

U. S. DEPARTMENT OF AGRICULTURE

BUREAU OF SOILS

IN COOPERATION WITH THE STATE SOIL SURVEY OF THE
UNIVERSITY OF NEBRASKA

SOIL SURVEY OF MERRICK COUNTY
NEBRASKA

BY

F. A. HAYES, OF THE U. S. DEPARTMENT OF AGRICULTURE
IN CHARGE, AND A. N. HUDDLESTON, M. H. LAYTON
G. E. BATES, AND H. L. BEDELL, OF
THE NEBRASKA SOIL SURVEY

[Advance Sheets—Field Operations of the Bureau of Soils, 1922]



WASHINGTON
GOVERNMENT PRINTING OFFICE
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[PUBLIC RESOLUTION—No. 9]

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

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

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

Approved, March 14, 1904.

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

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MAP

Soil map, Merrick County sheet, Nebraska

SOIL SURVEY OF MERRICK COUNTY, NEBRASKA

By F. A. HAYES, of the U. S. Department of Agriculture, in Charge, and A. N. HUDDLESTON, M. H. LAYTON, G. E. BATES, and H. L. BEDELL, of the Nebraska Soil Survey

DESCRIPTION OF THE AREA

Merrick County is situated in east-central Nebraska. Central City, in the southern part, is about 108 miles west of Omaha. The county is roughly triangular. The western edge is a north-south line. The northern side, although irregular, extends in a general east-west direction. The Platte River, which forms the remaining county boundary, has a nearly straight course and flows northeast. The county has an area of 476 square miles, or 304,640 acres.

The area included within Merrick County was once covered with a thick, smooth mantle of plains loess, sloping gently to the east. In comparatively recent times this mantle has been largely removed through erosion, and the surface of the county now lies considerably below that of the former plain. The streams most active in this erosion were the Platte and Loup Rivers. The intrenchment of these rivers into the loose loessial deposit has created a broad, low-lying strip of alluvial land, known in the Nebraska surveys¹ as the Platte Plain. This alluvial plain occupies all of the county except a few square miles in the extreme northwestern part, where the county extends beyond the Platte Plain into the loessial uplands. For convenience in reference, therefore, the county may be described as consisting of two topographic divisions—the uplands, or the remnants of the original loess plain which have not yet been entirely removed by erosion, and the alluvial lands or Platte Plain.

The uplands section of Merrick County does not exceed 5 square miles in area. It occupies the narrow strip $7\frac{1}{2}$ miles long and three-fourths of a mile wide extending north from the Loup River along the western county line. It represents a part of the eroded valley slope bordering the north side of the Platte Plain. The topography is, for the most part, rough and dissected, the surface being cut by an intricate system of small, steep-sided drainage ways, separated by narrow and usually crestlike divides. In a few places, however, the divides, though narrow, have flat tops. The entire upland area has a general slope to the south.

The Platte Plain, or the alluvial land, which comprises all the rest of the county, lies 75 to 200 feet below the uplands. It includes

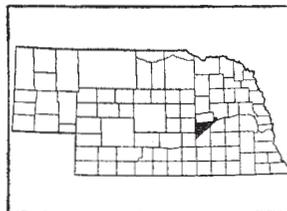


FIG. 25.—Sketch map showing location of the Merrick County area, Nebraska

¹ G. E. Condra, State Geologist and Director, Conservation and Soil Survey.

the Platte and Loup River terraces and bottom lands. The general surface is flat to gently undulating, modified in places by shallow stream channels, depressions, and old cut-offs, and by extensive deposits of wind-blown sands, which in the more exposed situations have a billowy to hummocky topography.

The terraces occupy about two-thirds of the Platte Plain and represent valley fillings deposited as flood-plain material by the streams when they were flowing at higher levels. Subsequent in-trenchment has left these deposits at different terrace or bench levels, depending upon the depth to which the streams had cut at the time of their deposition. Most of the older and higher benches have either been removed by erosion or have become so deeply covered with wind-blown sands that their identity is doubtful. The oldest remnant to retain much of its original terrace form occupies most of the area between the Platte River bottom lands and the northern county boundary. This large terrace is triangular in shape, being about 18 miles wide where it crosses the western county line and tapering to a point between Havens and Silver Creek in the northeastern part of the county. The surface lies 40 to 80 feet above the Platte River bottom lands. The general topography is that of a high, flat to gently undulating bench, modified by extensive hummocky to hilly sand deposits along its northern boundary and by the broad, shallow valley of Prairie Creek, which traverses it lengthwise. There are also numerous sloughlike depressions and basins representing abandoned channels that have become blocked by their own sediment or by wind-blown sand. The materials of many of these depressions and valleys have been classed with the bottom-land soils on account of their poor drainage.

There are a few other old terrace developments in the western part of the county, but they are usually so deeply covered with wind-whipped sand that their identity is obscured. The most extensive area showing the result of wind action is north of Prairie Creek in the northwestern, north-central, and extreme northeastern parts of the county, where there occurs a broad belt of wind-laid deposits, broken only by the Loup River flood plain. Over most of this region the less stable soils of the high terrace have been whipped by the wind into low sand ridges and knolls, creating a hummocky to billowy relief, and the original surface of the terrace is exposed only in the deeper troughs. Locally, where wind action has been especially severe, the loose, incoherent sands have been piled into dunes from 20 to 30 feet high, producing a rough, hilly relief. Most of these dunes have rounded tops, are well grassed, and not subject to active erosion.

The remaining terrace developments in the Platte Plain are comparatively inextensive. They consist of isolated knolls, ridges, and flats within and usually surrounded by flood-plain material. The largest bodies are in the vicinity of Central City and northeast of Chapman in the southern part of the county. The surface of these low benches is flat to very gently undulating, and lies but a few feet above the bottom land, the intervening slope being usually so gradual as to be almost imperceptible. In most places the low terraces are of such recent origin and lie so little above the flood plains that the two merge without any distinct demarcation.

The first bottoms or flood plains of the county occupy the lowest topographic positions. They occur along all the larger streams in strips and bodies of various sizes, the widest and most continuous developments being along the Platte River. The bottom lands lie only a few feet above the stream level, but are subject to overflow only during periods of exceptionally high water. The water table, however, is very near the surface, and in rainy seasons it rises enough to produce extensive areas of marshy land. The surface of the flood plains is flat, modified by old and present stream channels, oxbows, cut-offs, shallow depressions, and slight elevations.

Merrick County has an average elevation of about 1,700 feet above sea level, ranging from approximately 1,520 feet where the Platte River leaves the county to about 2,020 feet at the northern edge of the narrow upland strip along the western county line. The highest point within the Platte Valley, about 1,880 feet above sea level, occurs on top of one of the larger sand hummocks near the western boundary. The elevation of Silver Creek is 1,549 feet, Havens 1,586 feet, Clarks 1,623 feet, Thummel 1,663 feet, Central City 1,697 feet, Paddock 1,720 feet, Archer 1,742 feet, Chapman 1,767 feet, Palmer 1,798 feet, and Lockwood 1,806 feet. The general slope of the county is to the east.

The Platte River and its tributaries drain the entire county, except the small upland portion in the northwest corner, from which the run-off is south into the Loup River, and a small area in the vicinity of Palmer, which drains north into the same stream through Elk Creek and subterranean channels. The Platte River tributaries which drain the greater part of the area flow in a northeasterly direction, roughly parallel to the trunk stream and to each other. They are, from north to south, Prairie Creek, Silver Creek, and Warm Slough. Prairie Creek and Warm Slough rise outside the area. The former empties into the trunk stream in Platte County. Silver Creek and Warm Slough join the river within the area. The Platte River is heavily loaded with sediment and is engaged in aggradation and in lateral cutting rather than in deepening its channel. The stream has a fall of about $6\frac{1}{2}$ feet per mile. All the tributaries have low gradients. Prairie and Silver Creeks flow most of the year, but Warm Slough is intermittent, flowing only during seasons of precipitation. Even the Platte River becomes dry for short periods during the summer.

The creeks and rivers afford ample drainage for most of the county. Many of the more nearly level areas have no well-defined drainage ways, although most of the soils have a porous substratum which insures good underdrainage. The most poorly drained soils occur in the lower-lying bottoms along the rivers and creeks and in depressions throughout the terraces. A narrow strip bordering each side of the sandy, wind-blown area in the northern part of the county remains too moist for cultivation owing to seepage from the higher levels.

Well water of excellent quality is obtained at shallow depths over the greater part of the county. The wells are seldom more than 40 feet deep, and most of them range between 7 and 30 feet in depth. The nearness of the water table to the surface has prompted a few farmers to establish pumping systems for irrigating small patches of

garden fruits and vegetables. The pumps are mostly of the centrifugal type, and are driven either by gasoline or electric power. Throughout the small area of uplands in the northwestern corner of the county good well water is obtained at 75 to 150 feet.

The boundaries of Merrick County were defined by an act of the State legislature in 1855. The first settlement was made in 1859, and the county was organized during the winter of 1864. The early settlers came largely from eastern States. According to the 1920 census the population of the county is 10,763, all of which is classed as rural, as there are no towns having 2,500 or more inhabitants. The density is about 23 persons per square mile. Settlement is quite evenly distributed, but is densest along the railroads and in the vicinity of the towns. The area of hummocky, sandy land east of Palmer is the most sparsely settled.

Central City, the county seat and principal town, with a population of 2,410 in 1920, lies in the south-central part, and is the site of the Nebraska Central College. Silver Creek and Clarks, in the northeastern part, have 583 and 540 inhabitants, respectively. Palmer, in the northwestern corner, has a population of 577, and Chapman, near the southwest corner, has 224 inhabitants. Havens, Thummel, Paddock, Lockwood, Hord, and Archer are small villages or stations located along the railroads. The towns, villages, and stations furnish local markets, distributing centers, and shipping points for farm implements, supplies, and produce.

The transportation facilities of Merrick County are good. The main line of the Union Pacific Railroad follows the north side of the Platte River across the area, through Silver Creek, Havens, Clarks, Thummel, Central City, Paddock, Chapman, and Lockwood. A main line of the Chicago, Burlington & Quincy Railroad crosses the extreme southwest corner. A branch of this line extends north from Aurora in Hamilton County to Central City, then turns northwest to Palmer, where it branches, one line going to Burwell, in Garfield County, and the other to Sargent, in Custer County. Central City, Hord, Archer, and Palmer are on this line.

Most of the public roads of Merrick County follow section lines, except the Lincoln Highway, which extends along the Union Pacific Railroad diagonally across the area. This highway is surfaced with gravel between Central City and Chapman. The remaining roads are of ordinary 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. Little attention is given the minor roads. There are six bridges across the Platte River within the county, and cement culverts or bridges are quite common even on the minor roads. Telephones and rural mail delivery routes reach all sections.

The surplus products, consisting of grain, hay, cattle, and hogs, are usually marketed outside the county, the wheat, alfalfa, and livestock being 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. A flour mill and creamery located in Central City furnish a local market for the surplus wheat and dairy products.

CLIMATE

The climate of Merrick County is well suited to the production of hay and grain crops and to 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 mean annual precipitation is 26.15 inches. The greater part of the rainfall occurs during May, June, July, and August in the form of local thundershowers. The precipitation for November, December, January, and February is less than an inch per month. The mean 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 recorded (1905) was 40.14 inches, and in the driest year (1918) 19.30 inches. The average annual snowfall is 26.4 inches.

The mean annual temperature is 51.1° F. The mean for the summer months is 74.1° F. July is the warmest month, with a mean of 76.5° F., and January is the coldest, with a mean of 25.1° F. The lowest temperature recorded is -26° F. in January, and the highest 110° F. in August.

The average date of the last killing frost in the spring is April 28 and that of the first in the fall, October 3. This gives an average growing season of 158 days, which is ample for the maturing of all crops commonly grown. In the 20 years from 1895 to 1914 there were three seasons during which the period between killing frosts was 15 or more days less than the average. Killing frosts have been recorded as late in the spring as May 6 and as early in the fall as September 20.

During most of the year prevailing winds are from the north and west, but in May, June, July, and August they are usually from a southerly direction. The proportion of clear, sunshiny days is relatively high.

The table following gives the more important climatic data as recorded at the Weather Bureau station at Central City.

Normal monthly, seasonal, and annual temperature and precipitation at Central City

[Elevation, 1,702 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1918)	Total amount for the wettest year (1905)	Snow average depth
	° F.	° F.	° F.	Inches	Inches	Inches	Inches
December.....	28.4	69	-20	0.66	1.17	0.04	4.1
January.....	25.1	66	-26	.37	1.00	.58	5.9
February.....	29.2	64	-16	.66	.48	.32	6.4
Winter.....	27.6	69	-26	1.69	2.65	.94	16.4
March.....	39.3	78	2	1.01	.39	.58	5.5
April.....	48.9	86	20	2.60	1.28	4.12	1.6
May.....	61.3	95	35	3.82	2.84	7.85	.0
Spring.....	49.8	95	2	7.43	4.51	12.55	7.1
June.....	72.0	107	42	4.31	1.66	5.95	.0
July.....	76.5	103	45	4.18	2.69	5.62	.0
August.....	73.9	110	40	3.04	2.19	5.75	.0
Summer.....	74.1	110	40	11.53	6.54	17.32	.0
September.....	66.3	100	26	2.64	1.11	6.50	.0
October.....	54.7	91	18	2.01	2.78	.79	.4
November.....	38.2	76	-4	.85	1.71	2.04	2.5
Fall.....	53.1	100	-4	5.50	5.60	9.33	2.9
Year.....	51.1	110	-26	26.15	19.30	40.14	26.4

AGRICULTURE

The agricultural possibilities of the area now included in Merrick County were early recognized by immigrants on their way to the gold fields in California. The earliest permanent settlement was made in 1859, near the present station of Lockwood, in the extreme southwest corner. Later settlement spread throughout the Platte Valley, and in 1864 the number of inhabitants had increased sufficiently to organize the county. The Union Pacific Railroad reached the area in 1866, and within the next few years all the available land had been homesteaded. Sod corn was usually the first crop grown, which, together with game and pork, formed the chief food. As conditions became more stable, wheat, oats, flax, barley, and rye were grown.

The early agricultural development was slow. The settlers had little capital to meet the reverses which commonly beset the pioneer, and were not familiar with local climatic and soil requirements. Grasshoppers were very injurious during the early years, and destroyed the greater part of the crops in 1864, 1866, and 1869. The farming methods were crude, and in consequence the yields were often low. These conditions combined to discourage the settlers, so that many of them left the county, but those who remained acquired large tracts of land and usually became prosperous. At present there is a tendency to improve the crops by seed selection and to increase the productiveness of the soil by crop rotation, manuring, and grow-

ing leguminous crops, such as clover and alfalfa, but there is still much room for improvement in farming methods.

