

SOIL SURVEY OF HALL COUNTY, NEBRASKA.

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DESCRIPTION OF THE AREA.

Hall County is situated in the south-central part of Nebraska. Grand Island, the county seat, is 154 miles west of Omaha. The county is bounded on the north by Howard County, on the east by Merrick and Hamilton Counties, on the south by Adams County, and on the west by Buffalo County. It is nearly square, being approximately 24 miles long from north to south and 23 miles wide east and west. Its total area is 528 square miles, or 337,920 acres.

Hall County lies near the eastern margin of the Great Plains. In general the surface is smooth, and there is no conspicuous topographic relief. The Platte River crosses the county in a northeasterly direction, flowing through a shallow valley 12 to 15 miles wide. About 6 square miles of territory in the extreme northwestern corner is included in the South Loup River Valley. The upland consists of two small triangular areas, one in the northwestern part of the county and one in the southeastern part. These upland areas represent remnants of an originally continuous eastward-sloping plain.

The Platte River flows near the southern side of its valley, in a number of widely separated channels which inclose a great number of low-lying, elongated islands. The bottom land in general lies only 5 to 10 feet above the water, and there are many poorly drained depressions representing the sites of old channels. To the north of the first bottoms is a very extensive nearly level alluvial terrace, lying 15 to 40 feet above the flood plains. The city of Grand Island is situated near the southern border of this terrace, which for convenience in reference may be called the Grand Island terrace. The dividing line between the first bottoms and this terrace is a low bluff extending southwestwardly from Grand Island and lying 1 to 2 miles south of the Union Pacific Railroad. The terrace reaches a width of 6 to 13 miles, and is the largest topographic division in the county. Its surface has scarcely been modified. In a few places the

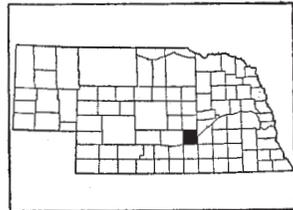


FIG. 57.—Sketch map showing location of the Hall County area, Nebraska.

wind has heaped up low hummocks of sand, but there has been little stream erosion. There are a few small eastward-flowing streams on the terrace, but they follow sluggish, winding courses and occupy relatively deep, canal-like channels, without tributaries. There are also a few winding, slough-like depressions, which seem to represent the abandoned channels of present streams.

The upland areas lie 50 to 150 feet above the Platte valley floor. The surface in general ranges from slightly rolling to nearly level and flat, but in places near drainage ways there are narrow zones of broken and eroded land. About 30 square miles of upland in the northern part of the county is rolling and uneven, owing to the heaping up of loose sand into irregular, low, rounded hills and dunes by the wind. This area forms a narrow divide between the Loup and Platte Valleys and is known as the "sand hills." A similar but much less extensive line of low hills occurs along the margin of the southern upland area facing the Platte Valley.

The elevation of the first bottoms and terraces of the Platte River ranges from 1,800 to 2,000 feet above sea level. There is a gradual slope eastward of about 9 feet per mile. The elevation of the Loup River valley in the northwestern corner of the county is about 1,900 feet above sea level. The upland in the northwestern part ranges from about 1,940 to 2,100 feet. The elevation of the southern upland area ranges from about 2,060 feet above sea level on the west to about 1,900 feet along the eastern boundary of the county.

The Platte River drains the entire county except a small area in the northwestern part which is drained by the South Loup River. The Platte is heavily loaded with sediment, and is engaged in aggradation and in lateral cutting rather than in deepening its channel. All the longer streams have low gradients. Most of the streams are intermittent. Even the Platte River frequently becomes dry for short periods during the summer. There are many nearly level areas which have no well-defined drainage ways and in which there has been little modification of the original constructional plains surface. The rainfall, however, is comparatively light, and many of the soil types have porous subsoils and are well underdrained, so that areas with only a very moderate slope may be naturally drained sufficiently for farming. The only areas that are markedly deficient in drainage are small depressions in the upland and the lower lying bottoms along the Platte River, aggregating not more than 6 per cent of the total area of the county.

The first settlement in this territory was made about 1857, by a colony of Germans, and the county was organized in 1859. Its population in 1880 was 8,572, and in 1910, 20,361. Approximately 86 per cent of the population consists of native white persons and 13.6 per cent of foreign-born white persons, principally Germans. All the

population outside Grand Island, or 49.3 per cent of the total, is classed as rural, and averages 19 persons to the square mile. All parts of the county are settled, but the density of settlement is slightly greater in the central-valley part along the Union Pacific Railroad.

Grand Island, with a population in 1910 of 10,326, is the principal city and the county seat. It has a number of manufacturing industries, and is one of the largest horse and mule markets in the West. Doniphan, with a population of 399, in the southeastern part of the county; Wood River, with a population of 796, in the southwestern part; and Cairo, with a population of 364, in the northwestern part, are important local trading points and grain markets.

Lines of the Union Pacific and Chicago, Burlington & Quincy Railroads and the St. Joseph & Grand Island Railway traverse the county and afford excellent transportation facilities. No farm is more than 10 miles from a railway station. The public highways are all earth roads, but they are generally maintained in good condition by frequent grading and dragging. Roads have been laid out on practically every section line except in a few square miles of rough sand-hill uplands and also in some parts of the Platte River bottoms, which are difficult of access on account of the numerous channels. Rural mail delivery routes reach all parts of the county, and practically all the farmers have telephone connection with Grand Island and other near-by towns.

Grand Island is the principal local market for farm products. Omaha, Kansas City, and Chicago are the principal large markets for grain and live stock.

CLIMATE.

Hall County has a climate transitional between that of the north-central Mississippi Valley and the semiarid climate of the High Plains. The rainfall is moderate, and frequently low. The humidity is relatively low and the rate of evaporation relatively high. There is a wide range between summer and winter temperatures.

The mean annual precipitation is 29.45 inches. The greater part of the rainfall occurs during the months from May to August, inclusive, generally in the form of hard thundershowers. The annual precipitation when normally distributed is sufficient for successful farming, without irrigation or rigid adherence to dry-farming methods. In some years, however, crops have been almost complete failures on account of droughts, and they suffer some injury on certain soils nearly every year. There is rarely an excess of rainfall. The precipitation in the wettest year on record (1905) amounted to 45.85 inches, of which 24.98 inches fell during the months of May, June, and July.

The mean summer temperature is 73.6° F. The maximum recorded temperature is 110°, in September, but July and August are usually the hottest months. The mean winter temperature is 26.1° F. The temperature frequently falls below zero, and a minimum of -34° has been recorded in February. The region is occasionally swept by cold northwest winds in winter.

The average date of the last killing frost in the spring is April 26, and that of the first in the fall October 7, giving an average growing season of 164 days, which is ample for the maturing of corn and all the other crops commonly grown. Killing frost has been recorded as late in the spring as May 19 and as early in the fall as September 12.

There is a high percentage of clear and sunny days. The rate of evaporation is probably a little higher than that of most of the central Mississippi Valley region, being probably a little above 40 inches. No record of the snowfall exists, but it is probably a little less than that of Omaha, 150 miles to the east, viz, about 25 inches.

Climatic data from the records of the Weather Bureau station at Grand Island are given in the following table:

Normal monthly, seasonal, and annual temperature and precipitation at Grand Island.

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1890).	Total amount for the wettest year (1905).
December.....	° F. 28.7	° F. 80	° F. -17	Inches. 0.87	Inches. T.	Inches. 0.00
January.....	24.7	72	-29	.51	.55	1.64
February.....	25.0	78	-34	.84	.20	1.55
Winter.....	26.1	80	-34	2.22	.75	3.19
March.....	36.6	91	-12	1.30	.23	.73
April.....	51.1	98	13	2.77	1.12	4.01
May.....	60.0	102	22	4.38	1.32	9.53
Spring.....	49.2	102	-12	8.45	2.67	14.27
June.....	71.1	113	36	4.78	2.94	8.97
July.....	75.6	108	48	4.10	.55	6.48
August.....	74.1	108	40	3.94	2.72	3.66
Summer.....	73.6	108	36	12.82	6.21	19.11
September.....	65.3	110	25	2.72	1.27	5.67
October.....	52.7	98	8	2.46	.65	1.21
November.....	38.4	88	-4	.78	1.05	2.40
Fall.....	52.1	110	-4	5.96	2.97	9.28
Year.....	50.4	110	-34	29.45	12.60	45.85

AGRICULTURE.

