most farms and constitute an important source of farm income. The animals are fattened on corn and alfalfa. The work stock consists of heavy draft horses and mules. A few tractors are used on the more level lands.

Systematic crop rotation is not generally practiced, although many farmers have evolved more or less definite systems which they follow as far as practicable. No commercial fertilizer is used. Most of the available barnyard manure is applied to the soil.

The soils of Nance County, with the exception of the recent sand deposits and eroded slopes, have weathered under grass vegetation and under conditions favorable for the accumulation of large quantities of organic matter. The material from which most of the soils have evolved is a calcareous light-colored silty deposit known in the Nebraska surveys as the Plains loess. This material has weathered into fine-textured soils which have been classed with a hard-land group. The recent sand deposits, which cover a relatively small percentage of the county, are of coarser texture than the loessial material and give soils of a more sandy and less coherent nature. These soils are included with a soft or sandy-land group. Variations in the degree and manner of weathering throughout the different deposits have produced various soils, with certain definite characteristics.

The Marshall silt loam is the most extensive and important upland soil of the county. The topography varies from undulating to hilly. Drainage is good and in the more hilly sections is often excessive. The type is adapted to all crops common to the region and gives good yields in all but the most unfavorable seasons.

The Valentine sand is of little agricultural importance. The soil is very unstable and subject to drifting when the native sod is destroyed. It is used largely for pasture land.

The Waukesha silt loam and very fine sandy loam are among the most productive soils of the county. They occupy the heavier textured terrace lands along the Loup River and the larger creeks throughout the uplands.

The O'Neill loamy sand is the principal terrace soil south of the Loup River. It also occurs in small bodies north of the stream and along Cedar River. The type has a low organic-matter content and is rather unstable during dry windy weather. Fair yields of corn and alfalfa are obtained during favorable seasons.

The Plainfield sand occupies a small total area on the terraces. It is not adapted to farming on account of its low organic-matter content and unstable nature. The land is used for pasture.

The Sioux fine sandy loam occupies the lower depressions throughout the terraces on the south side of the Loup River. It is poorly drained and used chiefly for pasture and hay land.

The Cass loamy fine sand is extensively developed throughout the Loup River flood plain. It is subject to drifting when cultivated and the greater part is used for pasture and hay land.

The Wabash silt loam occurs as narrow strips along the larger stream channels throughout the uplands.

The Sarpy sand is confined to small bodies lying within and bordering the channel of the Loup River and Prairie and Timber Creeks. The type is very sandy and not adapted to cultivation.

The Lamoure very fine sandy loam is developed extensively along Prairie Creek in the southeastern part of the county. Drainage is variable. The soil occupies first bottom positions and during wet seasons the underlying water table is too near the surface for profitable farming.

Rough broken land includes areas unsuited to cultivation either on account of the rough topography or the nearness of the underlying bedrock to the surface.

Riverwash occupies sand bars and low sand islands in the Loup River.

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