The agriculture of Merrick County at present consists of diversified farming, including the production of grain and hay and the raising of livestock. According to the last census reports the principal farm crops are corn, wheat, wild hay, oats, alfalfa, 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 Merrick County:

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

Crop	1879		1889		1899		1909		1919	
	Area	Production								
	<i>Acres</i>	<i>Bushels</i>								
Corn	16,632	583,731	53,601	1,957,295	74,630	2,377,240	64,648	1,960,706	67,046	1,728,228
Oats	5,179	129,225	21,831	559,822	28,035	945,400	13,672	386,868	17,689	553,677
Wheat	21,758	176,547	1,305	16,718	2,671	32,900	28,147	589,196	40,373	592,343
Rye	1,114	14,230	1,118	14,147	6,950	93,830	523	6,317	3,575	46,877
Barley	907	17,018	442	10,665	1,422	36,790	254	5,570	2,232	51,504
Buckwheat	38	298	253	2,547	1	10				
Flaxseed			907	6,852	25	300	12	15		
Potatoes		35,508	916	77,714	748	87,126	610	52,163	718	33,322
Other vegetables					478		224		21	
		<i>Tons</i>								
Hay (all kinds)	7,049	12,239	54,322	73,067						
Timothy							65	114	71	134
Timothy and clover							1,093	1,907	411	523
Clover					579	950	132	309	173	226
Alfalfa					805	2,224	6,259	17,987	13,494	30,382
Millet and Hungarian grass					631	1,293	212	387		
Wild grasses					63,478	70,422	43,167	66,751	25,270	30,099
Coarse forage					378	1,682	102	438	2,186	5,195
Sugar beets					561	4,235	12	59		
						<i>Quarts</i>		<i>Quarts</i>		<i>Quarts</i>
Strawberries					12	15,150	12	11,777	2	1,157
	<i>Trees</i>	<i>Bushels</i>								
Apples			3,498	656	8,550	3,656	11,349	11,776	5,039	3,605
Peaches			134	5	1,640	18	3,857	66	77	6
Pears			52		269	2	490	79	153	46
Plums			12,010	1,116	5,621	786	3,268	287	379	53
Cherries			1,290	11	3,232	185	2,333	208	1,893	1,001
	<i>Vines</i>	<i>Pounds</i>								
Grapes					3,522	9,248	8,060	41,490	861	1,288

The farming methods are fairly uniform throughout the county, although the relative importance of various practices varies with the sections. The proportion of land used for grazing and hay production is much larger throughout the few square miles of rough uplands in the northwestern corner, the poorly drained bottom lands along streams, and the less stable sands of the terraces than elsewhere in the county. A larger proportion of the heavier-textured, well-drained terrace soils than of the more sandy types is used for alfalfa.

According to the Federal census, the value of all cereals produced in Merrick County in 1919 was \$4,146,200; hay and forage crops, \$1,114,753; dairy products, excluding home use, \$274,361; and poultry and eggs, \$238,361. The value of domestic animals on farms is given as \$3,597,053.

Corn is the leading crop, and is the chief cash crop where not fed to livestock. The census reports 67,046 acres in corn in 1919 and a production of 1,728,228 bushels. The Nebraska Department of Agriculture reports 61,642 acres in corn in 1922, with a total yield of 1,541,150 bushels, an average of 25 bushels per acre. On farms operated by owners most of the corn is fed to hogs, beef cattle, and work stock, but on tenant farms more of the crop is sold. There are 62 silos in the county, and on farms where these occur from 15 to 20 acres of corn are cut for silage each year. 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. A small acreage is annually cut for forage. Many farmers fence off a few acres of unhusked corn for hog range, and a few husk only enough to feed their work stock, allowing the cattle for market to feed in the fields until fattened. The less progressive farmers grow corn on the same land several consecutive years, but much better yields are obtained where it is grown in rotation with small grains and alfalfa. In recent years considerable attention has been given to the improvement of the seed corn, although seed selection is not generally practiced. All the corn is of the dent varieties, Reid Yellow Dent being the most common. The crop is raised on all the soils of the county except those of the poorly drained flood plains and on the sandier members of the Valentine series, the heavier-textured terrace soils being preferred on account of the higher yields.

Wheat ranks second in acreage. At present winter wheat is grown practically to the exclusion of spring wheat, as the yield fluctuates less and there is less loss from drought and rust. The area devoted to both winter and spring wheat, according to the Federal census, was 40,373 acres in 1919, with a total yield of 592,343 bushels. The Nebraska Department of Agriculture reports 34,416 acres in winter wheat, with an average yield of 17 bushels per acre, and 129 acres in spring wheat, yielding an average of 12 bushels per acre in 1922. Turkey and Kanred are the leading varieties of winter wheat. The strains are kept pure by the more progressive farmers, but on many tenant farms they have been mixed. Wheat is planted upon the heavier, well-drained soils of the county, as it does not do well upon the sandy types. The crop is usually cut with a binder, but in exceptionally dry seasons, when the stems are too short for binding, the grain is headed. The crop is shocked or stacked in the field for threshing. Most of the wheat is sold direct from the threshing machine, but some is stored for a higher market.

The census reports 17,689 acres in oats in 1919, and a yield of 553,677 bushels. In 1922, according to the Nebraska Department of Agriculture, there were 15,519 acres in oats, yielding 434,532 bushels, or an average of 28 bushels per acre. Kherson is the leading variety. Very little effort is made to control smut, although the disease sometimes lowers crop yields during wet seasons. Oats are usually cut with a binder and either shocked or stacked for threshing. The grain is fed to horses and other stock and a small percentage is sold, the straw being left in the field, and the stock given access to the stacks. Oats are grown on all but the sandier and more poorly drained soils of the county, but the crop does best upon the heavier-textured soils of the terraces.

Among the grain crops rye ranks next to oats in acreage. In 1919 there were 3,575 acres in rye, and a total yield of 46,877 bushels. In 1922 the acreage had decreased to 1,954, yielding 31,264 bushels, an average of 16 bushels per acre. The crop is grown chiefly upon the heavier terrace soils, although it does fairly well upon the sandy types of the county. It is more drought resistant than wheat and will flourish on soils of a more impoverished nature. The crop is generally raised for the grain, although 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 either from shocks or stacks, the latter method being used when the crop is headed. Most of the rye is fed on the farms where produced.

Barley ranks next to rye in acreage. The last census reports 2,232 acres in barley in 1919, and a yield of 51,504 bushels. In 1922 the acreage had decreased to 1,208, yielding 26,576 bushels, or an average of 22 bushels per acre. This crop is grown locally upon the terraces and flood plains for feed, and does exceptionally well upon the moist but not wet bottom-land soils. The crop is cut with a binder and later threshed, the straw usually remaining in the fields as left by the thresher, and stock allowed to feed upon the stacks.

Among the hay crops wild hay occupies the leading acreage, being cut from 25,270 acres in 1919, with a total yield of 30,099 tons. In 1922 the acreage had decreased to 22,145, yielding 24,360 tons, or an average of 1.1 tons per acre. Wild hay is cut chiefly upon the poorly drained bottom lands of the county and the more sandy soils of the terraces. The higher yields are obtained from the poorly drained soils, although the hay upon the better-drained types grows less rank, is finer in texture, and has a higher feeding value. The hay is stacked in the field and either baled for market or hauled to the feed lots as needed for feeding work stock and cattle.

Alfalfa ranks next to wild hay in acreage. The Federal census reports 13,494 acres in 1919, and a yield of 30,382 tons. In 1922, according to the Nebraska Department of Agriculture, the area devoted to this crop had decreased to 10,419 acres, yielding 29,172 tons, or 2.8 tons per acre. Alfalfa does well on all the well-drained calcareous soils of the county, but is not adapted to the sandy Valentine types on account of their low lime content. The crop is usually cut three times during the season and occasionally a fourth cutting is obtained. Alfalfa is generally stacked in the field and hauled to the feed lots as needed as feed for cattle and hogs. Hogs are often allowed to run in the fields during the summer, but cattle are seldom grazed on green alfalfa on account of the danger of bloating. The crop is an excellent one for building up depleted soils and is often used in rotations, but is not in favor for short rotations, as most farmers prefer to keep the stand for several years before changing to other crops.

Among the minor crops sorgo (sweet sorghum), millet, Sudan grass, sweet clover, and red clover are the most important, and are grown chiefly for feed. Small patches of potatoes are grown on most farms for home consumption. Watermelons and cantaloupes are raised in a small way on the sandy soils of the terraces and bottom lands, and are sold mostly in the surrounding towns. On many of the farms there are small orchards of fruits of differ-

ent sorts, but the trees are usually in poor condition, as little attention is given to pruning and spraying. The local demand for fruit is not supplied, and it would seem that fruit growing, especially on the heavier terrace soils, could be profitably extended. Apples, cherries, plums, peaches, and pears are the most important cultivated tree fruits. Of the wild fruits, plums and grapes are abundant during favorable seasons along the larger streams.

The livestock industry holds an important place in the agriculture of Merrick County. The raising of cattle is the most important branch of the industry. According to the census, there were 33,257 cattle in the county in 1920, of which 24,039 were beef cattle, valued at \$1,308,164. Most of the herds are of grade stock headed by a purebred bull. The quality of the beef cattle in general is very good. The principal breeds are Hereford and Short-horn. There are 91,952 acres of pasture land in the county, and a few farmers purchase stock for summer grazing, but most of the range cattle are raised locally. There are several large cattle feeders in the county who annually ship in stock for winter fattening, the fattened animals being shipped to the Omaha markets.

Dairying receives little attention. There are a few purebred dairy herds, but no farms are devoted exclusively to the dairy industry. Holstein and Guernsey are the leading dairy breeds. Nearly every farmer milks a few cows, chiefly of the beef breeds, and sells the surplus dairy products to the local creamery in Central City. The census reports 9,218 dairy cattle, valued at \$474,156, in the county in 1920.

Hog raising is an important branch of the livestock industry. Nearly every farmer fattens a few hogs for market each year, and many have large herds. The Federal census reports 32,747 hogs in the county in 1920, with a total value of \$710,787. Poland-China, Duroc-Jersey, and Hampshire are the leading breeds. A few farmers have purebred herds, though most of the animals are grade stock. It is common practice to fatten the hogs on corn either in feeding yards or by turning the stock into the fields and allowing them to "hog down" the corn in the fall. Alfalfa is usually 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 cut. Many herds have been greatly reduced or entirely destroyed in the past by hog cholera, but much attention is now given to vaccination and sanitation in combating this disease, and losses have been largely eliminated.

Practically all the farmers raise their own work stock, and occasionally have a team to sell. The horses are of heavy draft type, ranging in weight from 1,300 to 1,500 pounds. The stallions are purebred, but the majority of the mares are grades. A few mules are raised. The census reports 8,105 horses, valued at \$690,895, and 738 mules, with a value of \$88,231, in the county in 1920.

The sheep industry is confined largely to the fattening of ewes and lambs. One of the largest feeders in the State operates in Merrick County and annually fattens several thousand sheep for the Omaha markets. The census reports 33,349 sheep, valued at \$322,072, in the county in 1919.

Poultry constitutes an important source of farm income. A small flock of chickens is raised on nearly every farm. The local demand for poultry products is usually good and the poultry industry is receiving increased attention. The Leghorn, Plymouth Rock, and Rhode Island Red are the principal breeds. Some ducks, geese, turkeys, and guinea fowls are raised. The Federal census reports 122,559 chickens and 3,718 other poultry in the county in 1919, valued at \$109,290.

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 Valentine soils on account of their low lime content and unstable nature, but that it does exceptionally well upon the well-drained Hail soils. As a rule the heavier and deeper soils are recognized to be better adapted to general farm crops than sandy soils. Under average prevailing conditions the hard lands are believed to be better suited to the small grains and forage crops and the sandy lands to such crops as rye, corn, and potatoes. The wet bottom lands and the more open and droughty members of the O'Neill series are used for pasture land and hay production.

Systematic crop rotation is not practiced, although many farmers have more or less indefinite systems and change crops with reasonable regularity. When alfalfa sod is broken the land is generally used for corn 2 years, oats 1 year, wheat 1 year, and back to corn. A system which includes no legume consists of corn 3 years, wheat 2 years, oats 1 year, and back to corn. Some of the tenant farmers grow corn on the same land several consecutive years. The more progressive farmers usually grow alfalfa or clover in their rotations. Corn is probably better adapted to recently broken alfalfa ground 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.

Land to be used for wheat is usually plowed late in the summer, after the busy season is over; this practice, however, does not give sufficient time for the proper aeration and mellowing of the soil before time to plant the grain. A few farmers take advantage of heavy rains to plow deep and mulch with a harrow to retain moisture, but the majority seldom plow deeper than 3 or 4 inches. Wheat is planted in the fall with a press drill. Sometimes wheat is sown between corn rows before the corn is shucked. When corn follows corn or small grain it is frequently listed in without any previous preparation of the ground. Some farmers disk the old corn or stubble land before listing, and a few plow the land. Oats are sown in the same manner as wheat, except that the grain is drilled in as soon as the frost is out of the ground in the spring and the soil conditions are favorable. Alfalfa requires a smooth, mellow seed bed and is usually planted after wheat. The seed is generally sown broadcast and harrowed in, though occasionally it is sown with a press drill to obtain a more even stand. Alfalfa usually does well when sown immediately after the first good rain in August, as the soil is then sufficiently moist to insure seed germination. From 12 to 15 pounds of seed per acre is considered sufficient.

The farms, as a rule, are well improved. The houses and barns are usually painted and kept in good repair. The land is fenced and cross fenced, mostly with barbed wire, though considerable woven-wire fencing is used around the feed lots and alfalfa fields. Modern labor-saving machinery is in general use. Most farms are equipped with grain drills, mowers, rakes, binder, riding cultivators, stirring plows, and disk harrows. A few also have corn binders and hay balers. Only the more expensive farm machinery is sheltered.

The Nebraska Department of Agriculture reports modern heating systems on 64 farms, modern lighting on 85, and modern water systems on 43, in 1922. According to the same report there are 375 gas engines, 64 tractors, 24 trucks, and 836 automobiles on the farms.

Commercial fertilizer is not used in Merrick County and green crops are seldom plowed under. Barnyard manure is applied to the land when available, but the supply is usually insufficient to have much effect upon crop yields, the land in the immediate vicinity of the barnyards usually receiving the greater part of the manure, especially on the tenant farms. The need of fertilizer is not yet apparent, as the land is new and in no imminent danger of becoming exhausted.

Farm labor is scarce, especially during the busy season. Wages range from \$35 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 1922. Corn shuckers receive from 4 to 5 cents a bushel. Most of the laborers are natives. 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 849 in 1879, 1,090 in 1889, 1,291 in 1899, 1,279 in 1909, and 1,364 in 1919. The proportion of the county in farms increased from 43.9 per cent in 1879 to 92.8 per cent in 1919. The average size of the farms in 1920 was reported to be 201.6 acres. The proportion of improved land in farms was 56.2 per cent in 1880, 93.8 per cent in 1910, and 81.3 per cent in 1920. The farms vary widely in size, but most of them contain between 160 and 320 acres. According to the Nebraska Department of Agriculture there were 127,180 acres under cultivation in 1922.

The average value of all farm property per farm, including land, buildings, machinery, and domestic animals, was \$2,184 in 1880, \$5,546 in 1890, \$6,708 in 1900, \$16,482 in 1910, and \$32,768 in 1920.

In the last 40 years the proportion of farms operated by owners has greatly decreased, being 83.3 per cent in 1880 and only 57.4 per cent in 1920. The owners occupied 738 farms and tenants were on 554 farms during 1920.

The share rental system predominates in Merrick County, although a combination of share and cash rent is used on some farms. Under the share system the tenant furnishes all equipment, labor, and seed, and receives two-fifths to one-half of the crops. On many farms the tenant receives two-fifths of the grain and one-half of the hay. On some farms the renter is allowed the use of the pasture land without charge.