The early farming in Hall County consisted mainly of the growing of corn and wheat. Cattle raising was carried on, but ranching was not as important as in more western areas of the State. Corn has always been more of a staple crop than wheat, which has been grown mainly as a cash crop and has fluctuated widely in acreage, varying with market conditions. The census of 1880 reported 41,609 acres in wheat and 19,408 acres in corn. By 1889 there was a decrease in the wheat area to 3,988 acres, while corn had increased to 85,354 acres. In 1899 the area in wheat was 20,346 acres, and in corn 95,225 acres. By 1909 corn dropped to 77,981 acres, while wheat steadily increased and occupied a total area 74 per cent as large. Oats were grown on 24,162 acres in 1909. Alfalfa has greatly increased in acreage during the last 15 years, and has become one of the staple crops. The growing of sugar beets became an important industry following the establishment of a beet-sugar factory at Grand Island in 1890. It soon declined, however, mainly because of a lack of desirable cheap labor, and probably less than 200 acres are now devoted to sugar beets. The present agriculture consists mainly of grain and hay production, with wheat, corn, oats, and alfalfa as the principal crops. Most of the farmers keep some live stock and a small number are engaged in the feeding of stock on an extensive scale.

Wheat is the principal income crop. Its total area in 1909 was about 15,000 acres less than that of corn, but there has been such an increase in the wheat area during the last few years, on account of the prevailing high prices and good yields, that it is now probably grown more extensively than any other crop. Wheat is grown on practically all the different soil types. It is a little more certain in yield than corn, since it matures sufficiently early to avoid the severe droughts and hot winds which may occur later in the summer. On soils of average productiveness the yield is commonly about 20 bushels per acre. Hard winter wheat is grown almost exclusively, Turkey Red being the principal variety.

The census of 1910 reports 77,981 acres in corn, with a production of 1,783,784 bushels. The average yield on the soils best adapted to corn is about 30 bushels per acre, but yields on all types are subject to wide variations from year to year, largely on account of late summer droughts and hot winds. Strains of Reid's Yellow Dent and Silver Mine are the principal varieties grown. Thorough cultivation is practiced, but little attention is given to seed selection. Most of the corn is fed to cattle and hogs, but a large number of farmers, especially tenants, sell the greater part of their crop.

The area in oats in 1909 was 24,162 acres, and the production 537,452 bushels. Oats, although grown on practically all farms and

on all soil types, are not generally regarded as very profitable. They are grown principally because they fit conveniently in rotations, following corn when it is desired to change the land to wheat. The crop is seldom grown for more than one year on the same field. The grain is fed principally to work stock, but is used to some extent in feeding sheep.

Alfalfa is one of the staple crops, occupying 17,669 acres in 1909. The acreage has steadily increased since that year, principally at the expense of corn and oats. It is grown on practically all the soils except those that are continuously wet and poorly drained. Yields range from 2 to 4 tons per acre per season. Four cuttings a year are ordinarily obtained on the soils best adapted to the crop. Alfalfa is grown mainly for winter feed and forage, but it is used extensively as a soiling crop and for hog pasture. On soils which give the heavier yields it is ordinarily a profitable income crop.

There is still a comparatively large acreage of wild-hay land, mainly on the bottom land but also in the more poorly drained depressions in the uplands and terraces. The yield of wild hay is commonly about $1\frac{1}{2}$ tons per acre. The census of 1910 reports wild hay cut from 25,374 acres.

Minor crops of the county include sorghum, kafir, millet, barley, sweet clover, and Irish potatoes. Most farmers grow vegetables in a small way, mainly for home use. Watermelons, cantaloupes, and other truck crops are grown on a small scale to supply local markets. Sweet corn is grown to a small extent near Grand Island for a local canning factory. There are small orchards, principally of apples, on most farms, but tree fruits are not an important source of income and the trees are seldom given much care.

The feeding of live stock is an important industry, commonly carried on in combination with grain farming. Most farmers keep a small number of hogs and cattle and there are a few farmers in each neighborhood who feed stock on an extensive scale, purchasing the surplus grain and hay of other farmers. Tenants as a rule keep less live stock than farm owners. Corn and alfalfa are the principal stock feeds. Most of the beef cattle sold are raised in the county, but the more extensive feeders generally buy a considerable part or all of their stock. Most of the sheep are shipped into the county from western ranches. According to the census, the total number of cattle in the county in 1910 was 27,928, of hogs 35,091, of sheep 14,133, and of horses 11,085.

The raising of horses, principally of the draft type, is an industry of some importance. Most of the farm owners raise their own work stock and generally have a few animals for sale.

Dairying is carried on to some extent. On most farms it is incidental to grain growing. Most farmers keep a few cows to supply

milk and butter for home use, and a large number sell small quantities of milk or cream to local dairies and creameries. There are, however, only a few large dairy herds in the county.

The staple farm crops are grown on all the different soil types, and on about the same proportional acreage. Most of the farmers, however, recognize that the silt loams of the Grand Island terrace and the upland, with compact and calcareous subsoils, are best adapted to alfalfa. The bottom-land soils are preferred for corn, although the average yields are but slightly above those obtained on the more productive upland soils. The silt loams of the terraces and upland are generally believed to give best results with wheat and oats.

Farm methods are nearly uniform throughout the county, as there is little variation in climatic conditions, topography, and marketing facilities. Plowing for wheat begins as soon as possible after the removal of the oat crop, generally about the middle of July or early in August. Most of the soils require only harrowing, and the wheat is drilled in in September or October. Many farmers seed wheat between the corn rows before the corn is harvested, using a 1-horse drill. Both binders and headers are used in cutting the grain. The greater part of the crop is thrashed from the shock, and most of the grain is sold directly from the thrashing machine. The straw is not valued highly, and many farmers burn it.

Corn is generally given level cultivation, but on some of the more poorly drained land the ridge method is preferred. Listing is common on the sandier soils. On the heavier soils the plowing is usually done in the fall. Most farmers snap the corn and later pasture the stalk land. Only a very small percentage of the corn crop is used for silage. Oats are commonly sown broadcast in April or early May, on disked land previously occupied by corn. Less frequently the grain is drilled in. Alfalfa hay is generally stacked in the field. The hay sold is generally disposed of locally without baling.

Commercial fertilizers have never been used in growing the staple crops. Most farmers use the manure produced on the farm, and rotted wheat and oat straw is often applied to the fields.

Practically all the farms are equipped with modern, labor-saving machinery. Tractors are beginning to be used extensively in fall plowing for wheat. The work stock consists mainly of horses, 6 to 8 head being kept on the average farm. The farmhouses are for the most part well built, and the barns are large and substantial. The value of all farm property in the county in 1910 is reported as \$28,768,614, averaging \$17,682 per farm.

Wheat, corn, and oats are commonly grown in succession, but no definite or uniform system of rotation is adhered to. Land is usually kept in wheat for 2 to 5 years. In some cases this crop is grown for 8 or 9 years in succession by both renters and owners. Wheat

land is generally changed to corn, and this crop also may be grown several years on the same field. Oats, which follow corn, are not often grown for more than one year. Alfalfa may be seeded after wheat or oats. The land is left to this crop as long as the yields are profitable, generally 5 to 7 years, and then put in wheat or corn.

Most of the farm labor is performed by the operator and his family, except during harvest. Laborers hired by the year receive \$25 to \$30 a month, with board. During wheat harvest \$3 to \$3.50 a day is paid for temporary help.

The average size of farms, according to the census of 1910, is 196.5 acres. There are very few farms as small as 40 acres and only a comparatively small number larger than 320 acres. The prevailing size of the grain farms is 160 acres. There are several individual holdings of more than 1,000 acres, but usually in these cases much of the land is valuable only for pasture or for wild-hay production.

The census of 1910 reports 94.6 per cent of the area of the county in farms, and 87.3 per cent of the farm land as improved. The total number of farms is reported as 1,627. About 42 per cent of the farms are operated by tenants. Under the most common system of share rental the landowner receives two-fifths of the crops, the tenant furnishing the stock, labor, and implements. Very few farms are rented for cash.

The selling price of land varies from \$20 or \$40 an acre for land suitable only for pasture or for wild-hay production to \$150 an acre for the most productive land. The average price of farm land is about \$100 an acre.

SOILS.

Hall County is situated in the east-central part of the Great Plains region. The soils have been influenced by a climate intermediate between that of the north-central Mississippi Valley and that of the semi-arid High Plains. However, they partake more of the nature of soils of humid than of semiarid regions. The greater part of the soils has been derived from old and recent alluvium laid down in the valley of the Platte River. The soils of the upland, which constitute a little less than one-third of the county, are derived mainly from the underlying formations, which consist of silt, sand, and sandy clay. These are mainly of Pleistocene age, but some of the material is possibly late Tertiary.