Land values range from about \$30 to \$200 an acre. The upland farms are for the most part badly eroded and sell for \$40 to \$60 an acre. The hard terrace soils command \$75 to \$175, and those of sandy nature \$40 to \$100 an acre. The sandy soils of the Valentine series sell for \$50 to \$90 an acre.

SOILS ²

The soils of Merrick County differ widely in their physical and chemical characteristics. These differences are the result of two factors: (1) The character and mode of accumulation of the parent materials from which they have weathered, and (2) the degree and kind of weathering to which the parent materials have been subjected. The latter factor, which is controlled to a large extent by topography, drainage, and climate, has had the greater influence in determining the present character of the soils in this county. Especially is this conclusion favored, since the parent materials are quite similar in general character, while the soils differ widely. The most obvious differences and those which can be readily ascertained in the field are variations in the lime and organic-matter content and in the texture and structure of the different soils. These differences are due to variations in the degree of weathering, leaching, and oxidation to which the parent materials have been subjected since their deposition.

The most mature soils of the county, or those which have been subjected to undisturbed weathering for the longest time, have developed a dark-brown surface layer, the result of accumulation of large quantities of organic matter, which has been derived mainly from the decay of grass roots and consists of finely divided, well-decomposed and well-incorporated organic material intimately combined with the mineral part of the soil. The surface soil has a fine granular structure, and may vary in texture from silt loam to loamy sand. The upper subsoil or subsurface layer is brown in color and is slightly more compact than the layer above it, while immediately below it lies a heavier and considerably more compact layer, the transition taking place gradually at about 18 inches. The layer ranges from about 6 inches to a foot in thickness. The lower part of the subsoil and extending into the substratum is rather light in color and flourlike in structure, normally consisting of a light-brown or light-gray, loose, silty material. Such carbonates as may have been present in what is now the upper 3 feet of the soil section have been removed, but are normally present in the underlying parent loess or loesslike deposit. The soil profile shows evidence of having been developed under conditions of good surface and subsoil drainage, which has favored thorough leaching and oxidation. It is present in the smooth, well-drained upland and terrace parts of the county, where the material has lain in its present position undis-

² Merrick County adjoins Hall and Howard Counties on the west, and Platte County on the east. In places the maps of these counties do not appear to agree along the boundaries. The Cass fine sand is mapped in Hall County, and on account of the small area of this type in Merrick County and the gradual change in texture, has not been extended into Merrick County, but has been included with the more extensive Cass loamy sand. For a like reason slight changes in texture may be noted in the names of some of the O'Neill and Gannett types along the Howard and Platte County boundaries.

turbed by erosion for a considerable time. In Merrick County the soils characterized by the described profile include the members of the Waukesha series and a flat phase of the Marshall series.

The soils of the O'Neill series may also be classed with the well-drained, well-oxidized, and thoroughly leached group, but the material of the lower subsoil is sandy and gravelly.

Throughout most of the small upland area in the northwestern part of the county the land is rough and dissected. Constant erosion has prevented the accumulation of much organic matter in the soil, and the rapid removal of the surface water from the slopes has not permitted leaching of the carbonates from the subsoil faster than new material has been exposed on the surface by erosion. The surface soil is thin and usually lighter in color than that of the rest of the Marshall group. The brown, slightly compact upper subsoil is seldom present and the surface soil rests directly upon the light-colored parent material. In many spots erosion has entirely removed the dark surface layers, exposing the light-gray, highly calcareous subsoil. This shallow soil, having a high lime content, is classed as a shallow phase of the Marshall group, and represents an immature stage of soil development.

A characteristic group of soils in Merrick County have developed on terrace materials. The surface layers are similar in color and structure to those of the group including the Waukesha series, but the subsoils differ in that they still contain carbonates. The surface soils are dark brown to black, but the black layer is normally not quite so thick as in those of the Waukesha series. The upper part of the subsoil has a brownish cast, but becomes gradually lighter in color with depth and is usually light gray or almost white and highly calcareous below 24 inches. The soils characterized by this profile are classed with the Hall series, and represent a slightly less mature stage of development than those of the Waukesha series.

The soils of the Valentine series and the areas of Dunesand have been developed from accumulations of wind-blown or water-laid sand. These accumulations are either of such recent origin or have been so continuously shifted about by the wind that they have accumulated very little organic matter. The soil material is almost entirely quartz. Any soluble carbonates which it may have contained were rapidly leached away through the loose porous sands. The profile is immature and the material consists of a gray or grayish-brown, loose, incoherent sand, the surface of which has been only slightly darkened by organic matter.

Some of the soils of Merrick County have been developed under conditions of poor drainage and oxidation has been much retarded. They include the Gannett series of the basinlike depressions and the Cass, Lamoure, and Sarpy series of the flood plains. The moist conditions have especially favored the accumulation of organic matter, so that all the poorly drained soils, except those of the Sarpy series, which are of the most recent origin, have dark-colored surface layers. The subsoils usually have a grayish cast or are mottled yellow and gray. The soils of the Lamoure series are the only members of this group which have retained any large amount of carbonates.

The principal characteristics previously described have been those imparted to the soils by the various weathering processes, including leaching, oxidation, and the accumulation of organic matter. In the following pages consideration is given to the characteristics due to the composition and processes of accumulation of the parent materials from which the soils have developed. On this basis the soils are divided into three groups—loessial, alluvial, and æolian.

The thick, smooth mantle of silty material that once covered the county has been extensively removed by erosion and at present occupies only a few square miles in the extreme northwestern part. In its unweathered condition this material is even-textured and composed largely of silt particles. It varies in color from brownish yellow to yellow or almost white, and is characterized by a tendency to split into vertical planes producing perpendicular bluffs along watercourses and roads and other places subject to erosion. Lime is abundant, and a small percentage of iron stains the material in many places.

Except for the small area occupied by these silty deposits, the county is covered by a rather deep layer of stream alluvium. This rests upon a sand sheet, probably of glacial origin, which also underlies the loessial material. In many places the surface materials of the alluvial deposits have been so modified by wind action that the resultant soils have been classed with the æolian or wind-blown group.

The alluvial material is of recent age and falls into two divisions: (1) Terraces, sometimes called benches, and (2) first bottoms or flood plains. The terraces lie above the limits of overflow; the first bottoms are subject to flooding in many places. The original loessial deposit has been removed from the greater part of the county by erosion of the Platte and Loup Rivers and their tributaries, creating the broad Platte Valley or Platte Plain. This erosion has not always advanced at a uniform rate. There were periods in which stream cutting practically ceased and the valley was filled with sediment to the level of the highest terraces, but later stream intrenchment below the terrace levels and subsequent depositions of sediment during floods created lower terraces and the present flood plains.

The character of the sediment deposited by the streams depended largely upon its source and upon the degree of mixing and assorting to which it had been subjected prior to its final deposition. The material carried by the Platte and Loup Rivers came not only from the local loessial uplands and from the sand sheet underlying the loess, but also included heterogeneous sediments derived from soil provinces to the west. The alluvial sediments derived from such a variety of materials was naturally complex, and was made more so by stream assortment.

When a stream carries sediment of a variety of textures the coarser material is deposited near the channel and the finer farther back, owing to the assorting power of currents of varying velocities. In places, however, fine materials are found near the stream, this being due to a comparatively recent change in the position of the channel, at which time the old stream bed of sand or silt may be covered with a finer-textured material. During periods of overflow immense de-

posits of sand, silt, or clay may result in changing the texture and other characteristics of the soils. Strata of widely varying textures may thus overlies one another, depending upon the water level and the course of the stream at the time of deposition. The alluvial materials of Merrick County, having been derived from so many different sources and having been assembled and assorted in such complex manner, have naturally given rise to soils varying in texture from heavy clays to coarse sands and gravels.

The alluvial soils have been classed with the O'Neill, Hall, Waukesha, Cass, Sarpy, and Lamoure series, and with Riverwash, a miscellaneous material consisting of sand bars, islands, and flats within or along the stream channels. The first three series mentioned occupy well-drained terrace positions and the others occur upon the bottom lands or flood plains. The O'Neill, Cass, and Sarpy soils, together with Riverwash, have been derived from sediments of a coarse sandy nature, while the Hall, Waukesha, and Lamoure soils are composed largely of fine-textured or silty material.

The Gannett soils may also be classed with those derived from alluvial deposits. They occupy shallow depressions upon the terraces, in which water accumulates during periods of high rainfall. In wet seasons some of the depressions fill with water and become temporary lakes.

The æolian or wind-blown materials occur where the wind has whipped the surface of the less stable alluvial deposits into an uneven relief. They have given rise to the areas of Dunesand and the soils of the Valentine series. The Dunesand occupies the rougher parts of the alluvial lands where the wind has piled the incoherent sands into ridges and hills varying in height from 20 to 40 feet. Sand blow-outs are numerous, though at present a negligible part of the Dunesand is subject to active erosion. The Valentine soils are more stable than Dunesand. They have a thicker grass covering and the relief is not so pronounced, the surface consisting of numerous low, rounded knolls and ridges separated by intervening shallow depressions. The topography has a choppy or hummocky appearance.

In the system of mapping employed by the Bureau of Soils the soils are grouped into series on the basis of similarity in color, structure, and other characteristics of the soil profile, and in the source, character, and process of accumulation of the material from which they have been developed. The soil series are divided into types on the basis of texture, or the relative proportion of the different-sized mineral particles composing the surface soils.

Brief descriptions of the several series found in Merrick County follows:

The Marshall series, derived from loess materials, includes types with dark-brown to black surface soils and a yellowish-brown subsoil. The depth and color of the surface layers depend largely upon the topography, being deepest and darkest on the more nearly level areas. The subsoil is usually calcareous, except in the flatter positions, where most of the lime has been leached out below 3 feet. The topography ranges from almost level to steeply rolling, and in places is hilly and dissected. Drainage is usually good, and in the rougher areas is excessive. In Merrick County no typical Marshall

soil is developed, although a flat phase and a shallow phase of the Marshall silt loam are mapped.

The Valentine series consists of types with brown to grayish-brown surface soils. The subsoil is a light-brown to brown loose sand. The surface soils contain small amounts of organic matter and clay, which give some of them a loamy character. Both soil and subsoil are low in lime. These types are developed on low, stationary sand hills. The topography varies from almost flat to sharply rolling, but in Merrick County it is mainly choppy to hummocky. The Valentine sand and loamy sand are mapped.

The soils of the O'Neill series are brown to dark brown and the subsoil is light-brown to gray, loose, incoherent sand and gravel. The types of this series are low in lime. They occupy terrace positions and have weathered from sandy alluvial deposits. Drainage is good and in many places excessive. Three types, the O'Neill loam, sandy loam, and loamy sand, are mapped.

The Hall series consists of types with dark-brown to black surface soils, underlain by a brown, slightly compact upper subsoil, which merges into a gray or grayish-yellow floury silt below an average depth of 24 inches. The lower subsoil is highly calcareous. The series has weathered from silty alluvial deposits derived chiefly from areas of loessial soils. It occurs upon terraces that are at present well drained. The topography is flat to very gently undulating. The members of this series differ from those of the Waukesha chiefly in the higher lime content of the subsoil. Four types, the Hall clay loam, silt loam, very fine sandy loam, and fine sandy loam, are mapped in Merrick County.

The Waukesha series is characterized by dark-brown to black surface soils underlain by a brown to yellow subsoil. The subsoil is heavier than the soils, but not compact or impervious. The series is only moderately calcareous, as the lime has usually been leached from the material to depths below 3 feet. The soils occupy terrace positions and are derived from transported and reworked loessial material carried down by the streams and deposited upon their former flood plains. The topography is flat to very gently undulating. The soils differ from those of the Marshall series in the mode of their formation, lower position, and more generally level topography. The subsoil of this series also has a lower lime content than the Marshall subsoil. The Waukesha fine sandy loam, very fine sandy loam, and loam are recognized in Merrick County.

The surface soils of the Lamoure series are dark brown to black. The subsoil varies from grayish brown to gray or mottled gray and brown, and as a rule is heavier in texture than the surface soil. The subsoil is very calcareous and in places the surface soils are also calcareous. The types have poor drainage and are locally subject to overflow. They occupy the flat stream bottoms and also occur upon the poorly drained portions of the lower terraces. They have weathered from silty loessial sediments deposited by the streams during periods of overflow. Three types are mapped in Merrick County—the Lamoure clay loam, very fine sandy loam, and fine sandy loam.

The Cass series includes types having dark-brown to black surface soils and a brown to gray lighter-textured subsoil, which passes with-

in the 3-foot section into gray sand or a mixture of sand and gravel. The types are usually low in lime, though locally they contain a little calcareous material throughout the soil profile. The soils occupy the lower stream bottoms and are subject to overflow during periods of high water. They have weathered from sandy alluvial deposits and differ from the Lamoure types in the more sandy nature of the subsoil. Five types, the Cass loamy sand, sandy loam, fine sandy loam, very fine sandy loam, and clay loam, are mapped in this county.

The soils of the Sarpy series are similar to those of the Cass in all respects except the lower content of organic matter and consequently lighter color of their surface layers. Only one type, the Sarpy sand, is recognized.

The Gannett series comprises types with dark-gray to black surface soils and a grayish or pale-yellowish sandy subsoil. They occupy shallow, poorly drained depressions. Only one type, the Gannett loamy sand, is recognized in this area.

Riverwash and Dunesand are miscellaneous materials which belong to no soil series. Both are composed of almost pure sand. Dunesand has a hilly, dunelike topography and is subject to drifting. Riverwash includes sand bars, islands, and flats along the Platte River.

In subsequent pages of this report the various soil types are described in detail and their relation to agriculture is discussed. The accompanying map shows their distribution in the county. The following table gives the actual and relative extent of the soils mapped:

Areas of different soils

Soil	Acres	Per cent	Soil	Acres	Per cent
Cass fine sandy loam.....	43, 648	14.3	Dunesand.....	7, 936	2.6
Valentine sand.....	27, 328	9.0	Cass clay loam.....	7, 168	2.3
O'Neill sandy loam.....	23, 360	7.7	Cass very fine sandy loam.....	6, 848	2.2
Lamoure clay loam.....	22, 336	7.3	Waukesha very fine sandy loam.....	4, 032	1.3
Lamoure fine sandy loam.....	18, 752	6.2	Valentine loamy sand.....	3, 904	1.3
Cass sandy loam.....	18, 048	5.9	Marshall silt loam, shallow phase..	2, 624	.9
Hall fine sandy loam.....	16, 640	5.5	Riverwash.....	1, 792	.6
Waukesha loam.....	16, 640	5.5	Hall clay loam.....	1, 088	.4
O'Neill loamy sand.....	15, 680	5.1	Sarpy sand.....	1, 088	.4
Cass loamy sand.....	14, 720	4.8	Hall silt loam.....	1, 024	.3
Hall very fine sandy loam.....	14, 464	4.7	Gannett loamy sand.....	512	.2
O'Neill loam.....	12, 800	4.2	Marshall silt loam, flat phase.....	320	.1
Waukesha fine sandy loam.....	11, 840	3.9			
Lamoure very fine sandy loam.....	10, 048	3.3	Total.....	304, 640	-----

MARSHALL SILT LOAM, FLAT PHASE

The Marshall silt loam, flat phase, is identical with that mapped in Howard County on the west. The surface soil is a very dark grayish-brown heavy silt loam, 8 to 15 inches deep. It has a higher percentage of clay, more granular structure, and slightly heavier texture than the average silt loam. The soil is rich in organic matter and appears black when wet. The next horizon is brown, has a silty clay texture, is slightly compact, and extends to an average depth of 24 inches. The upper 6 or 8 inches of this horizon is finely granular, below which the structure becomes coarsely granular to cloddy. The brown horizon is underlain by 18 to 20 inches of

light-brown friable silt having a slightly columnar structure but still retaining some of the coarsely granular to cloddy characteristics of the layer above. Below an average depth of 4 feet the subsoil changes rather abruptly to a light yellowish-gray, loose, floury silt or silty clay, which merges with the parent loess at $4\frac{1}{2}$ to 5 feet. The subsoil is not calcareous within a depth of 3 feet. Below about 40 inches, however, there is abundant lime, both in the finely divided form and as angular concretions from one-sixteenth to one-eighth inch in diameter.