The principal deposit on the upland is a pale-yellow or grayish, loosely consolidated material consisting mainly of silt and very fine sand. In structure and chemical characteristics it is similar to the loess along the Missouri and Mississippi Rivers. It is part of an extensive formation, probably Pleistocene in age, which underlies a

large part of central and eastern Nebraska and is known geologically as "Plains Loess." The silt formation in this county is overlain by a thin deposit of yellow fine and very fine sand. This surficial sand deposit is not uniformly distributed over the whole upland and in places it has been largely removed by erosion, but it has had an important influence on the character of the soils. The sand generally is not more than 10 feet in thickness, but in places it has been heaped by wind action into hills 25 to 30 feet high.

A formation composed mainly of grayish sand and bluish-gray sandy clay, brownish when weathered, is exposed in the bluffs south of the Platte River. It is evidently older than the silt and sand formations, and may be Tertiary in age. The surface exposures are of very small extent and the formation has had no important influence on the soils.

The basal deposit of the terrace alluvium consists of coarse sand and fine gravel, very similar or identical in lithologic character with that of the first bottoms. The sand consists principally of quartz. The coarser material represents a great variety of rocks, but principally those of igneous origin, small particles of granite and feldspar being most abundant. This basal deposit seems to underlie the entire terrace. It is exposed or lies very near the surface in the vicinity of Grand Island and along the southern margin of the terrace plain. Back from the terrace escarpment there is an increasingly thick covering of finer material, and the sand and gravel is encountered only at depths of 10 to 30 feet. The surface alluvium in the vicinity of Grand Island and directly adjacent to the terrace escarpment consists mainly of sand and fine and very fine sandy loam. To the west and north, nearer the upland, the alluvium becomes finer and more uniform, consisting mainly of silt and very fine sand. It is not improbable that a considerable percentage of the surface silt and very fine sand is of eolian origin.

The recent-alluvial deposits, or those occupying the first bottom along the Platte River, consist of a basal mass of sand and fine gravel, pervious and unconsolidated in structure, overlain by a deposit 3 to 6 feet in thickness, of fine sandy loam, silt and clay. The material of different textures is commonly distributed in narrow, parallel belts which bear a close relation to the position of present and former stream channels. This overlying layer has given rise to the soils over the greater part of the first bottoms. The most recent deposit consists of grayish or pale-yellowish fine and very fine sand, occurring in low, flat ridges adjacent to the stream channels. Old soil layers are frequently encountered beneath the sand at depths of 2 to 6 feet.

The soils of the several divisions vary considerably in physical and chemical characteristics with physiographic position and age.

The soils of the Platte first bottoms, which are the most recent in origin, occupy the lowest positions, and are on the whole most poorly drained, have very dark colored, calcareous surface soils, underlain by subsoils which are commonly lighter textured and have been little modified since deposition. The terrace lying to the north is in many respects a duplicate of the first bottoms, and the soils here are believed to differ from the first-bottom types mainly as a result of their greater age. There has been greater concentration of clay in the subsoils, and the material has been modified to greater depths by leaching and oxidation. The surface soils are on the whole not quite so dark and are less calcareous, while lime has been concentrated to a greater extent in the subsoils. The soil material of the upland, except in some of the areas occupied by wind-blown sand, is older than that of the terraces and first bottoms, and because of this and the higher topographic position it has undergone more leaching and oxidation. The surface soils are, on the whole, not quite so dark, and brown and yellow colors prevail to a greater extent in the subsoils. Where the surface is flat, the concentration of clay in the subsoil is greater than on the terrace, as, for example, in the areas of Grundy silt loam.

Within the individual topographic divisions there are some slight differences in the age of the underlying deposits, giving rise to variations in soil characteristics. There is fairly conclusive evidence that in the formation of the Platte Valley there has been a gradual shifting of the channels toward the southeast and south. The earliest channels probably hugged the upland bluffs in the northwestern part of the county. The western and northern part of the alluvial terrace is consequently older than the eastern and southern border, and the soils here are the finest textured and have the most impervious subsoils. The greater thickness of fine material over the coarse substratum also probably bears a relation to the greater age. In the northern part of the first bottoms likewise the soils of corresponding texture are notably higher in silt and clay content to greater depths than along the present channels. Alluvium originally of the same lithologic character has in one place given rise to a black, highly organic fine sandy loam, 12 to 15 inches deep, overlying a fine sandy loam subsoil, while in another place the material is a gray, incoherent silty fine sand representing the most recent deposition by flood waters. On the upland, the soil in the sand-hill areas is evidently more recent than in the areas of silt loam. The sand has not been stationary sufficiently long for organic matter to accumulate to a greater depth than 4 or 5 inches, and there is scarcely any difference in texture to a depth of 3 feet.

Silt loam soils predominate throughout the county, with fine and very fine sandy loams next in extent. There are no gravelly or stony

types. The heavier soils are prevailingly dark in color and high in organic matter, and calcareous either in the surface soil or subsoil or in both. The sand soils are the lightest in color and the least calcareous. The different soil types are rather widely distributed in small areas throughout their respective topographic divisions. The two largest developments of uniform soil are an area of Hall silt loam on the terrace plain in the central part of the county to the north of Wood River and west of Alda, and an area of Grundy silt loam on the upland in the southeastern part. The soils of least agricultural value occur mainly in low-lying, poorly drained areas in the Platte River bottoms and in the sand-hill area in the northern part of the county.

The soils are grouped into series on the basis of common origin, physiography, color, structure, and chemical character. In this county the structure of the subsoil is an important basis of differentiation. The series are divided into types on the basis of texture or the relative quantities of different-sized soil particles, such as sand, silt, and clay, present. The predominating upland soils, derived from the yellow silt and sand formation of the Loess Plains, are classed in the Grundy, Marshall, and Colby series. The wind-blown soils are classed in the Valentine series. The Scott soils occupy poorly drained areas in the Grundy and Marshall soils, and the Gannett soils similar situations in areas of the Valentine soils. The terrace soils are classed in the Judson, O'Neill, and Hall series, and the first-bottom soils in the Cass and Lamoure series.

The Grundy soils are similar to the Marshall in color but differ in having a heavy, stiff-structured subsoil, amounting in places to a hardpan. The topography of the Grundy soils is nearly flat or slightly undulating.

The Marshall soils differ from the Colby principally in the darker color of both soil and subsoil. In this county the lower subsoil of the Marshall usually is sufficiently calcareous to effervesce with acid at depths of 30 to 40 inches.

The soils of the Colby series in Hall County are grayish brown to dark grayish brown in color and underlain by yellow, friable, or only moderately compact subsoils. The surface ranges from undulating to steeply sloping and broken.

The Scott series includes brownish and grayish soils, commonly underlain by a thin subsurface layer of gray, friable silt. The subsoil is a tough, plastic clay. It is dark or light drab in color, mottled with brown, the degree of mottling varying with the local drainage conditions.

The surface soils of the Valentine series are brown and the subsoils yellow. The material consists of loose sands blown by winds into a billowy or choppy surface, with occasional rather high dunes. The

Valentine series is rather extensive in central and north-central Nebraska, occupying the so-called "sand hills." The sand is probably residual from an underlying Pleistocene formation and to a less extent from a sandy clay and sand formation of Tertiary age, redeposited by wind. Possibly some of the material in this county has been blown from the adjacent Loup and Platte River Valleys.

The Gannett series comprises dark-gray or black soils with grayish and pale-yellowish subsoils. The Gannett soils occupy circular and valleylike depressions in the sand-hills area of Nebraska, and are poorly drained.

The Judson soils occur on alluvial terraces lying above present overflow levels. They are characterized by light-brown or yellowish surface soils and yellowish, friable subsoils. They are similar in color and structure to the soils of the Colby series.

The Hall series includes dark-colored soils which are commonly heavier and stiffer in the subsoil than in the surface layer. The color of the surface soil ranges from brown to nearly black. The subsoil is commonly some shade of yellow, with drab colors in the more poorly drained situations. The lower subsoil or substratum is commonly calcareous. The Hall soils are developed on alluvial terraces which lie above stream overflow levels. The topography varies from nearly level to undulating, but in general the drainage is sufficiently good for farming. This is the most extensive series in Hall County. It occupies about 39 per cent of the total area.

The O'Neill series is closely associated with the Hall, and is similar in origin. It differs mainly in that the subsoil is lighter in texture than the surface soil, in this respect being analogous to the Cass series of the first bottoms. Course sand and fine gravel frequently occur within three feet of the surface.

The Cass series is characterized by dark-brown or black surface soils and a lighter colored subsoil, commonly pale yellow or grayish. A distinguishing characteristic is the lighter texture in the subsoil than in the surface layer. In Hall County the surface material in most places is sufficiently calcareous to effervesce with acid. The Cass is the most extensive series in the bottom lands of the Platte River.

The Lamoure series is similar to the Cass in color, but differs in that the subsoil is as heavy as the surface soil, or heavier. The material is often calcareous throughout the 3-foot section and always effervesces in the lower subsoil. Drainage is sufficiently thorough for successful farming.