The profile previously described is fairly uniform throughout the area of Marshall silt loam, flat phase, in Merrick County. In a few places, however, the lower part of the brown horizon becomes decidedly compact. Had this condition prevailed extensively such areas would have been classed with the Grundy silt loam, but owing to their small extent they were not separated on the soil map.

The soil profile of this phase differs little from the typical Marshall silt loam as mapped in the more eastern counties of the State. Its topography, however, is more generally flat, and for this reason it has been included with the flat phase of the type. It differs from the shallow phase of the Marshall silt loam in its more level topography, deeper and darker surface soil, and lower lime content.

The phase is confined to one small body of about 320 acres in the extreme northwestern part of the county. It is well drained, occupies one of the highest topographic positions, and has weathered on a remnant of the original loess plain that has not yet been reduced by erosion.

The phase is of little agricultural importance in this county, on account of its small extent. It is, however, the strongest upland soil, and practically all of it is under cultivation. Wheat, corn, alfalfa, and oats are the principal crops, although rye, barley, sorgo, and millet are often grown in small patches for feed. Wheat is the chief cash crop. Hogs are raised extensively, and every farm supports enough cows to supply the home dairy needs. Cattle grazing is not practiced, as the land gives larger returns from cultivated crops. Grain yields vary widely from year to year, depending upon the rainfall and upon the care taken in preparing and cultivating the land. The average yield of wheat is about 20 bushels, corn 30 bushels, oats 30 bushels, and alfalfa $3\frac{1}{2}$ to 4 tons per acre from three cuttings. During years of exceptionally high rainfall a fourth cutting of alfalfa is often obtained.

The soil of this phase can be handled under a rather wide range of moisture conditions, considering its heavy silty texture. When plowed wet the land has a tendency to clod, but the lumps are easily reduced. Corn is usually listed, though a few farmers prefer to check plant. Winter wheat is grown more extensively than the spring varieties. It usually is drilled on old corn or stubble ground after thorough plowing and harrowing. Oats are sown with a press drill as early in the spring as the condition of the soil will allow. Alfalfa seed is sown broadcast on well-prepared stubble ground. The stand usually is allowed to remain six or seven years before planting the land again to grain crops. Crop rotation is not systematically practiced, although more or less indefinite systems subject to numerous substitutions are followed and the crops are changed

with comparative regularity. Commercial fertilizer is not used, but barnyard manure is applied to the land when available.

The selling price of the Marshall silt loam, flat phase, will average about \$125 an acre in this county.

MARSHALL SILT LOAM, SHALLOW PHASE

The surface soil of the Marshall silt loam, shallow phase, is a grayish-brown to dark grayish-brown mellow silt loam, 4 to 10 inches deep, of a fine granular structure. The material contains considerable clay and becomes moderately compact if worked when wet. The surface soil passes abruptly into a light-brown silt loam, which continues uniform to an average depth of 18 inches. This horizon is coarsely granular to cloddy and slightly more compact than the layer above. There is, however, no suggestion of a clay pan, as the material is easily crushed between the fingers. The third horizon is a gray, loose, friable silt which merges with the light-gray to almost white parent loess at about 3 feet. As the color indicates, the type contains considerably less organic matter than the Marshall silt loam, flat phase. The surface layer of 6 inches is moderately well supplied, but the content of organic matter decreases with depth, and below 24 inches it is almost entirely absent. The subsoil below 14 inches is highly calcareous and lime concretions are thickly scattered throughout the lower part.

Although the above description is typical of the greater part of the phase as it occurs in Merrick County, there is considerable variation in the depth and color of the surface soil, depending upon the topography and upon the amount of erosion to which the soil has been subjected. In many places upon the sharper crests of ridges and the steeper valley sides erosion has entirely removed the dark-colored surface layers, exposing the light-gray parent loess. Were such areas of sufficient size to warrant mapping they would be classed with the Marshall silt loam, eroded shallow phase, as was done in Howard County on the west. In this county, however, the severely eroded land, while relatively extensive, is too patchy in occurrence to warrant separation on the soil map. Upon the broader divides there are a few places that have been subjected to very little erosion, and the surface soil is dark brown to black and quite deep, but these areas were also too small to map separately.

The Marshall silt loam, shallow phase, occupies a total area of less than 5 square miles. It occurs as a narrow strip between the Howard and Nance County boundaries in the extreme northwestern part of the county. The phase has weathered upon loess under conditions which have prevented the accumulation of much organic matter in the surface layers.

The topography ranges from steeply rolling to hilly, and in places is extremely dissected. The more gradual slopes are ordinarily smooth and even, but in the dissected areas most of the slopes are gullied. Drainage is good, and in many places excessive.

The Marshall silt loam, shallow phase, is not sufficiently extensive to be of much agricultural importance in Merrick County. It is not so easily handled as the more level flat phase, but is a valuable upland farming soil. About 70 per cent of it, including the land

having the most favorable topography, is used for crop production, the rougher areas being included in grazing and hay land.

Of the cultivated crops wheat, corn, alfalfa, oats, rye, and barley are the most important. Orchard fruits appear to bear well in favorable seasons. The yields of all crops, except possibly alfalfa, are slightly lower than those obtained on the flat phase of the Marshall silt loam. The shallow phase is considered especially well adapted to alfalfa on account of the high lime content in its subsoil. The crops are planted in much the same manner as those on the flat phase, although greater care is usually taken to prevent erosion, especially on the steeper slopes. Barnyard manure is applied to the land when available.

The selling price of the phase ranges from \$50 to \$100 an acre, depending largely upon improvements and adaptability to crop production.

The chief need of this soil is the control of erosion. In its virgin state the soil is naturally productive, but its topography is favorable for erosion and the consequent removal of organic matter when the soil is under cultivation. Alfalfa or sweet clover are very valuable crops on this land and should be in the rotation as often as possible, as they prevent soil washing and at the same time add nitrogen and humus. In those fields where erosion is especially severe small dams of earth, straw, or rubbish should be placed in the gullies in order to check the velocity of the run-off.

VALENTINE SAND

The surface soil of the Valentine sand is a loose, incoherent gray to grayish-brown sand, 6 to 8 inches deep. The immediate surface usually is slightly darker than the lower part, owing to a small quantity of organic matter, but does not contain enough of this material to prevent the soil from drifting when the protective vegetation is destroyed. The subsoil is a loose, incoherent sand which extends below 3 feet. It is usually gray in color, though locally it may be tinged with light brown or pale reddish brown, and is practically devoid of organic matter. Neither the soil nor subsoil is noticeably calcareous. The sand of which the type is so largely composed consists of the medium, fine, and very fine grades, with the medium sand predominating. It is composed chiefly of quartz and feldspar grains, with barely sufficient silt and clay to render the mass slightly coherent when wet. The soil differs from Dunesand in its smoother surface and more stable nature. The sand grains are also slightly more rounded and less angular than those of the Dunesand.

The Valentine sand is rather extensively developed throughout the northern part of Merrick County, where it occurs as a broad, fairly continuous strip extending in a northeast-southwest direction. The type has been formed by the partial weathering of wind-blown sands derived in part from the sand sheet underlying the loess and partly from coarse sandy sediments which have blown from the larger stream channels. The original material has been reworked and reassorted to such an extent that it is difficult to make any positive classification in regard to origin.

The topography of the type varies from almost flat to rolling, the greater part presenting a hummocky to billowy relief. Even the flatter areas usually are modified by scattering low, rounded knolls and ridges. Drainage is entirely subterranean through the loose porous sands, which afford 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. Some corn is grown in the lower depressions, where moisture conditions are most favorable. Small grain is seldom grown on account of the loose nature of the seed bed. The type supports an excellent growth of native grasses, including sand grass, stipa, big and little bluestem, and some grama grass. These grasses will support 100 to 150 head of cattle per square mile during the summer grazing season, or when cut for hay will yield about one-half ton per acre.

The type appears to withstand drought almost as well as the Valentine loamy sand, but it is less stable and more subject to wind erosion when under cultivation. Coarse manure and straw spread over the land have proved beneficial in preventing excessive drifting. Corn usually is listed deeply.

Land of the Valentine sand sells for \$30 to \$50 an acre, depending largely upon improvements, topography, and location. It is doubtful if the native grass covering should ever be broken on this soil, as it is extremely difficult to prevent drifting under cultivation. Great care should be taken to maintain a protective covering of vegetation.

VALENTINE LOAMY SAND

The surface soil of the Valentine loamy sand is a gray to 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 the surface soil and in the resulting darker color. In a few places where conditions have especially favored the growth and decay of plant life the surface soil to a depth of 6 or 8 inches is a dark-brown to almost black loamy sand. The subsoil, beginning at an average depth of 10 inches, is a gray to yellowish-brown loose, incoherent sand, locally tinged with red. It usually contains barely enough silt and clay to make it slightly sticky when wet. Neither the soil nor subsoil has sufficient lime to effervesce with dilute hydrochloric acid.

The Valentine loamy sand occurs chiefly as small, isolated bodies scattered through areas of wind-blown soils in the northern part of Merrick County. The bodies are usually adjacent to or within areas of Valentine sand. The type is most extensively developed in the northwestern part and along the Platte River. A typical area occurs about $2\frac{1}{2}$ miles northeast of Silver Creek in the extreme northeastern part of the county.

The original source of the sand which 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 for a longer time.

The topography is flat to gently undulating. Most of the type occupies a slightly lower position than the Valentine sand and has

fewer ridges and other irregularities. Drainage is entirely subterranean, as the porous sand affords an ample outlet for all surplus water.

The Valentine loamy sand is of little agricultural importance in Merrick County, on account of its small extent, but it is a better farming soil than the Valentine sand. About 60 per cent of it is under cultivation and the rest is used for hay and pasture. A quarter section will support 40 to 50 head of cattle during the summer grazing season, or when cut for hay will yield 80 to 100 tons.

Corn is the leading cultivated crop, followed by wheat, oats, and alfalfa. Small grain and alfalfa are poorly adapted to this type, the former on account of the loose, sandy nature of the seed bed and the latter because of the low lime content in the soil, but both crops are needed in the rotation. The land is plowed every three or four years, as a thorough disking is sufficient to maintain good tilth during the intervening years.

Crop yields vary widely, depending upon the rainfall, the average yields being corn 20 bushels, oats 20 bushels, wheat 10 bushels, and alfalfa 2 to 2½ tons per acre from three cuttings.

The selling price of the Valentine loamy sand ranges from \$40 to \$75 an acre, depending largely upon location and improvements.

While the soil of this type is slightly more stable than that of the Valentine sand, it drifts badly under cultivation unless care is taken to protect the surface. Large quantities of barnyard manure and straw have proven beneficial. It is advisable not to disturb the soil until ready to plant, as it should not be left unprotected longer than is absolutely necessary.

GANNETT LOAMY SAND

The surface soil of the Gannett loamy sand is a very dark brown to black loamy sand 8 to 12 inches deep. In a few places where conditions have especially favored the growth and decay of vegetation the soil is spongy in structure and appreciably lighter in weight, closely resembling Muck. On the better-drained areas the organic content is much lower and the color lighter. The surface layer passes rather abruptly into a grayish-brown incoherent medium to fine sand, which is very low in organic matter and lacks the porous, compressible character that marks the surface soil in places. The subsoil material continues to great depths, and below 4 feet is similar to that of the Dunesand. The surface soil in most places is faintly calcareous, but there is seldom enough lime in the lower subsoil to effervesce with acid.

The Gannett loamy sand is not uniform throughout the area of its occurrence in Merrick County, but owing to the small total area of the type it was not deemed advisable to show the local variations on the soil map. The two bodies along the Howard-Merrick County line northwest of Palmer differ from the typical in that the surface soil approaches a very fine sandy loam in texture, and the subsoil contains a considerably larger proportion of silt and clay than normal, which gives the material a decidedly coherent and slightly sticky nature when wet. In Howard County such soil was more extensively developed than in this county and was classed as a heavy

phase of the Gannett fine sandy loam. In a few places a layer of coarse white sand is encountered below 30 inches.

The Gannett loamy sand does not exceed 600 acres in total area. It occupies a few poorly drained and commonly depressed areas on the terraces in the northern part of the county. Two of the largest, though not very typical, developments lie northwest of Palmer. Small bodies occur upon the terraces north of Prairie Creek in the extreme northeastern part of the county.

The Gannett loamy sand is used exclusively as pasture and hay land. In average years the grasses on one acre will support a cow or horse during the summer grazing season. When cut for hay the yield ranges from 1 to 1 $\frac{1}{4}$ tons per acre. It is difficult to obtain accurate land values for this soil, as it seldom occupies more than a small portion of the farms on which it occurs.

The Gannett loamy sand could probably all be reclaimed for crop production by a system of drainage ditches, but it is doubtful if the increased production would warrant the expense involved. The native hay could be greatly improved both in quality and quantity by adding tame grasses, particularly timothy and red clover.

O'NEILL LOAMY SAND

The surface soil of the O'Neill loamy sand is a dark grayish-brown, loose, loamy sand 8 to 10 inches deep. The upper 4 to 6 inches is considerably darker than the lower part, owing to a higher content of organic matter. This material gives the surface soil a loamy character, but is seldom sufficient to prevent soil drifting when the native sod is destroyed. The upper subsoil is a grayish-brown incoherent sand, differing little in texture from the surface layer, but not so well supplied with organic matter. Below an average depth of 18 inches the subsoil changes to a light-gray fine to very fine sand containing small amounts of silt and clay, which in places give the material a slightly coherent structure when moist. Coarse sand and fine gravel are encountered in places below 30 inches. The transition between the different soil horizons is very gradual both in color and texture. The organic matter decreases with depth and is practically absent below 24 inches. Both the soil and subsoil are low in lime.

The O'Neill loamy sand does not have a very large total area in Merrick County. It occurs in the northern part as narrow strips and small, irregular-shaped bodies adjacent to areas of the Valentine soils and Dunesand. One of the largest bodies borders the Nance-Merrick County line northwest of Silver Creek, in the northeastern part of the county, and typical developments occur northeast, north, and southeast of Mead School.

The type has been derived from sandy alluvial sediments deposited by the Platte and Loup Rivers when they were flowing at higher levels. Wind-blown sand from the Valentine and Dunesand areas has also contributed largely to its formation.

In general the topography is flat to slightly undulating; in some areas the surface has been so modified by wind action as to become slightly hummocky. Drainage over most of the type is excessive and is all subterranean, the rainfall seeping away through the loose,

porous sands, and in dry years crops often suffer from lack of moisture.

The O'Neill loamy sand is only locally important in the agriculture of Merrick County. It is not so well adapted to general farming as the loam and sandy loam types of the series on account of the less coherent nature of its surface soil, but its generally even topography favors cultivation, and when the soil is carefully managed to conserve moisture and prevent drifting it produces fair yields of corn and alfalfa. About 70 per cent of it is under cultivation and the rest is grazing and hay land. The native vegetation consists of a fairly dense growth of big and little bluestem, grama, sand, and needle grasses. These grasses will support 50 to 60 head of cattle on each quarter section during the summer grazing season, or when cut for hay will yield about one-half ton per acre. Most of the cattle are native stock, largely of Hereford and Shorthorn breeding. Very few cattle are winter fattened on this type. Hogs are raised on most farms.

The average yield of corn is about 25 bushels per acre and of alfalfa 2 to 2½ tons per acre from three cuttings, the yields depending upon the rainfall. Alfalfa makes a good growth, but the stand is rarely as thick and does not last as long as on the Waukesha and Hall soils, owing probably to the low lime content of this type. No commercial fertilizer is used, but all the barnyard manure available is applied to the land.

The O'Neill loamy sand sells for \$40 to \$75 an acre, depending largely upon improvements.

The soil of this type is naturally unstable and in order to cultivate it successfully it must be protected from wind action. Heavy applications of barnyard manure and straw have proved beneficial on many fields. The land should not be stirred more than is absolutely necessary to destroy weeds.

Included with the O'Neill loamy sand are two small areas of Plainfield sand, the total extent of which does not exceed 160 acres. These areas lie on the north side of Prairie Creek, adjacent to the Nance-Merrick County line, in T. 16 N., R. 3 W. They differ from the O'Neill loamy sand only in the lower organic matter content and consequently lighter color of their surface soils. The material is a loose, incoherent medium to fine sand of gray or grayish-brown color, becoming gradually coarser with depth, and below 30 inches consisting largely of coarse sand and fine gravel. The type is of no value for farming on account of its loose, incoherent surface soil, and is all included in pasture land.

O'NEILL SANDY LOAM

The surface soil of the O'Neill sandy loam is a grayish-brown to dark grayish-brown, open, porous sandy loam 10 to 15 inches deep. The medium and coarse sand grains predominate, but there is sufficient very fine sand, silt, clay, and organic matter to give the material a loamy character and dark color. The surface soil passes abruptly into a loose, incoherent, light grayish-brown medium to coarse sand containing very little organic matter. Over most of the type the subsoil becomes coarser with depth, and below 30 inches consists

largely of coarse sand and gravel. Neither the soil nor subsoil contains sufficient lime to effervesce with dilute hydrochloric acid.

The type has a few minor variations. Around the margins of the bodies which border areas of Waukesha soil the subsoil contains considerably more silt and clay than typical, and locally approaches a gritty, sandy clay in texture. The Waukesha and O'Neill soils merge so gradually that it is often necessary to draw arbitrary lines separating them. The principal textural variations are toward a fine sandy loam and loamy sand, and it is possible that small bodies of these textures are included with this type. On the north side of the Loup River, adjacent to Howard County, there is a small body having a very fine sandy loam surface texture, but owing to its small extent it was not separated on the soil map. The O'Neill sandy loam is the third in extent of the Merrick County soils. It occurs in numerous areas throughout most of the terraces. One of the largest developments, comprising an area of about 4 square miles, lies between the Mead and Silverdale Schools in the central part of the county; another area of about the same size lies a few miles northeast of the one just mentioned. Areas of considerable size border the bottom lands along Silver Creek northwest of Havens, and a small though quite typical area occurs 3 miles north of Chapman in the southwestern part of the county.

The type occupies terrace or bench positions, and has weathered upon sandy alluvial materials deposited by the streams when they were flowing at higher levels. Wind-blown sands from the surrounding types have also contributed to its formation. The surface is flat to very gently undulating, usually with a slight slope down the valley, and most of the drainage is subterranean. The type is not retentive of moisture on account of its porous, sandy nature, and crops often suffer from drought during dry, windy weather.

About 90 per cent of the type is under cultivation, the rest being used for grazing and hay land. The soil is quite stable and does not blow badly even under intensive tillage. Corn and alfalfa are the chief cultivated crops, and wheat, oats, and rye are grown to a small extent. The soil is not well adapted to small grain, on account of the loose and rather incoherent nature of the seed bed. Alfalfa does quite well for a few years, providing the moisture supply is sufficient, but the duration of the stands is curtailed by the low lime content of the subsoil.

The average yield of corn is about 25 bushels, wheat 15 bushels, oats 25 bushels, rye 20 bushels, and alfalfa 2 to 2 $\frac{1}{4}$ tons per acre from three cuttings. Native hay yields one-half to three-fourths ton per acre. Hog raising is practiced rather extensively, as the land is better suited to corn and alfalfa than to small grain.

The O'Neill sandy loam ordinarily sells for \$50 to \$90 an acre, depending upon location and improvements. Land of this type around Central City, however, commands a much higher price on account of its favorable location.

O'NEILL LOAM

The surface soil of the O'Neill loam is a loose, friable material consisting largely of silt and clay about 12 inches deep, with sufficient sand of various grades to give it a loam texture. It contains

much organic matter and is dark grayish brown in color. The upper subsoil is a grayish-brown loose and rather incoherent sandy loam to coarse sandy loam, which extends to an average depth of 24 inches. It contains a smaller amount of organic matter and a larger percentage of coarse sand and fine gravel than the surface soil, which accounts for its lighter color and coarser texture. This horizon is underlain by a porous, incoherent mass of gray or grayish-brown sand and gravel containing only slight traces of organic matter. The change in color and texture between the different soil horizons is usually very gradual. The type is not noticeably calcareous within 3 feet of the surface.

The soil is not very uniform in texture. It includes numerous small areas in which the surface material ranges from very fine sandy loam to sandy loam, depending upon differences in the texture of the parent material from which the soil has weathered and upon the character of additional wind-blown deposits from the surrounding types. Around the margins of the type where it borders areas of Waukesha soils the subsoil has accumulated considerable fine material and is decidedly more coherent than elsewhere. The above variations are of such a patchy nature and local importance that they are not separated on the soil map.

The O'Neill loam is rather extensively developed in Merrick County, occurring upon both the high and low terraces, chiefly in the western and southwestern parts. The largest area, containing about 11 square miles, is between Prairie and Silver Creeks in the central part of the county. This area is not very uniform, and includes some Waukesha soil within its borders. A large triangular body of the type extends across the western county line northwest of Lockwood, and small developments occur east of Central City, northwest of Chapman, and southwest of Archer.

The O'Neill loam has weathered from materials similar to those which have given rise to the O'Neill sandy loam. The finer texture of its surface soil is probably due in part to more complete weathering and in part to the recent addition of finer-textured stream and wind deposits.

The topography is flat to very gently undulating, except where modified by scattering low mounds and ridges. Usually there is a slight slope down the valleys. Underground drainage is generally excessive, and the type is not retentive of moisture on account of the loose, porous nature of the subsoil. Crops frequently suffer from drought during seasons of low rainfall.

The O'Neill loam is an important agricultural soil in Merrick County. About 90 per cent of it is under cultivation and the rest is included in pasture and hay land. Corn is the leading cultivated crop, followed by wheat, alfalfa, and oats, ranking in acreage in the order named. The soil, although somewhat droughty, has a finer surface texture and retains water better than the sandy loam type, and for these reasons is better adapted to small grain. Hogs are raised on nearly every farm. The cattle industry is confined to the raising of a few milk cows and the winter fattening of steers. The average yields of all crops are slightly above those obtained on the O'Neill sandy loam.

Land of this type sells for \$60 to \$100 an acre, according to location and improvements.

HALL FINE SANDY LOAM

The surface soil of the Hall fine sandy loam is a very dark grayish-brown to black fine sandy loam 6 to 10 inches deep, generally rich in organic matter, which gives the soil its dark color. The upper subsoil is a lighter brown fine sandy loam, containing large proportions of silt and clay; it is decidedly hard and brittle when dry and becomes tough and plastic when wet. Below 18 inches the material changes rather abruptly to a light grayish-brown slightly compact sandy clay, which continues to an average depth of 24 inches. The lower subsoil is a loose, friable, yellowish-gray sandy clay loam. As the color indicates, the organic-matter content gradually decreases with depth and only slight traces occur in the material at depths approaching 3 feet. The structure of the subsoil is more or less granular throughout. The material is highly calcareous below 20 inches.

The Hall fine sandy loam is not uniform in Merrick County. The chief variations from the typical material occur on the high terrace south of Palmer, where the material of both surface and subsoil has been greatly modified by wind-blown sand from the surrounding Valentine and Dunesand areas. In a few places the surface soil has become so sandy as to approach a loamy sand in texture, and is considerably lighter in color than usual. Locally the heavy subsoil horizon is very poorly developed or entirely lacking, the material below 36 inches being a loose, rather incoherent loamy sand. Throughout the type as mapped there are a few small bodies in which the surface soil ranges in texture from loam to very fine sandy loam. The variations are of such local nature and minor importance that they do not warrant locating on the soil map.

The Hall fine sandy loam occupies a total area of 16,640 acres in Merrick County. It occurs in areas scattered throughout nearly all parts of the terrace sections. The largest, though not very uniform, area lies between Palmer and Worms in the western part of the county; a typical area occurs 2 miles north of Paddock in the south-central part; and small areas lie near Central City, Palmer, and south of Paddock.

The type has been derived in much the same manner as the other members of the Hall series. Its larger sand content is due in part to a deposition of coarser material and partly to sands blown from the surrounding types. The topography is flat to very gently undulating, except locally where the surface is modified by scattering low mounds of sand, as in a few of the bodies within or adjacent to areas of Valentine soils. The type as a rule is well drained. In some of the lower and flatter situations there is an excess of moisture in wet years. The water table is ordinarily encountered at depths of 7 to 12 feet, varying with the elevation of the surface.

This type is not so important in the general agriculture of the county as some of the more extensive soils, but it is naturally a strong and fertile soil adapted to all the common crops and produces as high yields as any of the terrace types. About 85 per cent of it

is under cultivation and the rest, including the lower lying and more poorly drained areas, is used for pasture and hay land. Corn, alfalfa, and oats are the leading crops, ranking in acreage in the order named. Millet, barley, and rye are grown locally for feed. Hogs are raised on every farm, and some farmers buy cattle for fattening during the winter months. Crop yields depend largely upon the rainfall. Under the same moisture conditions all crops produce as well as on the Hall silt loam.

The soil has a loose, mellow structure and is easy to work and maintain in good tilth. It is not injured by plowing immediately after rains and can be worked under almost any moisture conditions.

Land of the Hall fine sandy loam sells for \$80 to \$150 an acre, depending largely upon drainage, improvements, and location.

HALL VERY FINE SANDY LOAM

The surface soil of the Hall very fine sandy loam, to an average depth of 10 inches, consists of a very dark grayish-brown material composed largely of very fine sand, silt, and organic matter. It contains only a small percentage of clay and scarcely any material coarser than fine sand. The upper subsoil is a light grayish-brown very fine sandy loam which contains relatively large proportions of silt and clay and is considerably more compact than the surface soil owing to its greater clay content. Below about 18 inches the subsoil changes rather abruptly to a dark grayish-brown silty clay, ordinarily extending to about 24 inches, which is extremely tough and plastic when wet and becomes hard and brittle upon drying. The lower subsoil is a light-gray to almost white silt or very fine sandy loam, which under natural field conditions is loose and friable, but contains a small percentage of clay which gives it a slightly compact structure when dry. The subsoil below an average depth of 20 inches is highly calcareous, lime existing both in a finely divided form and as numerous small concretions.

The Hall very fine sandy loam is fairly uniform throughout the area of its occurrence in Merrick County, but there are a few minor variations. Along Prairie Creek, between Archer and Worms, in the western part of the county, there are considerable areas of the type which, on account of inferior drainage, somewhat resemble the Lamoure soils; but the subsoil is well oxidized, has developed a heavy horizon, and is practically free of mottling, and for these reasons such areas are classed with the Hall very fine sandy loam. The principal textural variation is toward a fine sandy loam, and some patches of Hall fine sandy loam are included. In a few of the more poorly drained spots the lower subsoil is a yellowish-drab, compact, waxy clay. Locally the subsoil is not noticeably calcareous within 3 feet of the surface, and, had these areas been of sufficient size to warrant mapping, they would have been included with the Waukesha series.

The Hall very fine sandy loam does not occupy a very large total area in Merrick County, but there are several individual bodies of considerable size. The largest area, comprising about 10 square miles, occurs as a broad strip along Prairie Creek, between Archer and Worms. A smaller typical development occurs along the Hall-

Merrick County boundary, near Pleasant Ridge School, and small bodies are mapped in the vicinity of Central City and Palmer and about 4 miles northwest of Clarks.

The type has been developed on alluvial terraces lying well above overflow. The topography is flat. Drainage is generally good, as there is usually sufficient slope to carry off most of the surplus water, and the subsoil affords fair internal drainage. None of the type is subject to erosion.

The Hall very fine sandy loam is a rather important agricultural soil in this county, being naturally fertile and ranking with the Hall silt loam in productiveness. About 75 per cent of it is under cultivation and the rest is included in farm sites, feeding lots, or pasture land. Corn and alfalfa are the principal crops, followed by wheat and oats. Rye, millet, and barley are grown locally for feed. Cattle raising is not practiced extensively, as most of the land is better suited to crop production than to grazing. Many farmers feed cattle for outside markets. Hogs are raised on every farm. A few farmers have purebreds and specialize in this industry.

Farming methods and crop yields are about the same as those on the Hall silt loam, but this type can be cultivated under a slightly wider range of moisture conditions on account of its higher sand content.

Land of this type sells for \$125 to \$150 an acre, depending upon improvements, drainage, and location with respect to markets.

HALL SILT LOAM

The surface soil of the Hall silt loam is a very dark grayish-brown to almost black, loose, friable silt loam 6 to 8 inches deep. Over most of its area it has a rather high percentage of very fine sand and very little material of a coarser nature. The soil is rich in organic matter, which gives it its dark color. The upper subsoil, extending to an average depth of 15 inches, is a somewhat lighter brown silt loam to very fine sandy loam of fine granular structure and only slightly more compact than the surface soil. The next horizon is a heavy silty clay, which differs little in color from the layer above but is decidedly tough and plastic when wet and very hard and brittle when dry. At a depth of 24 or 30 inches the subsoil changes rather abruptly to a friable silt or silty clay of yellowish-gray color, highly calcareous, and extending to below 3 feet. The type is quite uniform throughout the area of its occurrence in Merrick County.

The Hall silt loam occupies a few small bodies near the Howard-Merrick County line. The largest development, which includes about 900 acres, is about $3\frac{1}{2}$ miles southeast of Worms, a smaller area lies about 1 mile west of this body, and local developments occur southwest of Palmer and north of the Loup River.

The soil occupies terrace or bench positions, and has weathered from alluvial material deposited by the streams when they were flowing at a higher level. The topography is flat, with a gentle slope down the valleys. The surface lies 8 to 12 feet above the stream channels and is well drained, the slight slope being sufficient

to afford ample outlet for surface waters. The soil is nowhere subject to stream erosion.