In the following pages of this report the various soils mapped in Hall County are described in detail and discussed in their relation to agriculture. The name and the actual and relative extent of each are shown in the following table:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Hall silt loam.....	56,320	20.2	Hall sandy loam.....	6,656	2.0
Friable-subsoil phase.....	12,032		Lamoure silt loam.....	5,312	1.6
Hall very fine sandy loam.....	28,928	8.6	Cass sandy loam.....	5,056	1.5
Valentine sand.....	28,800	8.5	Gannett loamy sand.....	4,992	1.5
Cass fine sandy loam.....	23,808	7.0	Hall clay loam.....	4,928	1.5
Grundy silt loam.....	23,360	6.9	Marshall silt loam.....	4,672	1.4
Hall fine sandy loam.....	21,952	6.5	Lamoure clay loam.....	4,544	1.3
Colby silt loam.....	21,120	6.2	O'Neill fine sand.....	4,352	1.3
Cass fine sand.....	16,128	4.8	Marshall loam.....	3,712	1.1
Cass clay loam.....	10,944	3.2	Gannett sandy loam.....	2,560	.8
Lamoure fine sandy loam.....	10,368	3.1	Judson fine sandy loam.....	2,240	.6
O'Neill loam.....	9,856	2.9	Scott silt loam.....	384	.1
Colby fine sandy loam.....	9,728	2.9			
O'Neill sand.....	7,808	2.3			
Colby sandy loam.....	7,360	2.2			
			Total.....	337,920

GRUNDY SILT LOAM.

The surface soil of the Grundy silt loam consists of a very dark brown, mellow silt loam, 10 to 12 inches deep, grading into a lighter brown, slightly more compact silt loam. This changes rather abruptly, usually at a depth of 18 to 24 inches, to a yellowish-brown, tough, impervious clay, which resembles a clay hardpan. This clay is stiff and plastic when wet and becomes extremely hard and crumbly when dry. The subsoil varies in color from yellowish brown to yellowish drab, but is usually lighter in the lower part. A substratum of grayish or pale-yellowish, friable silt is encountered at depths of $3\frac{1}{2}$ to 5 feet. The lower subsoil and the substratum are calcareous, but the surface material nowhere contains sufficient lime to effervesce with acid.

This soil is confined principally to one large, uniform area in Doniphan and South Platte Townships, in the southeastern part of the county. It occupies a nearly level or slightly undulating plain, little modified by stream erosion. The surface is not quite as rolling as in the areas of Colby and Marshall soils, but most of the land has sufficient slope to be adequately drained for farming.

Practically all the type is under cultivation, and it is regarded as one of the more valuable general-farming soils of the county. Wheat, corn, alfalfa, and oats are the principal crops, named in order of acreage. Kafir, sorghum, and millet are grown in small fields. Orchard fruits probably bear somewhat better than on the terrace and first-bottom soils. Only a few farmers feed stock extensively and most of the grain and hay produced is sold.

Yields of wheat vary widely with the season and the state of improvement of the land, ranging from 15 to 35 bushels per acre, with an average of perhaps 20 bushels. The average yield of corn is about 30 bushels per acre. Oats yield 30 to 40 bushels and alfalfa $3\frac{1}{2}$ to 4 tons per acre. The soil withstands drought fairly well. On the whole it is probably a little more productive than the associated Colby silt loam, ranking about equal to the Marshall silt loam.

The surface soil is well supplied with organic matter and with ordinary care is maintained in good tilth. Most farmers plow to a depth of about 6 inches. The soil does not clod seriously and it is seldom necessary to use a roller to work up a good seed bed for wheat. No commercial fertilizers are used, but the small amount of barnyard manure produced is generally applied to the land. Many farmers grow wheat several years in succession on the same field. Land of the Grundy silt loam ordinarily sells for \$100 to \$125 an acre.

MARSHALL LOAM.

The surface soil of the Marshall loam is a very dark brown, mellow loam. It becomes lighter colored and higher in clay content at about 15 inches, and grades at 18 to 20 inches into a dark yellowish brown, friable, fine-grained clay, which changes to a yellow, friable silty clay at about 30 to 36 inches. The type as mapped varies in texture, much of it being a fine loam or a fine sandy loam, and it everywhere contains a relatively large proportion of very fine sand and silt. It is intermediate in color and structure between the associated Colby and Grundy soils.

The Marshall loam occurs in Doniphan and South Platte Townships, in five areas varying from 300 to 1,500 acres in extent. Its surface is slightly undulating, not quite as level as that of the Grundy silt loam but not quite as uneven as that of the Colby soils. The drainage is good.

All the type is under cultivation to the staple crops of wheat, corn, oats, and alfalfa. Its productiveness is about the same as that of the Marshall and Grundy silt loams. It is somewhat easier to work than those types, and probably withstands severe droughts a little better than the Grundy soil.

In the following table are shown the results of mechanical analyses of samples of the soil and subsoil of the Marshall loam:

Mechanical analyses of Marshall loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
372473.....	Soil.....	0.4	3.1	2.0	6.4	27.6	46.0	14.4
372474.....	Subsoil.....	.1	.8	.5	2.0	23.6	54.5	18.5

MARSHALL SILT LOAM.

The surface soil of the Marshall silt loam is typically a very dark brown, mellow silt loam, 12 to 15 inches deep. The subsurface material is a lighter brown, friable silt loam, which grades into a yellowish-brown, friable silty clay loam at 20 to 24 inches. The subsoil gradually becomes lighter in color and coarser in texture with depth, changing to a pale yellow, friable silt at 3 to 4 feet. There is commonly a 2 to 4 inch surface layer of dark-brownish very fine sandy loam. In some places the soil is a fine loam rather than a silt loam. The lower subsoil and the underlying yellow silt substratum are calcareous. In color of the soil section and in subsoil structure the Marshall silt loam is intermediate between the Colby silt loam and the Grundy silt loam.

The Marshall silt loam occurs in several small areas in the northwestern part of the county and in two small areas in the extreme southeastern part. Its surface varies from nearly level to undulating or gently sloping. In the northwestern part of the county the type occupies drainage divides, the steeper slopes comprising areas of Colby silt loam. The two small areas in the southeastern part of the county occur on comparatively gentle slopes along small drainage ways. The land is sufficiently sloping to be well drained without being subject to destructive erosion.

This soil is productive, and practically all of it is under cultivation. Wheat, corn, and alfalfa are the principal crops. Oats are grown to some extent. Yields are slightly higher than on the Colby silt loam, and, owing to the more favorable topography, tillage and harvesting are carried on with slightly less labor and expense. Land of the Marshall silt loam is valued at \$80 to \$100 an acre.

COLBY SANDY LOAM.

The surface soil of the Colby sandy loam consists of a brown, loose sandy loam, 10 to 15 inches deep. It is dark in color and moderately high in organic matter to a depth of 6 to 8 inches, below which it is light brown or yellowish brown. The subsoil is a yellow, friable sandy loam. The surface material is generally finer in texture than the subsoil. It varies from a loamy sand to a dark-colored soil closely approaching a loam or fine sandy loam. In places there has been a slight concentration of clay in the upper subsoil, forming a layer, 6 or 8 inches in thickness, of friable sandy clay or clay loam. Layers of incoherent, medium, and coarse sand are occasionally encountered in the subsoil.

The Colby sandy loam occurs in the higher uplands in the southeastern part of the county. It is encountered mainly in one large area extending from the Hamilton County line to a point about 4

miles southwest of Doniphan. Two very small strips representing an eroded phase occur on the slopes of the bluffs facing the Platte Valley in South Platte Township. In general the surface of the type is nearly level, but in places it is made slightly undulating by hummocks or knolls a few feet high. Drainage is everywhere thorough, but there are no slopes steep enough to be seriously eroded, except in the two small areas on the bluff slopes in South Platte Township.

This soil is productive, and practically all of it is under cultivation. Wheat, corn, oats, and alfalfa are the principal crops. The soil is looser and more easily worked and maintained in good tilth than the upland silt loams. It is probably not quite as well suited to wheat as are the silt loams, but it withstands drought moderately well and produces on the average about the same yields of corn. It has practically the same agricultural value as the Colby fine sandy loam.

COLBY FINE SANDY LOAM.