The Hall silt loam is not an important agricultural soil in this county on account of its small extent. It is one of the most productive soils of the region, however, and in other counties where it occurs extensively it is highly prized for general farming. All of the type in this county is under cultivation, corn, wheat, alfalfa, and oats being the principal crops. Hogs are raised on every farm. A few farmers are engaged in cattle feeding, but as a rule the cattle industry is confined to the raising of only enough cows to supply the home dairy needs. The average yield of corn is about 30 bushels per acre, oats 40 bushels, wheat 20 bushels, and alfalfa $3\frac{1}{2}$ to 4 tons from three cuttings. Alfalfa seems to do as well on this soil as on any other type in the county.

The Hall silt loam is easily worked and maintained in good tilth under favorable moisture conditions. If plowed when wet there is a tendency to clod, but the lumps are easily reduced. No commercial fertilizer is used, but manure is applied when available. The more progressive farmers rotate their crops and frequently seed the land to alfalfa.

Land of the Hall silt loam ranges in price from \$125 to \$150 an acre, depending largely upon improvements. It includes some of the highest-priced land in the county.

HALL CLAY LOAM

The Hall clay loam as mapped in this county is identical with the type as mapped in Howard and Hall Counties on the west. The surface soil is a very dark grayish-brown to black, slightly plastic and sticky clay loam 8 to 10 inches deep. It contains considerable very fine sand, but little material of a coarser nature. The soil is subject to considerable shrinkage, resulting in numerous seams and cracks which are injurious to crop roots. The upper subsoil is a grayish-brown, heavy, compact silty clay to clay, extending to an average depth of 24 inches. This is underlain by a dark-drab or yellowish-drab sticky clay containing considerable very fine sand. In places below 30 or 36 inches a grayish sticky sand or coarse sand usually saturated with water is encountered. The material of all the soil horizons becomes hard and brittle upon drying. The surface soil is slightly calcareous, and the subsoil contains an abundance of lime, both in the finely divided form and in the form of angular concretions.

Small alkali spots, distinguished by the white efflorescence of salts at the surface, are common in nearly all parts of the type. They range in extent from a few square rods to about one-half acre, and contain sufficient salts to injure even the native grass vegetation. Low mounds of fine and very fine sandy loam occur throughout the type, but are too small to be shown on the soil map.

The Hall clay loam is confined to a few areas upon the terrace along Prairie Creek in the west-central and southwestern parts of the county, north and southwest of Archer, and along the western county line south of Worms.

The type occupies flat and rather poorly drained depressions, and most of it is used for pasture land and hay production. Some areas

are farmed in connection with the more arable land. The native grasses will support a cow or horse per acre during the summer season. Hay yields from three-fourths to 1 ton per acre, but has a somewhat lower feeding value than that obtained on the better-drained soils of the county, on account of the large proportion of alkali and salt grasses.

The heavy, clayey nature of the soil makes it difficult to handle. If plowed when wet the soil bakes and clods, requiring subsequent freezing and thawing or wetting and drying to restore granulation. It is almost impossible to plow the soil when extremely dry. Under favorable moisture conditions the soil can be tilled with little difficulty, and good yields of the staple crops are obtained.

The Hall clay loam requires artificial drainage if the largest returns are to be realized. Even under the present conditions the quality and quantity of the hay crop could be greatly improved by the addition of timothy and clover, both of which are well adapted to this soil. Thorough drainage and the use of barnyard manure is probably the best treatment for the alkali spots.

WAUKESHA FINE SANDY LOAM

The surface soil of the Waukesha fine sandy loam is a very dark grayish-brown, friable, fine sandy loam 8 to 12 inches deep, rich in organic matter, which accounts for its dark color. The upper subsoil to an average depth of 24 inches is a dark grayish-brown fine sandy loam containing considerably more silt and clay than the surface soil. The lower subsoil is a gray or light grayish-brown material, composed largely of silt, clay, and very fine sand, which extends below a depth of 3 feet. The transition from horizon to horizon is very gradual both in color and texture. The organic matter decreases with depth and only slight traces occur below 30 inches. Neither the soil nor the subsoil is noticeably calcareous, but below 4 feet the substratum is rich in lime and consists of a light-gray, loose, floury silt to very fine sand. The subsoil has a more or less plastic and gritty feel when wet, but becomes hard and brittle and crumbles easily upon drying.

The type is fairly uniform throughout the area of its occurrence in Merrick County. There are a few small patches having very fine sandy loam or sandy loam surface textures, and locally the subsoil is more sandy than usual, but these variations were not sufficiently important to warrant separation on the soil map.

The Waukesha fine sandy loam occurs as narrow strips and small, irregular-shaped bodies upon the high terrace between Silver and Prairie Creeks in the west-central, central, and northern parts of the county. The largest developments are in Mead and Clarksville Townships; a typical body occurs about 2½ miles northeast of Hord, in the central part of the county, and a narrow linear development occurs north of Havens.

The type has weathered upon terrace or bench materials deposited by the streams when they were flowing at higher levels. Wind-blown sands from the surrounding types have also assisted in its formation.

The topography is flat to very gently undulating. The surface lies 60 to 80 feet above the Platte and Loup River bottom lands. Drain-

age is everywhere good. Surface channels are not well developed, but there is usually sufficient slope to carry off the surplus moisture and the subsoil affords good underdrainage.

The Waukesha fine sandy loam is an important agricultural soil in this county. It is very strong and fertile, comparing favorably with the loam and very fine sandy loam members in productiveness. Practically all of it is under cultivation to corn, wheat, oats, and alfalfa, ranking in acreage in the order named. Wheat is the chief cash crop. The winter fattening of cattle is practiced rather extensively, and hogs are raised on nearly every farm. All the livestock is of good breeding and many herds of hogs are purebred.

Crop yields are about the same as those obtained on the Waukesha loam, and the soil is handled in the same manner as the other well-drained hard-land types of the county. It can be cultivated under almost any moisture conditions without injury. Crop rotation is not systematically practiced, although most farmers have more or less indefinite systems subject to numerous substitutions which they use on their land. The crops are changed with reasonable regularity and considerable alfalfa is grown. Barnyard manure is applied when available. Under the present system of management the land is not decreasing noticeably in fertility. Land of this type sells for about the same price as the loam type.

WAUKESHA VERY FINE SANDY LOAM

The surface soil of the Waukesha very fine sandy loam is a very dark grayish-brown, loose, friable, very fine sandy loam 8 to 10 inches deep, containing a large percentage of fine and medium sand. The soil is rich in organic matter, which gives it its dark color. The upper subsoil is a grayish-brown fine sandy clay extending to an average depth of 24 inches, which has a plastic, gritty feel when moist, but becomes brittle and crumbles easily upon drying. The lower subsoil is a light grayish-brown very fine sandy loam containing relatively large quantities of silt and clay, but having a loose, friable structure. The organic matter so abundant in the surface soil gradually decreases with depth and is scarcely noticeable below 30 inches. As a rule the type is not calcareous within 3 feet of the surface, although lime, in both the powdered form and as small concretions, becomes abundant below depths of 4 feet.

The type as mapped in Merrick County is confined to three areas in the western part. The largest of these comprises about 4 square miles on the terrace bordering the South Branch of Prairie Creek in Vieregg and Prairie Creek Townships. The smaller areas lie southeast of Chapman and on the north side of Warm Slough about 2 miles northwest of Paddock.

The soil has been developed upon alluvial material deposited by the streams when they were flowing at a higher level, subsequent deepening of the channels having left the deposits as terraces or benches somewhat above the present flood plains. The topography is flat, usually with a gentle slope down the valley and toward the streams. Drainage is good as there is sufficient slope to carry off all surplus surface water and the subsoil affords good underdrainage. None of the soil is subject to erosion.

The Waukesha very fine sandy loam is of little agricultural importance in this county, on account of its small extent. It is naturally strong and fertile and well adapted to all crops common to the region. Practically all of it is used for the production of corn, wheat, oats, and alfalfa. Hogs are raised on every farm, and on some farms a carload or two of both cattle and hogs are fattened annually for market. Ordinarily only enough cattle are kept to supply the home dairy needs.

The average yield of corn is about 35 bushels, wheat 20 bushels, oats 40 bushels, and alfalfa $3\frac{1}{2}$ to 4 tons per acre. Alfalfa and corn are either fed on the farms where produced or sold to local feeders. Wheat, the chief cash crop, is usually hauled direct from the threshing machine to the elevators. The land is managed in much the same way as the fine sandy loam type, and its productiveness is not being noticeably impaired.

The selling price of land of this type ranges from \$150 to \$175 an acre, depending largely upon improvements.

WAUKESHA LOAM

The surface soil of the Waukesha loam is a very dark grayish-brown to almost black loam or very fine sandy loam 10 to 15 inches deep, rich in organic matter, and with a relatively large percentage of silt and clay. The upper subsoil is a grayish-brown moderately compact sandy clay loam having a fine granular structure, rather hard and brittle when dry and slightly sticky and plastic when wet. Below an average depth of 24 inches the subsoil becomes lighter in color and less compact than the layer above, being a light-gray friable silt loam containing small amounts of clay and very fine sand. It has a coarse granular to cloddy structure and is occasionally mottled with gray splotches and rusty iron stains. The transition between the different soil horizons is very gradual both in color and structure. Lime concretions sometimes occur below 30 inches, although their presence is not characteristic and the type as a whole seldom contains sufficient lime within the 3-foot section to effervesce when dilute hydrochloric acid is applied.

In a few places the material below 30 inches is a light-gray, smooth, floury silt loam much resembling the lower subsoil of the Marshall silt loam, although it is seldom calcareous. Upon the lower terraces the surface soil is usually somewhat deeper and darker than on the high benches and the subsoil is less compact. Around the margins of the bodies bordering soils of the O'Neill series the subsoil is considerably coarser in texture and has a more open and porous structure than usual. The principal textural variations of the surface soil are toward a silt loam and a sandy loam, and it is possible that small patches of these textures are included with the type, but these variations are usually of such small extent and minor importance that they do not warrant separation on the soil map.

The Waukesha loam is rather extensively developed in Merrick County. It occurs chiefly upon the high terrace throughout the central and north-central parts, but is locally developed upon the lower benches along the Platte River in the southern part of the county. The largest area, comprising about 10 square miles, lies

northeast of Archer. Smaller though very typical bodies are south of Archer, between Prairie and Silver Creeks. Low terrace developments of this soil occur south and west of Central City and east of Chapman.

The topography of the type is flat to very gently undulating, with a slight slope down the valley. Drainage is good, there usually being sufficient slope even on the flatter areas to carry off the surplus moisture, and the subsoil affording good underdrainage.

The Waukesha loam is an important agricultural soil in Merrick County. Its large area, level topography, and stone-free character make it highly prized for general farming. The type originally supported a luxuriant growth of prairie grasses, but practically all of it is now under cultivation. Corn is the chief crop, followed by wheat, oats, and alfalfa, ranking in acreage in the order named. Rye, barley, cane, and millet are grown on a few farms for feed. Cattle feeding is practiced extensively, most of the animals being of grade Hereford or Shorthorn breeding. Very few cattle are grazed on this type, as the land yields larger returns from cultivated crops. Hogs are raised on every farm and some farmers have large herds, Duroc-Jersey and Poland-China being the leading breeds.

Crop yields on this soil will average as high as those obtained on any other type in the county. Corn yields 25 to 60 bushels per acre, with an average of about 35 bushels. The average yield of wheat is about 20 bushels, oats 40 bushels, and alfalfa $3\frac{1}{2}$ 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.

The soil of the Waukesha loam is naturally strong and fertile, and will withstand severe cropping to one grain, but better yields are obtained where a legume, such as alfalfa or clover, is included in the rotation. Barnyard manure is applied when available, and crops are changed with reasonable regularity. The soil does not appear to be decreasing in productiveness under the present system of farming.

The selling price of this land ranges from \$125 to \$175 an acre, depending largely upon location and improvements.

LAMOURE FINE SANDY LOAM

The surface soil of the Lamoure fine sandy loam is a very dark grayish-brown to black, friable, fine sandy loam 8 to 10 inches deep, containing a rather high percentage of medium sand but little material of a coarser nature. The soil is rich in organic matter. The upper subsoil is a dark grayish-brown sandy clay loam containing considerable fine gravel. It has a slightly compact structure, is somewhat plastic when moist, and becomes hard and brittle when dry. The lower subsoil, beginning at about 20 inches, is a mottled gray and white material composed largely of sand, clay, and lime. It is slightly compact and the structure in general is similar to that of the layer above. Numerous lime concretions occur in most places below 30 inches. The transition between the different soil horizons is rather abrupt both in texture and color.

Included with this type are two small bodies of Lamoure sandy loam, the total area of which does not exceed 900 acres. One of the bodies lies $3\frac{1}{2}$ miles southeast of Mead School, situated in the

north-central part of the county; the other borders the channel of the Platte River, including portions of sections 9, 10, and 16, T. 11 N., R. 8 W. The areas differ from the Lamoure fine sandy loam chiefly in the slightly coarser texture of the surface soil and upper subsoil. Both areas are poorly drained and used chiefly for hay land.

The Lamoure fine sandy loam occurs in numerous narrow strips and irregular-shaped areas upon the flood plains of all the larger streams of the county, but the individual areas are usually small. One of the largest developments lies on both sides of Prairie Slough for several miles southwest of Archer, and a smaller body lies north of this town. One of the most typical developments is north of the Central City cemetery, in the south-central part of the county. Local bodies occur in the vicinity of Clarks, Palmer, Silver Creek, and both north and south of Chapman.

The type has been formed in the same manner as the Lamoure very fine sandy loam. The coarser nature of its surface soil is due largely to the addition of wind-blown sand from the Cass types.

The topography is flat, modified by slight elevations and shallow depressions. The surface lies slightly above that of the Lamoure very fine sandy loam, but the type as a whole is poorly drained. The water table generally is too near the surface for profitable farming.

The type is of little agricultural importance in this county on account of its patchy distribution and generally poor drainage. About 80 per cent of it is used for pasture or hay land and the rest, including the higher and better-drained areas, is used for the production of corn and alfalfa. Beef cattle, chiefly Hereford and Shorthorn grades, are grazed extensively on this type. The winter fattening of cattle is not generally practiced, as most of the animals are either shipped to market after coming off the summer range or are sold to local feeders on other types of soil. Hogs are raised on most farms. The native grasses yield about the same as those on the Lamoure very fine sandy loam. The average yield of corn is about 25 bushels and of alfalfa 2 to 2½ tons per acre.

The land sells for \$50 to \$100 an acre, depending upon drainage, improvements, and location.

Artificial drainage is necessary if much of this type is to be brought under cultivation. A system of tiling or of deep drainage ditches would reclaim the land for corn and alfalfa. The soil is nearly as strong and fertile as any of the bottom-land types in Nebraska, and is easily handled when properly drained.

LAMOURE VERY FINE SANDY LOAM

The surface soil of the Lamoure very fine sandy loam is a black very fine sandy loam 8 to 12 inches deep, containing a relatively large proportion of silt and very little material coarser than fine sand. There is an abundance of organic matter, as the color indicates. The subsoil is a grayish-brown very fine sandy clay of rather compact structure, underlain at about 18 inches by mottled gray and white material of similar texture and structure, which extends to below the 3-foot depth. Both subsoil horizons are sticky and plastic when wet, but become hard and tough upon drying. The

transition between the surface and upper subsoil is quite abrupt both in color and texture, but the two subsoil layers merge gradually into each other. The surface soil normally is slightly calcareous and the subsoil has a high lime content. Small angular concretions of lime are very abundant in the lower strata.