The surface soil of the Colby fine sandy loam consists of a light-brown or yellowish, loose fine sandy loam, grading at 6 to 12 inches into a yellow, heavy fine sandy loam or fine sandy clay loam. The subsoil, beginning at 15 to 20 inches, is a light-yellow, friable, mealy, fine or very fine sandy loam. In general the soil is very similar to the Colby silt loam in composition and origin, but it has a slightly looser surface soil and a more porous, friable subsoil. The substratum, which is encountered at depths of 3 to 10 feet, is the same yellow silt that underlies the Grundy and Colby silt loams. In the southern part of the county the areas of this type include small developments of Colby silt loam and very fine sandy loam, which could not be accurately separated. As a rule the knolls and slopes are occupied by the fine sandy loam, while the soil in many of the intervening depressions is finer in texture. In the northern part of the county, in association with the Valentine sand, the soil in places consists of light-brown or yellowish, loose fine sandy loam or very fine sandy loam, underlain by yellow, friable loamy fine sand which changes rather abruptly at 20 to 36 inches to yellow friable silt.

An area of Colby fine sandy loam about 6 square miles in extent is mapped in Martin and South Platte Townships, with a few smaller bodies in close association with the Colby silt loam. The type also occurs in a narrow east-west strip along the southern border of the sandhills, in South Loup and Mayfield Townships, extending from the Buffalo County line to a point about 5 miles east of Cairo. The surface in general is uneven or slightly undulating. Low, rounded hummocks or knolls and intervening shallow depressions give rise to a choppy surface resembling that formed by wind

in areas of loose sand. The type is well drained, but is not subject to serious erosion.

Practically all this soil is under cultivation. Corn, wheat, oats, and alfalfa are the principal crops. The methods of farming and the disposition of the crops are much the same as on the Colby silt loam. Corn gives practically the same yields as on the silt loam, namely, about 25 bushels per acre, but the fine sandy loam does not seem to be as well adapted to wheat and alfalfa.

The type in most places is easily maintained in good tilth, where manure or rotted straw is applied, and it can be worked under a wider range of moisture conditions than the silt loam. The hummocky character of the surface does not seriously interfere with plowing and harvesting, but it detracts to some extent from the agricultural value of the land.

COLBY SILT LOAM.

The surface soil of the Colby silt loam is a dark brownish gray, mellow silt loam, ranging from 6 to 10 inches in depth. It usually contains a relatively high percentage of very fine sand and is ordinarily loose in structure, but becomes moderately compact if worked when wet. The surface soil is underlain by a yellow silty clay loam layer, 4 or 5 inches in thickness. The subsoil, beginning at 12 to 18 inches, is a pale-yellow, friable silt loam or very fine sandy loam, usually calcareous at about 3 feet. The surface soil is variable in thickness and color, being very thin and light gray or yellowish on the more eroded slopes, and dark in color and fairly well supplied with organic matter in the more nearly level areas. The type differs from the Grundy and Marshall silt loams mainly in its lighter color and more friable subsoil.

The Colby silt loam is somewhat more widely distributed in the southeastern upland area than in the northwestern upland. In the northwestern part of the county it largely occupies gentle or moderate slopes, but to some extent occurs on very steep slopes along drainage ways, where the land is too steep for successful farming and has been gullied in places. In the southern part of the county the areas along the border of the upland facing the Platte River bottoms are characterized by moderate to steep slopes, and are rather deeply eroded in places. Back from the margin of the upland the larger areas have a slightly uneven surface, with low, rounded hillocks or knolls and intervening level depressions. The steep slopes and uneven surface make plowing and harvesting of crops more difficult and detract to some extent from the agricultural value of the land.

All the type, except the steeper slopes in the more eroded areas, is under cultivation. Its average productiveness is slightly lower

than that of the Marshall and Grundy silt loams. The soil withstands drought fairly well, and in some respects is more desirable than the more level types of the bottom land and terrace. Wheat is the principal crop, followed by corn, alfalfa, and oats. Many farmers grow wheat continuously on the same fields for periods of 4 to 9 years. Small patches of kafir, sorghum, and millet are occasionally grown. Orchard fruits seem to bear a little better than on the bottom-land and terrace soils. The yields of all crops vary widely with the season, the state of improvement of the soil, and the care used in cultivation. The average yield of wheat is probably about 18 bushels per acre, of corn 25 bushels, of oats 35 bushels, and of alfalfa about 3 tons.

This soil is not as well supplied with organic matter as the associated Marshall and Grundy silt loams, and it is not quite as easily maintained in good tilth, but with the application of even moderate quantities of barnyard manure little difficulty is experienced in maintaining it in good condition. On some of the more eroded slopes of knolls and along drainage ways the yellow silt or clay of the subsoil is turned up in plowing, and the soil tends to compact and clod.

The selling price of this land varies from \$50 or \$60 an acre in the more broken areas to \$80 or \$90 an acre in the smoother areas.

SCOTT SILT LOAM.

The Scott silt loam typically consists of a dark-gray or black moderately compact silt loam, 6 to 12 inches in thickness, underlain by a dark-drab subsoil of stiff, plastic, impervious clay. There is generally a 2 to 4 inch layer of ashy-gray silt between the surface silt loam and the hardpan clay of the subsoil. Over a considerable part of the type as mapped the surface soil is a silty clay loam in texture.

The Scott silt loam occurs in poorly drained, shallow depressions in areas of the Grundy silt loam in the southeastern part of the county. It is of very small extent, and of practically no agricultural importance. In most places it is too wet for the successful cultivation of the staple crops, and it is valued chiefly as pasture and hay land.

VALENTINE SAND.

The Valentine sand consists of a light-brownish or yellowish, loose sand which shows very little difference in texture or color to a depth of 3 feet. To a depth of about 7 inches the soil is light brown in color and contains a small amount of organic matter. The type consists almost entirely of about equal parts of medium and fine sand, with no coarser particles and barely sufficient silt and clay to render the mass slightly coherent when wet. The sand deposits from which

the soil is derived have a thickness of 5 to 25 feet. The Valentine sand is locally known as "sand hills."

This type occupies a total area of 45 square miles. It occurs principally in the northern part of the county, directly north of Cairo and Abbott, in South Loup, Mayfield, and Prairie Creek Townships. An area of about 4 square miles is mapped south of the Platte River in Martin Township. The billowy, undulating surface has been formed by the shifting and heaping up of sand by the wind, and is characterized by high, rounded hills or ridges. The type represents quiescent dunes, with a maze of lower wind-formed knolls. There are no well-defined drainage lines, most of the rainfall being absorbed by the porous, deep sand. The hills range from 75 to 150 feet above the first bottoms of the Platte and Loup Rivers.

This land is used mainly for pasture. Probably not more than 10 per cent of it is under cultivation. It supports an excellent growth of native grasses and has a carrying capacity of 30 to 40 cattle to the quarter section. The pasture season ordinarily extends from April to October. The land is used as summer pasture for stock which is fed on farms during the winter. Some of the more favorably situated land is farmed. Corn and wheat are fairly successful with careful cultivation and yearly change of crops. Alfalfa seems to do well, but considerable difficulty is encountered in getting a good stand. The soil seems to withstand drought as well as the heavier types, but it is less durable and productive. The surface soil in many places is drifted by the wind. Coarse manure and straw spread over the land have generally been found beneficial in preventing excessive drifting. Corn usually is deeply listed.

Land of this type most suitable for farming has a selling price of \$35 to \$40 an acre. Pasture land sells for about \$20 an acre.

GANNETT LOAMY SAND.

The surface soil of the Gannett loamy sand is a dark-gray or black sand, having a small content of silt and containing sufficient organic matter to produce a loamy structure. At depths ranging from 6 to 12 inches there is a subsurface layer of light-gray or pale-yellowish, loose sand. This is underlain by a darker colored, generally bluish-gray, more compact sand, which shows splotches of brownish iron oxide. The lower subsoil is in places slightly calcareous. It becomes moderately hard when dry, although it contains very little silt or clay. Over much of the type as mapped the soil is a loamy fine sand. This is included with the predominant loamy sand type owing to the fact that the finer textural distinctions are of little importance in mapping a soil of this character.

The Gannett loamy sand occurs in several small irregular areas in the northern part of the county, in Lake, Prairie Creek, and South

Loup Townships. It has a total extent of 7.8 square miles. The type has been formed in circular, valleylike depressions, inclosed by or adjacent to hills of Valentine sand. The surface is nearly flat or slightly uneven. The type receives the seepage from the sand hills and is for the most part without adequate natural drainage.

This soil supports a heavy growth of coarse native grasses and is valued chiefly for the production of wild hay and pasturage. A small proportion of it has been placed under cultivation to the staple crops. Yields are comparatively low even in favorable years. Alfalfa is not successful on account of the poor drainage and the shallow depth to ground water. The land has about the same selling price as areas of the associated Valentine sand.

GANNETT SANDY LOAM.

The Gannett sandy loam consists of a dark-grayish, loamy medium sand, 6 to 10 inches deep, underlain by a pale yellow, less coherent medium sand which extends to a depth of 15 to 20 inches and gives way to a lower subsoil of dark-drab, stiff, plastic, rather impervious clay. This in several places was observed to be calcareous. There is a rather abrupt change in texture from the sand of the surface soil to the clay of the subsoil. The substratum at depths of 3 to 5 feet is a friable yellow silt. In the wetter situations the surface soil contains a higher percentage of organic matter and is black in color. As mapped, the type includes developments of loamy sand and fine sand soils.