The type is fairly uniform throughout the area of its occurrence in Merrick County. The subsoil varies somewhat in color and in the relative proportion of sand and clay, and the surface soil in places approaches a fine sandy loam in texture, but these variations from the typical soil are local and of minor importance and do not warrant separation on the soil map.

The Lamoure very fine sandy loam is not extensive in Merrick County, although it occupies many small areas scattered throughout the bottom lands along all the larger streams. The largest developments lie west and northeast of Silver Creek, in the northern part of the county. A typical area occurs along the Nance-Merrick County line north of Clarks. Small areas also are mapped along Warm Slough, Prairie Slough, and near the head of Silver Creek.

The type has weathered from recent alluvium composed mostly of loessial material deposited upon the flood plains of streams during periods of high water. The topography is flat, modified in places by shallow depressions and old stream channels, and drainage is poor. The surface of the type lies only a few feet above the normal stream levels and is subject to overflow in places. The water table is so near the surface as to keep the soil too moist for most crops. The rather compact subsoil layers prevent adequate underdrainage, and in seasons of heavy rainfall water stands on the surface of the lower-lying areas for some time.

Owing to its poor drainage, most of the type remains in pasture and hay land. The native vegetation includes a large variety of water-loving grasses and sedges, together with considerable salt grass. These grasses will support a cow or horse per acre during the summer grazing season, or when cut for hay will yield three-fourths ton to $1\frac{1}{4}$ tons per acre. The grazing of beef cattle is practiced rather extensively, most of the herds consisting of grade Herefords and Shorthorns. A few hogs are raised on most farms.

The selling price of the Lamoure very fine sandy loam ranges from \$40 to \$90 an acre, depending largely upon drainage and improvements.

As with the other members of the Lamoure series, the chief need of this soil is artificial drainage. It is naturally strong and productive, and when adequately drained is equal to the Wabash soils of eastern Nebraska in crop production.

LAMOURE CLAY LOAM

The surface soil of the Lamoure clay loam is a tough and refractory black clay loam 8 to 15 inches deep, containing considerable fine and very fine sand but little material of coarser grades. The upper subsoil is a dark grayish-brown or mottled gray and dark-gray compact clay loam to sandy clay loam extending to an average depth of 24 inches, below which the subsoil becomes gradually lighter in color, becoming a light-gray to grayish-yellow sandy clay in the

lower part of the 3-foot section. The soil and upper subsoil are sticky and plastic when wet, and the lower subsoil has a sticky, gritty feel, but the material throughout the soil profile becomes extremely hard and tough upon drying. As the color indicates, the content of organic matter gradually decreases with depth, and the lower subsoil is very deficient in this material. Both soil and subsoil are generally more calcareous than most of the other bottom-land types, the calcium carbonate usually occurring in finely divided form rather than in large concretions, as in the Lamoure fine sandy loam and very fine sandy loam types. Numerous rusty-brown stains due to poor drainage are encountered throughout the subsoil. Below depths of $3\frac{1}{2}$ to 5 feet the substratum consists of a loose, porous mass of medium to coarse sand and gravel.

The type has a few minor variations. Along Silver Creek, north of Central City, the subsoil below 20 inches contains considerably more coarse material than typical, and consists of a sticky, gritty mass of coarse sand, gravel, lime, and clay, which resembles wet mortar in appearance. Below 30 to 36 inches the lime and clay content diminishes and the typical substratum is encountered. Around the margins of the type where it borders soils of a sandy texture the surface layers merge gradually one into another, and small patches of Lamoure fine and very fine sandy loams are included. Small alkali spots, distinguished by the white efflorescence of salts at the surface, are common in nearly all areas of this type. They range in extent from a few square yards to one or two acres.

The Lamoure clay loam is extensively developed in Merrick County. It is the dominant soil along Silver Creek, and occupies numerous small bodies and narrow strips upon the bottom lands of Prairie Slough, Warm Slough, and the Platte River. The large developments along Silver Creek contain many areas of other soils within their borders. The type has weathered under conditions of poor drainage from alluvial loessial material.

The topography is flat, except where modified by old stream channels, shallow depressions, and slight elevations. The surface lies only a few feet above the normal flow of the streams, and extensive areas are subject to overflow during periods of high water. The water table is everywhere near the surface, and during wet years it rises sufficiently to produce local areas of marshy land. The impervious subsoil prevents free underdrainage, and water often stands in the lower depressions after rains.

The type is of little agricultural importance in Merrick County on account of its poor drainage. About 90 per cent of it is used for pasture and hay land and the rest, including the higher-lying bodies and a few small areas which have been artificially drained, is used for corn and alfalfa. The native grasses on this type will support a cow or horse per acre during the summer grazing period, or when cut for hay will yield 1 to $1\frac{1}{4}$ tons per acre. The hay is comparatively coarse, being composed largely of marsh and salt grasses, and has a lower feeding value than that obtained upon the better-drained terrace soils of the county. The average yield of corn upon the artificially drained portions of the type is about 35 bushels per acre. Alfalfa yields 3 to $3\frac{1}{2}$ tons from three cuttings.

The Lamoure clay loam sells for \$30 to \$60 an acre, depending largely upon drainage and location.

The type is probably the strongest and most fertile soil in the county, but artificial drainage is necessary before cultivated crops can be successfully grown. Even after drainage is established careful management is necessary if the largest returns are to be realized, as the heavy nature of the soil makes it extremely difficult to handle. If plowed when wet lumps are formed which require subsequent wetting and drying before granulation is restored. It is almost impossible to plow the land when extremely dry. Heavier machinery and more power are required to till this soil than that of the lighter-textured terrace and bottom-land types. In general, however, the extra expense involved in handling the land is small compared to the increased returns derived from careful management.

CASS LOAMY SAND

The surface soil of the Cass loamy sand is a dark grayish-brown, loose, fine to medium sand 6 to 8 inches deep. It contains considerable organic matter, which gives it a dark color and loamy character, but is not sufficient to prevent drifting during prolonged dry weather if the native vegetation is destroyed and the surface left unprotected. The upper subsoil is a sandy loam of slightly lighter color than the layer above, containing considerably more silt and clay than the surface soil, which tends to bind the sand particles together rather firmly when dry. The lower subsoil, beginning at an average depth of 24 inches, is a light grayish-brown to gray, loose, incoherent material composed largely of medium and coarse sand, with some fine gravel. The transition between the surface and upper subsoil is very gradual both in color and texture, while that between the two subsoil layers is abrupt. The organic-matter content gradually decreases with depth and only slight traces occur below 30 inches. The upper subsoil is usually calcareous, but the surface layer and the lower subsoil seldom contain sufficient lime to react when dilute hydrochloric acid is applied.

A few variations occur. Locally the upper subsoil horizon is entirely lacking and the surface soil rests upon coarse sand and gravel extending to below the 3-foot section. In a few of the poorly drained areas rusty-brown mottlings occur throughout the subsoil, and the material is often slightly more compact than usual owing to a larger silt and clay content. The most important variations in surface texture are toward a sandy loam and a sand, the former being encountered where conditions have especially favored vegetative growth and decay, 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 found in a few places adjacent to streams where the soil is of such recent origin that sufficient organic matter has not accumulated to give it a loamy texture. The above variations are of such small extent and local importance that their separation on the soil map is not practicable.

The Cass loamy sand does not occupy a very large total area in Merrick County. It occurs in many small areas and narrow broken strips throughout the bottom lands along the main streams, the largest developments occurring along the Platte River. The type

normally borders the stream channels, except where separated from them by narrow strips of Sarpy sand. The soil is extensively developed on Prairie Island, northeast of Central City; typical areas occur in the Loup River bottoms about 3 miles north of Palmer and along Prairie and Silver Creeks in the northeastern part of the county, and small areas occur upon the smaller islands of the Platte River. The type has weathered from sandy alluvium recently deposited upon the flood plains along streams and modified considerably by wind-blown sand.

The topography is flat to undulating, and is characterized by numerous dry channels, old cut-offs, shallow depressions, and slight elevations. The surface in general is slightly more uneven than that of the other Cass types of the county. Drainage is variable. Most of the type lies only a few feet above the normal flow of the streams, and in wet seasons the water table rises too near the surface for profitable farming. The bodies along Prairie Creek, Silver Creek, and the Loup River are subject to inundation during periods of high water, but the Platte River seldom overflows its banks. In very dry years much of the type has excessive underdrainage, and crops often suffer from lack of moisture. During normal seasons the moisture conditions over limited areas are favorable for crops.

The type is of little agricultural importance in Merrick County on account of its unstable nature and variable drainage. About 75 per cent of it is included in grazing and hay land, and the remainder is used chiefly for corn production. The native vegetation varies with the drainage conditions. Sand grass, bluestem, and needle grass occur upon the drier areas, and water-loving grasses, sedges, and rushes are found in the lower situations. The grasses will support 80 to 100 head of cattle on each quarter section during the grazing season, or when cut for hay will yield one-half to three-fourths ton per acre. The hay is usually stacked in the field for winter feeding. The average yield of corn is about 20 bushels per acre. The grazing of beef cattle is the principal industry. Cattle feeding is not practiced extensively, as most of the stock is sold to local farmers for fattening. Hogs are raised on most farms.

The Cass loamy sand sells for \$40 to \$75 an acre, depending largely upon location and drainage.

It is doubtful if more of this soil should be brought under cultivation, as it seems to be better suited to the production of wild hay than cultivated crops. The native vegetation could be greatly improved by sowing timothy and clover seed among the pasture grasses.

CASS SANDY LOAM

The surface soil of the Cass sandy loam to an average depth of 10 inches consists of a very dark grayish-brown loose sandy loam containing an abundance of organic matter. The sand of which the soil is so largely composed consists chiefly of the medium and coarse grades, together with some fine gravel, the medium sand predominating. The upper subsoil to about 20 inches is slightly lighter in color and coarser in texture than the surface horizon, and is underlain by a light grayish-brown, incoherent coarse sand which contains considerable gravel below 30 inches.

As the color indicates, the organic matter content gradually decreases with depth and is scarcely noticeable in the lower part of the 3-foot section.

The subsoil is usually slightly calcareous, though large areas occur in which the material does not contain sufficient lime to effervesce with dilute hydrochloric acid. Such areas usually lie slightly above the general level of the remainder of the type and approach the O'Neill sandy loam in appearance. The O'Neill and Cass soils differ chiefly in topographic position and drainage. The former occupy terrace positions, usually have excessive underdrainage, and are more or less droughty, while the latter occur upon first bottoms and are either subject to overflow from the main channels or lie so near the water table as to have a decidedly moist subsoil. There are, of course, a few minor differences, such as the more thorough oxidation and leaching of carbonates from the O'Neill soils, but throughout the slightly elevated areas these differences are not sufficiently marked to be used as a basis of separation. Much of the Cass sandy loam as mapped occupies an intermediate topographic position between the terraces and bottom lands, but the subsoil is invariably wet, and for this reason the O'Neill characteristics were disregarded and the soil was classed with the Cass series.

The Cass sandy loam is extensively developed throughout the bottom lands of the Platte River in Merrick County. The bodies are numerous and vary in size from a few acres to several square miles. The largest developments lie between Silver Creek and the Union Pacific Railroad in Lone Tree, Central, and Clarksville Townships. Smaller bodies occur near Chapman and Havens in the southwestern and northeastern parts of the county, respectively. The type is not mapped in the Loup River bottom lands.

The topography is flat to very gently undulating, except where locally modified by scattering low mounds and ridges. The soil is well though not excessively drained. The water table is usually within 7 feet of the surface, and the lower subsoil is kept moist except in the driest seasons.

Owing to its large extent, this is an important agricultural soil in Merrick County. Its level topography, good drainage, and favorable moisture supply make it especially well suited to corn and alfalfa. Wheat and oats are also grown extensively, but the land is not considered so well adapted to small grain as are some of the heavier-textured soils, the moisture supply usually being too deep for maximum yields of shallow-rooted crops. Cattle feeding is practiced extensively, and most farmers raise enough milk cows, chiefly of the beef breeds, to supply their home dairy needs and to furnish a surplus of dairy products for sale in the local markets. Hogs are raised on every farm. The livestock is usually of good breeding, and many farmers have purebred herds of hogs. The average yield of corn is about 40 bushels per acre, wheat 15 bushels, oats 30 bushels, and alfalfa 3 to 4 tons. The alfalfa crop is usually cut three times, but in favorable years a fourth cutting is often obtained.

The soil has a loose, loamy structure. It can be cultivated under almost any moisture conditions without injury, and can be handled with lighter machinery and less power than is required on the

heavier soils. No commercial fertilizer is used, but all the available barnyard manure is applied to the land. Crops are rotated with reasonable regularity and considerable alfalfa is grown. Under the present system of management the soil does not appear to be diminishing in fertility.

Land of this type sells for \$100 to \$150 an acre, depending upon improvements.

CASS FINE SANDY LOAM

The surface soil of the Cass fine sandy loam is a dark grayish-brown, friable fine sandy loam 8 to 10 inches deep, composed chiefly of the fine and medium grades of sand, with some very fine sand. The upper subsoil is a light-gray very fine sand containing large amounts of silt and clay; it is loose and friable when moist, but becomes brittle and crumbles easily upon drying. The lower subsoil, beginning at an average depth of about 24 inches, is a light-gray mass of loose, incoherent sand and gravel, which extends below the 3-foot depth. The transition between the different soil horizons is rather abrupt, especially in texture. The surface soil contains much organic matter, but this material rapidly decreases with depth, and is practically absent below 20 inches. The surface is only slightly calcareous, but the subsoil has a high lime content. Rusty-brown stains are usually encountered in the lower part of the subsoil.

In many places the upper subsoil of very fine sand and silt is entirely absent, and the dark surface soil rests directly upon a layer of incoherent medium sand, which becomes gradually coarser with depth. The principal textural variation is toward a very fine sandy loam, although local areas contain so little organic matter in the surface soil as to approach a loamy fine sand in texture.

The Cass fine sandy loam is the most extensive soil type in Merrick County. It occurs as narrow linear strips and small irregular-shaped bodies upon the bottom lands of all the larger streams. The largest areas are along the Platte River. Bodies of considerable size lie along the Loup River, Wood River, Prairie Creek, Silver Creek, and Warm Slough, as well as along the larger tributaries of these streams. The soil has been derived from sandy flood-plain materials deposited by the streams during comparatively recent times, but subsequent weathering and the accumulation of organic matter has greatly modified the surface of the original deposits.

The topography is generally flat, though modified in places by slight depressions, old stream channels, or low, rounded mounds of almost pure sand. The surface lies 6 to 8 feet above the normal flow of the streams and is seldom subject to inundation from the main channels. During normal years drainage is sufficient for crop production over the greater part of the type, but in wet seasons the water table rises too near the surface over large areas for profitable farming. In very dry seasons the underdrainage is excessive, and most crops do not do so well as upon types with heavier subsoils.

The Cass fine sandy loam is only of moderate importance in the agriculture of Merrick County, on account of its uncertain drainage. About 70 per cent of it is under cultivation and the rest is used for pasture and hay land. The native vegetation includes a great variety of prairie and water-loving grasses, with some volunteer

timothy and clover. Of the cultivated crops corn, oats, and alfalfa are grown chiefly. The type is not well adapted to small grain because it is difficult to obtain a firm seed bed, and during exceptionally dry years the soil is subject to more or less drifting, with consequent injury to crop roots. Truck crops, including watermelons, cantaloupes, celery, tomatoes, cabbage, onions, and radishes, are grown to a small extent, as the soil is porous and warms up early in the spring. A few hogs are raised on every farm, and cattle are grazed on those farms that contain enough poorly drained land for pasture. All livestock is of good breeding. Most of the cattle are grade Hereford and Shorthorn, and the hogs either Duroc-Jersey or Poland-China. Many farmers have purebred herds of hogs.

The average yield of corn is about 25 bushels, oats 30 bushels, alfalfa 2 to 3 tons, and native hay three-fourths to 1 ton per acre. Average yields of truck crops were not obtainable, as the trucking industry is new and accurate records have not been kept.

The soil can be handled under almost any moisture conditions without injury and with lighter machinery and less power than is required for the heavier-textured terrace and bottom-land soils of the county. Commercial fertilizers are not used even for the truck crops, though all the available barnyard manure is applied to the land. The soil is in no immediate danger of becoming exhausted, as it receives considerable humus through surface wash from the higher-lying soils.

Land of this type ranges in value from \$50 to \$175 an acre, depending upon drainage, improvements, and location, the higher price applying to areas suitable for truck crops.

Although the yield of hay obtained on this soil is quite high, it has a coarser texture and lower feeding value than that obtained 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 among the native grasses.

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, with a relatively large proportion of silt and very little material coarser than very fine sand. The upper subsoil is a grayish-brown to gray very fine sand containing considerable silt and clay, loose and friable when moist but rather hard and brittle when dry. The lower subsoil, beginning at about 20 inches, is a gray incoherent medium to fine sand, which becomes coarser with depth and often gives way to a layer of coarse sand and gravel below 30 or 36 inches. In many places the lower subsoil is mottled with faint rusty-brown stains, due to poor drainage. The surface soil is rich in organic matter, but this material gradually decreases with depth and is deficient in the lower subsoil.

In a few places the upper subsoil of very fine sand is entirely absent, and the surface soil rests directly upon coarse sand and fine gravel at depths of 10 to 15 inches. In other places very little coarse material is encountered within the 3-foot section, and the subsoil consists of a gray fine to medium sand of loose, incoherent structure. Locally the subsoil is made up of alternating layers of very

fine sand, silt, and clay, the sand predominating. A few bodies of Cass fine sandy loam, too small to be shown on the map, are included with this type.

The Cass very fine sandy loam is not extensive in Merrick County. It occurs chiefly as small bodies and narrow broken strips upon the bottom lands along the Platte River. The largest developments lie north and west of Paddock and southwest of Lockwood. Typical bodies occur south of Central City and along Warm Slough south of Thummel. A rather large area borders the northern county line about 7 miles northeast of Palmer. The remaining bodies are small.

The soil has weathered from sandy alluvium deposited in the bottom lands along the streams during periods of high water. The high organic matter content of the surface soil is due largely to the subsequent growth and decay of plant life.

The topography is prevailingly flat, except where relieved by old stream channels, sloughs, and low ridges. Drainage is variable. The surface of the type is only slightly above the normal flow of streams, and during wet seasons the water table rises too near the surface for profitable farming, but in normal years drainage is adequate for the production of corn and alfalfa. Part of the soil has been artificially drained.

The type is not important in the agriculture of Merrick County, chiefly on account of its uncertain drainage. About 85 per cent of it is included in pasture and hay land and the remainder devoted chiefly to corn and alfalfa. The native grasses will support a cow or steer per acre during the summer grazing season, or when cut for hay will yield three-fourths to $1\frac{1}{4}$ tons per acre. The average yield of corn is about 20 bushels per acre, although yields as high as 70 bushels have been obtained from carefully managed and well-drained fields. Alfalfa yields $2\frac{1}{2}$ to 3 tons per acre from three cuttings.

Land of the Cass very fine sandy loam sells for \$40 to \$100 an acre, depending largely upon drainage, location, and improvements.

The yield of hay obtained on this land is coarser and has lower feeding value than that on the better-drained soils. Since the type is well adapted to timothy and clover, the quality of the hay could be greatly improved by sowing mixed clover and timothy seed among the native grasses.

CASS CLAY LOAM

The surface soil of the Cass clay loam is a very dark grayish-brown, heavy clay loam or sandy clay loam 8 to 10 inches deep, stiff and plastic when wet, but hard and tough when dry. The material is rich in organic matter and appears almost black when moist. The upper subsoil to an average depth of 24 inches is a gray fine sandy loam containing sufficient clay to give the mass a plastic gritty feel when moist and a slightly compact nature when dry. The lower subsoil is a loose, friable gray sand or clayey sand, which becomes gradually coarser and less coherent with depth, merging at about 36 inches into light-gray or grayish-brown coarse sand and fine gravel. The transition between the soil and upper subsoil is very gradual both in color and texture, while that between the two subsoil horizons is abrupt. The entire subsoil usually contains sufficient clay to bind the sand particles together when dry. The organic

matter decreases with depth and is deficient in the lower subsoil. The entire soil is calcareous.

The Cass clay loam is not extensive in Merrick County, occurring in a few small bodies and narrow, broken strips scattered throughout the Platte River bottom lands. The areas seldom exceed 1 square mile, and most of them range in size from 160 to 320 acres. One of the longest strips borders a tributary of Silver Creek north of Clarks; a typical development lies north of Central City in the southern part of the county; and small areas occur along Warm Slough, Wood River, and Silver Creek. The soil usually occupies local depressions or old stream channels which have become partly filled with silt and clay.

The type is poorly drained, as the surface lies but a few feet above the stream channel. Those bodies bordering Wood River, Silver Creek, and Warm Slough are subject to overflow during periods of high water. The areas along the Platte River are seldom inundated, but the water table lies so near the surface as to prevent successful farming, and in wet years it often rises to the surface, producing extensive areas of marshy land.

On account of its poor drainage very little of the type has been placed under cultivation and is valued chiefly as hay and pasture land. In most places it supports a heavier growth of grasses than the lighter-textured types. A few fields are under cultivation to corn, but the yields are usually low. The crops drown out during wet seasons and in dry years the clay shrinks badly, producing seams and cracks which injure crop roots. This soil is usually confined to narrow strips and seldom occupies entire farms, but it has a tendency to reduce the general value of the farms on which it occurs.

Artificial drainage is necessary if the land is to be profitably farmed, but throughout most of the type drainage is impracticable on account of the slight elevation above the stream channels. Its best use is for pasture and hay land, and tame grasses, such as timothy and clover, should be sown with the native grasses to improve the quality of the hay.

SARPY SAND

The Sarpy sand consists of 6 to 8 inches of light grayish-brown, loose, incoherent sand underlain by material of the same texture and structure to a depth of more than 3 feet. The surface soil is usually slightly darker than the remainder of the soil section, owing to a small amount of organic matter. Locally the subsoil below 30 inches is mottled with rusty iron stains, indicating poor drainage. In a few places it becomes quite coarse below 24 inches, and is composed of a loose mixture of coarse sand and fine gravel. The type differs from the Cass loamy sand only in the lower organic matter content and consequently lighter color of its surface horizon.

The Sarpy sand is very inextensive in Merrick County, being confined mainly to a few narrow strips either bordering the channel or upon small islands of the Platte River. The largest body, comprising about 600 acres, lies east of Havens in the northeastern part of the county. The type occurs upon islands in the Platte River

south and east of Silver Creek and is locally developed south of the Loup River in the northwestern part of the county.

The material has been derived from sandy alluvium recently deposited in the stream bottoms and has not yet developed a dark-colored surface soil from the growth and decay of vegetation. In many places the material resembles Riverwash, but is more stable and not so easily influenced by each slight rise of the streams.

The topography is flat to slightly hummocky, the surface having numerous depressions and slight elevations caused by stream and wind action. The type lies but a few feet above the normal flow of the streams and is subject to occasional inundation, but the uneven surface favors ready run-off and the porous soil and subsoil permit free underdrainage.

Owing to its small extent, low organic-matter content, and incoherent structure the soil is of little agricultural importance in this county. It is all included in pasture land, but the native vegetation is rather sparse and the land does not have a high value even for grazing. Narrow strips of forest, including a fairly dense growth of cottonwood and willow, occur along the stream channels.

It is doubtful if the Sarpy sand should ever be used for crop production, as it blows badly when disturbed, is rather droughty, and is subject to occasional overflow. The seeding of tame grasses, such as timothy and alsike clover, in the poorly drained areas and sand grasses on the more exposed situations would increase the grazing value.

RIVERWASH

Riverwash occurs upon sand bars, sand flats, and islands along the channel of the Platte River. The material is not extensive, as the individual bodies are few and small. The surface lies a few feet above the normal flow of the river and is subject to frequent inundation.

Riverwash is not permanent; the material undergoes change with each overflow, and even during normal flow small areas are shifted about, added to, or destroyed by the varying current. It is also modified to some extent by the wind. Riverwash supports a scant vegetation and is all included in pasture land. It is undergoing changes from weathering, and the more stable bodies will ultimately develop into soils similar to other bottom-land types.

DUNESAND

Dunesand consists of a grayish-brown, yellowish-brown, or brownish-gray, smooth, incoherent fine to medium sand, which extends to a depth of more than 3 feet, with little change in texture or color. The immediate surface contains some organic matter, but not enough to prevent the sand from drifting when the covering of grass is removed. The sand is unusually retentive of moisture, considering its loose, open structure. The material is seldom noticeably calcareous.

Dunesand occurs chiefly in the northern part of the county in close association with areas of Valentine sand. One of the largest developments, comprising about 5 square miles, lies north of Archer, in Midland Township. Smaller developments are north of Silver

Creek in the extreme northeastern part of the county and north of Mead School in the north-central part.

The topography of the Dunesand has been caused by wind action. The surface is sharply rolling, ridged, and heaped into dunes varying in height from 30 to 60 feet, and steep slopes abound. Numerous small hummocks, hollows, and blow-outs vary the otherwise billowy appearance of the landscape. A negligible part of the material is subject to active wind erosion at present. Drainage is all subterranean.

Dunesand is of little value for farming. A few patches here and there are under cultivation, corn being grown chiefly, but the yields are low except in the most favorable seasons. Practically all of the Dunesand is used for pasture land. The native vegetation includes many grasses, of which long-leaved reed grass, redfieldia, sand grass, and stipa are the most common. These afford good grazing during spring and summer, and will support 50 to 60 head of stock per section. The selling price of Dunesand ranges from \$25 to \$50 an acre, depending largely upon improvements.

SUMMARY

Merrick County is located in east-central Nebraska. It is roughly triangular in shape and contains 476 square miles, or 304,640 acres. All of the county, except a few square miles of upland in the extreme northwestern part, is included within the alluvial lands of the Platte and Loup Rivers. The topography of the small upland area is for the most part rough and dissected, although a few of the divides have flat tops. The alluvial lands include the terraces and bottom lands of the Platte and Loup Rivers, and have a generally flat to gently undulating relief. They lie 75 to 200 feet below the uplands.

The county has an average elevation of about 1,700 feet above sea level. The general slope is toward the east. The drainage is effected through the Loup and Platte Rivers and their tributaries. As a whole the county is well drained, although there are extensive areas throughout the bottom lands which are either subject to overflow from the streams or in which the water table often rises too near the surface for profitable farming.

The first settlement in Merrick County was made in 1859, and the county was organized in 1864. Central City, the county seat and largest town, had 2,410 inhabitants in 1920.

The county has a good transportation system. Telephones and rural delivery routes reach all sections. The surplus products, consisting of grain, hay, cattle, and hogs, are usually marketed outside the county.

The climate of Merrick County is well suited to the production of hay and grain crops and the raising of livestock. The mean annual precipitation is 26.15 inches, and the mean annual temperature 51.1° F. The rainfall is usually quite favorably distributed. The average length of the growing season is 158 days.

The present agriculture consists of diversified farming, including the production of grain and hay and the raising of livestock. The chief crops are corn, wheat, wild hay, oats, alfalfa, rye, and barley. Cattle, hogs, and poultry are raised on most farms and constitute

an important source of farm income. The work stock consists of the heavy draft types of horses and mules. All livestock is of good breeding.

Commercial fertilizers are not used on any of the soils of Merrick County, but barnyard manure is applied when available.

Land values range from \$40 to \$200 an acre, depending upon the topography, drainage, improvements, character of the soil, and location with respect to markets.

The soils of the county differ widely in their physical and chemical characteristics, owing to the character and mode of accumulation of the parent materials from which the soils have weathered and to the degree and manner of weathering to which the parent materials have been subjected. Differences in the degree and kind of weathering, which are controlled to a large extent by drainage, topography, and climate, have produced decided differences in the surface character of otherwise similar parent materials. Those soils that have been subjected to undisturbed weathering for the longest time have a dark grayish-brown to black color, due to the accumulation of large quantities of organic matter. The loose, drifting sand of the Dunesand areas, the stationary Valentine soils, and the severely eroded upland soils have not developed this dark color. Various degrees of weathering, leaching, and oxidation also have produced decided differences in the soil profile of similar parent materials.

On the basis of characteristics due to the composition and mode of accumulation of the parent materials, the soils of Merrick County are classed into loessial soils, alluvial soils, and æolian soils. The loessial materials are composed of fine-textured silts deposited over the upland part of the county during glacial times. They have given rise to different phases of the Marshall series. The alluvial materials are composed of sediments deposited as valley terraces and flood plains by the streams. They have been included in the O'Neill, Hall, Waukesha, Cass, Sarpy, Lamoure, and Gannett series, and Riverwash. The æolian materials are mostly of a sandy nature and have either been blown to their present position or have been so whipped about and reassorted by the wind that their exact origin is difficult to determine. They have been included with the Valentine series and Dunesand.

The soils of the Marshall series are the only ones developed in the uplands of Merrick County. The flatter areas of these soils are adapted to all crops common to the region. The eroded areas are used chiefly for pasture land.

The Valentine sand and loamy sand are the dominant soils in the northern part of the county. The former is used chiefly for grazing. The latter is more stable and is used quite extensively for corn production.

The Gannett loamy sand occupies poorly drained depressions on the terraces and is used extensively for hay and pasture.

The Hall soils are extensively developed in this county. They occur on the terraces or second bottoms, have a generally flat topography, and as a rule are well drained. The subsoil of this series is highly calcareous. The types are well adapted to all crops common to the region.

The Waukesha soils are extensively developed on the higher terraces. They differ from those of the Hall series chiefly in the lower lime content of the subsoil. All members of this series are well adapted to general farming.

The soils of the O'Neill series have porous, sandy subsoils and are more or less droughty, though good yields of most crops are obtained in average years. The types are all low in lime.

The Cass soils occupy first bottoms or flood plains and have a porous sandy subsoil. Drainage is uncertain, owing to their low position. Most of the types are used as pasture and hay lands.

The types of the Lamoure series occupy some of the lowest flood-plain positions in the county. As a rule they are poorly drained, and unless artificial drainage is established are suited only for hay and pasture.

The Sarpy sand consists of recently deposited sand which has been slightly weathered and has little agricultural value.

Dunesand is mapped in the northern and northeastern parts of the county. It represents wind-blown materials derived chiefly from river sand and from the sand sheet underlying the loess. Riverwash includes sand bars and low islands in the Platte River.



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