The Gannett sandy loam occurs in nearly level, poorly-drained areas and small depressions in the uplands in the northern part of the county, principally in Prairie Creek Township. Drainage for the most part is poor. In topography and relation to the hills of Valentine sand the type is similar to the Gannett loamy sand. It differs chiefly in having a clay subsoil at depths of 3 feet or less.

This type is of minor agricultural importance. Its chief disadvantage is poor drainage. It supports a heavy growth of native grasses, and affords good pasturage and fair yields of hay. Probably a little more than one-half of the type is farmed, corn, wheat, and oats being the principal crops. Occasionally good yields are obtained, but the average productiveness is much lower than that of the terrace soils to the south and east, such as the fine sandy loam and very fine sandy loam of the Hall series.

JUDSON FINE SANDY LOAM.

The Judson fine sandy loam consists of a light-brown and grayish-yellow soil varying in texture from a fine sandy loam to a loose, loamy fine sand or very fine sand, changing at 6 to 10 inches into a light-yellow, friable fine sandy loam. The type is similar to the

Colby fine sandy loam in color and physical characteristics, but differs in the manner of formation and in its physiographic position.

This type occurs south of the Platte River, in Martin and South Platte Townships, occupying a narrow, poorly defined alluvial terrace lying 10 to 15 feet above the adjacent first bottoms. The surface in places is nearly level, but for the most part it is uneven and hummocky. The greater part of the type is adequately drained for farming, and it is practically all under cultivation. Corn, wheat, and oats are the principal crops. The average yield of corn is about 25 bushels per acre, and of wheat 15 to 18 bushels. The soil has a loose, friable structure and is easily worked. Its productiveness is about the same as that of the upland Colby soils directly to the south.

O'NEILL SAND.

The O'Neill sand consists of a light-brown, loose, loamy medium sand which shows little change in texture to a depth of 3 feet. The soil to a depth of 10 to 12 inches is somewhat darker than below, as a result of the incorporation of organic matter, and the subsurface sand is brownish yellow or grayish. In a few places on the terrace south of the Platte River the type in some narrow strips contains coarse sand and fine gravel in the subsoil.

The principal areas of O'Neill sand are mapped on the terrace directly west and southwest of Grand Island. Important developments occur a few miles southwest of Wood River, and on the terrace south of the Platte. The total area of the type is 12.2 square miles. Its surface is undulating, characterized by knolls or hummocks 5 to 15 feet high. These appear to be in part accumulations by wind action. Drainage is good, most of the rainfall being rapidly absorbed by the porous sand.

The greater part of this type is in farms. The yields of corn, ordinarily 18 to 20 bushels per acre, probably average less than on the heavier terrace soils, and the type does not seem to be quite so well suited to wheat and oats. Alfalfa makes a good growth, but the stand is rarely as thick as on the Hall silt loam and very fine sandy loam and similar types. This soil is not as durable and productive as the heavier soils of the terrace, but it is easily plowed and tilled, has adequate drainage even in wet years, and withstands drought quite as well as the heavier types. It is, however, subject to shifting by the wind, and injury to young plants frequently results. Coarse manure and straw are applied, where available, to check the tendency to drift, and corn usually is deeply listed.

The selling value of this land is considerably lower than that of the associated soils, such as the fine sandy loam, very fine sandy loam, and Hall silt loam.

O'NEILL FINE SAND.

The O'Neill fine sand differs from the O'Neill sand mainly in its finer texture. The surface soil has a fair content of organic matter to a depth of 6 to 10 inches, and is loamy in structure. In many places the subsoil sand seems to be slightly coarser than the surface material.

This type occurs in a large number of small, irregular areas, mainly north and northwest of Grand Island, and in the Loup River Valley in the northwest corner of the county. It has a total area of 6.8 square miles. Practically all the type is under cultivation. Fair yields of corn, wheat, and alfalfa are obtained. The type on the whole is probably a little more productive than the O'Neill sand.

In the following table are shown the results of mechanical analyses of samples of the soil and subsoil of the O'Neill fine sand:

Mechanical analyses of O'Neill fine sand.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
372495.....	Soil.....	0.3	4.5	5.3	38.5	30.5	12.8	7.9
372496.....	Subsoil.....	.4	4.4	5.9	53.6	26.9	3.6	4.8

O'NEILL LOAM.

The O'Neill loam consists of a dark-brownish, fine-textured loam, 12 to 15 inches deep, grading into a light-brown sandy loam which changes to a yellowish or grayish, loose coarse sand, containing some fine gravel, at any depth from 20 to 36 inches. The substratum to a depth of 10 to 20 feet consists of grayish or yellowish sand and gravel. In some places the surface soil closely approaches the Hall sandy loam in texture.

The O'Neill loam is confined mainly to the southern border of the Grand Island terrace. It extends in disconnected areas across the county. The principal area is in the vicinity of Grand Island. The surface of this soil varies from nearly level to slightly uneven and hummocky. There is sufficient slope for adequate surface drainage, and the porous, sandy subsoil and substratum rapidly absorb moisture. The greater part of the type, with the exception of the area occupied by the city of Grand Island, is under cultivation to the staple crops of corn, wheat, oats, and alfalfa. Its average productiveness is somewhat lower than that of the types having heavier and more retentive subsoils. Corn frequently "fires" and gives greatly decreased yields in dry years. Sweet corn is grown in small fields, and some trucking is carried on near Grand Island. Millet,

sorghum, and kafir are grown in small patches for forage. Yields of corn vary from 10 to 30 bushels per acre, depending upon the rainfall. Wheat yields 15 to 18 bushels per acre and oats 20 to 30 bushels. The surface soil is loose and mellow, and can be worked under a wide range of moisture conditions.

The selling price of farm land of this type is generally lower than that of the associated heavier soils to the north, such as the Hall fine sandy loam, very fine sandy loam, and silt loam.

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

Mechanical analyses of O'Neill loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
372421, 3724101....	Soil.....	2.1	11.8	5.4	10.7	20.9	38.3	10.9
372422, 3724102....	Subsoil.....	4.7	20.7	11.7	28.9	10.6	15.1	8.1

HALL SANDY LOAM.

The typical Hall sandy loam consists of a dark grayish brown or black, friable sandy loam which becomes lighter in color at a depth of 10 or 12 inches and at 18 to 24 inches grades into a light-brownish or yellowish, heavier subsoil. This varies in different places from a compact sandy loam to a silty clay. The type is not very uniform. As mapped it includes some areas of brown loamy sand which does not differ materially from the O'Neill sand except in its heavier subsoil. In some of the more poorly drained depressions the lower subsoil is a drab, plastic, calcareous clay. The soil everywhere contains a relatively large proportion of fine and very fine sand, and it is not in all places closely differentiated from the Hall fine sandy loam.

The greater part of the Hall sandy loam occurs in Center Township, directly west of Grand Island. It is developed mainly in the flatter and more poorly drained areas associated with the O'Neill sand, and much of the type receives run-off and seepage water from hills occupied by the latter soil. It is less extensive than the Hall very fine sandy loam and fine sandy loam, and of lower average productiveness. About 90 per cent of it is under cultivation—corn, wheat, and oats being the principal crops. Corn is sometimes "drowned out" in the more poorly drained depressions.

HALL FINE SANDY LOAM.

The surface material of the Hall fine sandy loam is a very dark brown, loose fine sandy loam. In general it becomes somewhat

lighter in color at 10 or 12 inches, but it continues as a brown fine sandy loam, containing considerable organic matter, to a depth of 18 or 20 inches, where it grades into a yellowish friable fine sandy clay. This in turn passes into a yellowish or grayish, friable sandy clay and sticky sandy loam or sand at 3 or 4 feet. The soil is uniformly fine in texture, containing high percentages of very fine sand and silt and only a very small percentage of particles coarser than fine sand. Much of the soil included with this type is a fine loam in texture. This latter soil does not differ from the fine sandy loam in color or topography, and it is not possible to make an accurate separation. Part of the type as mapped along the southern margin of the sand hills from Cairo eastward varies from typical in having a lower subsoil of yellow silt or very fine sandy loam.

The Hall fine sandy loam occurs principally to the north and northwest of Grand Island, in Mayfield, Prairie Creek, and Lake Townships, and in a belt one-fourth to one-half mile wide, extending southwestward along the southern border of the Grand Island terrace from a point near Alda to the county line. The areas are very irregular in outline, and in no place cover an entire square mile. The surface is nearly level or only slightly undulating, but the type on the whole is slightly higher lying and better drained than the closely associated Hall very fine sandy loam. In places it occupies hills or ridges lying 5 to 15 feet above the surrounding level, and only a very small total area is flat and poorly drained.

Practically all the type is in farms, and it is regarded as one of the more valuable soils of the county. Corn, wheat, alfalfa, and oats are the principal crops, named in order of acreage. The greater part of the grain and hay produced is sold from the farms. Crop yields show wide variation from year to year. The average yield of corn is about 30 bushels per acre, of wheat 20 bushels, of oats 35 bushels, and of alfalfa, per season, 3 to 3½ tons. The soil has a loose, loamy structure and is easily worked and maintained in good tilth.

The greater part of the type has a selling price of \$100 to \$125 an acre, depending upon the location and improvements.

HALL VERY FINE SANDY LOAM.

The surface soil of the Hall very fine sandy loam is a very dark brown, uniformly fine material consisting predominantly of very fine sand and silt, with but a small percentage of clay and scarcely any material coarser than fine sand. It becomes slightly lighter in color at a depth of 12 to 15 inches, and at 18 to 20 inches grades into a moderately compact, light-brownish or yellowish fine sandy clay. The substratum, beginning at depths of 36 to 40 inches, is generally lighter in texture than the subsoil, consisting of very fine sandy

loam or sand. The surface soil has a high content of organic matter and appears black when wet. In the flatter, poorly drained areas the lower subsoil is frequently a grayish or yellowish-drab, compact, puttylike clay, containing sufficient lime to effervesce with acid. In some places the division line between the Hall very fine sandy loam and silt loam is rather arbitrary, and it is probable that considerable silt loam is included with the very fine sandy loam. In a narrow strip extending from about 100 yards to one-half mile back from the banks of Wood River occurs a variation of the Hall very fine sandy loam, in which the subsoil is lighter in texture than the surface soil, consisting of a loose, loamy, very fine sand. This soil is derived in part from pale-yellowish, very fine sand which seems to represent a later deposition than the alluvium directly to the north or south. In places an old silt loam soil is encountered at depths of 4 to 8 feet beneath the superficial deposit of very fine sand.

The Hall very fine sandy loam is confined to the Grand Island terrace. It occupies a large area in Lake Township directly north of Grand Island, and a belt ranging from one-fourth mile to 3 miles wide extends southwestward from Alda past the town of Wood River to the county line. These areas are irregular in outline and contain numerous inclusions of other types. Smaller developments are mapped near Cairo and Abbott.

The surface of this soil is nearly level or slightly undulating. In some of the lower and flatter situations there is an excess of moisture in wet years, but most of the type has sufficient natural drainage for farming. The water table is ordinarily encountered at depths of 5 to 10 feet, varying with the elevation of the surface.

This is a productive soil, and because of its comparatively large extent it is one of the more important farming types of the county. Eighty-five per cent or more of its area is under cultivation. Wheat, corn, alfalfa, and oats are the principal crops, named in order of acreage. The average yield of wheat is probably 20 bushels per acre, of corn 30 bushels, and of oats 40 bushels. Alfalfa yields $3\frac{1}{2}$ tons per acre per season. The areas of lighter subsoil apparently differ little in agricultural value from the typical soil.

The surface soil of the Hall very fine sandy loam is loose and loamy, and in years of normal rainfall it is easily maintained in good tilth. The soil is slightly more coherent than the associated fine sandy loam and sand types, and it forms a somewhat better seed bed for wheat and oats, but it can not be worked quite as soon after heavy rains.

Land of the Hall very fine sandy loam has a selling price of about \$100 to \$125 an acre, depending upon the location and improvements.

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

Mechanical analyses of Hall very fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
372497.....	Soil.....	0.3	2.6	2.8	13.4	31.0	40.3	9.4
372498.....	Subsoil.....	.4	3.4	4.4	14.4	25.8	35.6	16.3

HALL SILT LOAM.

The soil of the Hall silt loam is uniformly a very dark brown, friable silt loam, high in organic matter, to a depth of 8 to 12 inches, underlain by a somewhat lighter brown, more compact silt loam which continues to depths ranging from 15 to 24 inches. The surface soil contains only a very small percentage of particles coarser than very fine sand. There is generally a fairly abrupt change to the subsoil, which consists of 6 to 8 inches of dark-yellow clay, tough and plastic when wet and very hard and impenetrable when dry, underlain by less plastic silty clay to a depth of 36 to 40 inches. The lower subsoil usually contains sufficient lime to effervesce freely with acid. The lime content apparently is not high in the surface material, although there is no evidence of a deficiency. The substratum is a pale-yellow or grayish, friable silt loam and very fine sandy loam, extending to depths of 10 to 20 feet.

Over a total area of about 11 square miles, southwest and south of Cairo, the soil varies from typical in having a more friable structure in the lower subsoil and in being on the whole less calcareous. The subsoil is more generally yellow or brownish, with an entire absence of the characteristic drab or grayish color in the lower part of the soil section. The soil of this variation consists of 18 to 24 inches of dark-brown, mellow silt loam, directly underlain by a hardpan of dark-yellow, tough, plastic silty clay, 6 to 10 inches thick. This generally extends to a depth of about 30 inches, and changes, rather abruptly in texture, to a yellow, friable silt loam or silty clay loam. This soil is closely associated with the typical Hall silt loam. It occupies a topographic position slightly higher than associated areas of typical Hall silt loam, since it is found on low ridges or swells 10 to 20 feet above the general level of the terrace plain and also on a poorly defined high bench lying along the base of the upland.

Another minor variation is rather widely distributed throughout the areas of the typical Hall silt loam, occurring in the flatter situations and in very shallow, poorly drained depressions ranging from

1 acre to 20 or 30 acres in extent. The surface soil is somewhat more compact than typical, and the hardpan layer is slightly darker in color and more impervious. The lower subsoil is pale yellowish or drab, and highly calcareous. Very small accumulations of alkali are frequently encountered in these areas.

The Hall silt loam occurs principally in one large area west and north of Alda and Wood River, in the central-western part of the county. There are two very small, isolated areas, one in Lake Township north of Grand Island and one a short distance northeast of Doniphan. The typical soil covers 16.7 per cent of the county. The principal area, on the Grand Island terrace, lies 20 to 40 feet above the first bottoms of the Platte, and about 1,900 to 2,000 feet above sea level. There is an imperceptible eastward slope. The surface varies from flat to faintly undulating. The area is traversed by a few winding, sluggish creeks, with deep channels, and there are a few narrow, winding ditchlike depressions, which represent remnants of old stream channels. The soil is nowhere subject to stream erosion. Except in a few shallow depressions the natural drainage is adequate for farming in normal years.

Because of its large extent and high average productiveness the Hall silt loam is the most important soil in the county. About 90 per cent of it is under cultivation. Some of the more poorly drained areas are used for pasture. Corn, wheat, alfalfa, and oats are the principal crops grown. Barley, millet, sorghum, and kafir are grown in occasional small fields. On account of the very small acreage of pasture on the average farm, little live stock is kept. A small number of farmers are engaged in stock feeding, using the surplus grain and hay produced in the neighborhood. A very small percentage of the farmers keep dairy herds, and sell both milk and cream. The average yield of corn is about 28 bushels per acre, of wheat 23 bushels, of oats about 40 bushels, and of alfalfa, as a total of several cuttings, between $3\frac{1}{2}$ and 4 tons. Alfalfa probably gives better results than on any other soil in the county.

Under favorable moisture conditions this soil is easily worked and maintained in good tilth. It is somewhat heavier than most of the terrace soils, and if worked when wet it tends to compact and clod, so that rolling is often necessary to work up a good seed bed for wheat. Four-horse teams are commonly used with gang plows turning two furrows to a depth of 6 or 7 inches. Owing to the level character of the surface, tractors can be easily used in fall plowing.

The greater part of the Hall silt loam has a selling price of \$100 to \$125 an acre.

Hall silt loam, friable-subsoil phase.—The Hall silt loam, friable-subsoil phase, differs from the typical Hall silt loam mainly in the lighter texture and more friable structure of the subsoil. The surface

soil is a very dark brown silt loam, well supplied with organic matter, extending to a depth of 12 to 15 inches. It is underlain to 18 or 20 inches by a light-brown, compact silt loam, which gives way to a pale-yellow, friable, coarse silt loam, or very fine sandy loam. In a few places the lower subsoil is a pale-yellow, soft, fluffy very fine sand. There is probably a smaller percentage of lime in the subsoil than in the case of the typical Hall silt loam. The subsoil variation is due mainly to a textural difference in the underlying alluvium, which in general becomes sandier toward the south and east. There is a gradual change in texture from the heavy to the lighter subsoil, so that no sharp lines of division between the phase and the typical soil can be drawn. It is also rather difficult accurately to differentiate this phase from associated areas of Hall very fine sandy loam.

The principal area of Hall silt loam, friable-subsoil phase, is a strip one-fourth to 1 mile wide skirting the southern and eastern boundary of the large area of typical Hall silt loam lying north of Wood River. A second area of considerable size occurs at the town of Wood River, and a small area is encountered south of the Platte River, in South Platte Township.

This phase does not differ materially from the typical Hall silt loam in topography and drainage, and there is apparently very little difference in agricultural value. Alfalfa may not give quite as good results, but corn withstands drought as well as on the typical soil, or better, and gives equally good yields.

In the following table are shown the results of mechanical analyses of samples of the soil and subsoil of the typical Hall silt loam:

Mechanical analyses of Hall silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
372405, 372449....	Soil.....	0.0	0.3	0.2	1.1	24.8	59.2	14.3
372406, 372450....	Subsoil.....	.1	.4	.4	1.4	16.7	46.7	34.5
372406a.....	Lower subsoil	.3	8	.4	1.0	19.6	51.1	26.9

HALL CLAY LOAM.

The Hall clay loam consists of 8 to 10 inches of very dark gray or black, slightly plastic and sticky clay loam, grading into dark-drab or yellowish-drab, stiff fine sandy clay. The surface for 2 to 4 inches commonly consists of a dark-grayish or black, loose, fine sandy loam or very fine sandy loam. This rests upon a subsurface layer of plastic clay. Grayish, sticky sand, underlain by coarse sand, usually saturated with water, is encountered at depths of 3 to 4 feet. The surface soil generally is slightly calcareous, and the subsoil con-

tains sufficient lime in the form of carbonate to effervesce freely with acid. Small alkali spots, distinguished by a white efflorescence of salts at the surface, are common in nearly all the areas of this type. They range in extent from a few square yards to 1 or 2 acres, and contain an excess of salts sufficient to injure corn, wheat, and alfalfa. The larger areas of the type include low mounds of fine sandy loam and very fine sandy loam which are too small to be shown accurately on the soil map.

The Hall clay loam occurs in a number of small, widely separated developments. The largest areas are mapped in Lake Township, directly north of Grand Island, and in Mayfield and Harrison Townships, a short distance southwest of Abbott. Numerous oval or circular patches, many of them too small to be shown separately on the soil map, are distributed throughout the larger areas of Hall fine sandy loam, very fine sandy loam, and silt loam. The clay loam occupies shallow, poorly drained depressions on the Grand Island terrace.

The greater part of the type in the larger areas is too wet for successful farming, and is valued as pasture land and for wild hay. Most of the smaller areas are farmed in connection with more arable land. The soil is sticky and difficult to work when wet, and tends to bake and clod when very dry. In favorable years good yields of the staple crops are obtained. Where the type can be drained it can be made as productive as the naturally better drained soils. Thorough drainage and the use of barnyard manure are probably the best methods of treatment for the alkali spots.

CASS FINE SAND.

The Cass fine sand consists predominantly of 6 to 8 inches of loamy fine sand which gradually becomes lighter in color and coarser in texture with depth, and grades into a lower subsoil of yellowish or grayish, incoherent medium sand. The top soil is dark brown or black, depending upon the local drainage conditions. Generally there is only a very small percentage of organic matter below a depth of 3 or 4 inches. A considerable proportion of the type as mapped is a medium sand in texture. There are small included areas of Cass fine sandy loam and clay loam in the more poorly drained depressions. Over much of the lower land coarse sand and gravel are frequently encountered at depths of 20 to 30 inches.

The Cass fine sand is closely associated with the Cass fine sandy loam, and is similar in mode of occurrence, having been deposited in narrow, elongated strips directly along present and abandoned channels of the Platte River, and as islands in the present channels. A

very small area has been formed along the channels of the South Loup River, in the extreme northwestern part of the county. The organic content and the soil color vary with the age of the deposit. The surface is uneven and hummocky, being characterized by depressions inclosed by ridges 5 to 10 feet high or by low, wind-formed knolls. Drainage is generally good. The uneven surface favors ready run-off, and the open, porous subsoil and substratum permit free underdrainage.

This type is less extensive than the Cass fine sandy loam, and is of much less agricultural importance. The greater part of it is used for pasture. Most of the land was cleared at an early date and now supports a fair growth of native grasses, together with such introduced forage plants as redtop, bluegrass, and sweet clover. Most of the small islands in the stream channels are covered with cottonwood, elm, ash, willow, and a brushy growth of locust and buffalo berry.

Only a very small percentage of the Cass fine sand is under cultivation. Corn, the principal crop, gives fair yields on the darker colored and deeper areas of fine sand, since this soil withstands drought as well as the heavier types. The areas of medium sand, however, have not proved durable. Occasionally fair stands of alfalfa are obtained on the typical fine sand areas. The soil seems to be unsuited to the production of wheat and oats. It is easily plowed and tilled under all moisture conditions. On account of its loose, incoherent structure it drifts to some extent during high winds.

Land of the Cass fine sand has a selling price of \$50 to \$60 an acre.

The darker colored areas of this type with deep fine sand subsoil can be profitably used for general farming with the liberal use of manure and frequent change of crops.

CASS SANDY LOAM.

To a depth of 6 to 10 inches the Cass sandy loam consists of a very dark brown, loose, friable sandy loam, fairly well supplied with organic matter. The soil becomes lighter in color and coarser in texture with depth, and changes at 15 to 20 inches into a grayish or pale-yellowish coarse sand. The surface material generally contains enough calcium carbonate to cause effervescence with acid. The subsoil in general is loose and porous, but in a few places a dark-colored, coherent sandy loam extends to a depth of 20 to 30 inches, the soil closely resembling Lamoure sandy loam in structure and other characteristics.

The Cass sandy loam occupies low northeast-southwest ridges in the higher parts of the first bottoms of the Platte River. The largest areas occur in Washington and Alda Townships.

This soil is well drained, and practically all of it is under cultivation. Corn is the principal crop, followed by wheat, oats, and alfalfa.

The agricultural value seems to vary with the depth of the sandy loam material, the type being most productive in those areas where the dark-colored sandy loam extends to depths of 15 or 20 inches. Where the coarse subsoil is near the surface corn frequently is injured by drought. Corn gives about the same yields as on the Cass fine sandy loam, averaging about 25 bushels per acre. Fair yields of alfalfa can be obtained. Wheat ordinarily yields 15 to 20 bushels per acre.

The soil has a loose, loamy structure, and is easily plowed and cultivated. Its productiveness can not be maintained under a system of continuous cropping. A definite system of rotation, including alfalfa or other leguminous crops, and the use of manure are necessary to insure profitable yields.

CASS FINE SANDY LOAM.

The Cass fine sandy loam typically consists of a very dark gray or black fine sandy loam which changes to gray at 6 to 10 inches and gradually becomes lighter in texture with depth, passing at 12 to 20 inches into gray or gray and yellowish mottled, loamy fine sand, loose in structure. The lower subsoil consists of a gray, porous medium sand which changes at 3 to 4 feet to coarse sand and fine gravel. The topsoil is generally well supplied with organic matter, and it contains sufficient calcium carbonate to effervesce slightly with acid. The principal variations in texture are toward a silt loam and a very fine sandy loam. In places there is only a very thin layer of soil high in organic matter, underlain by yellowish-gray, incoherent fine sand, the type here closely resembling the more loamy areas of the Cass fine sand. In some of the lower situations the black fine sandy loam is underlain at a depth of 12 to 15 inches by gray, medium and coarse sand.

A silty variation of this type is encountered in three areas, aggregating about 750 acres, in Alda and Washington Townships, and in a small area in the extreme northwest part of the county in the South Loup River bottoms. This soil is of small extent, but all of it is under cultivation. It consists of a dark-brownish, mellow silt loam, 6 to 8 inches thick, grading into dark-grayish, compact very fine sandy loam which is underlain by grayish, loamy fine sand at 20 to 30 inches. There is usually a substratum of coarse sand at about 40 inches. The surface soil is well supplied with organic matter and appears black when wet. The soil is moderately calcareous to a depth of 20 to 30 inches.

The typical Cass fine sandy loam is largely confined to the first bottoms of the Platte River, where it occurs in strips 100 yards to one-half mile in width parallel to present and old channels of the river. A very small area is mapped in the extreme northwestern

part of the county, in the South Loup River Valley. The surface varies from nearly level to slightly uneven and hummocky. The greater part of the type lies 6 to 12 feet above the stream channels. Only the lowest land is subject to inundation, and this is rarely overflowed. Surface drainage is sufficient in the average year for profitable farming, but in wet years the water table frequently comes within 3 feet or less of the surface. In very dry years the underdrainage is excessive, and corn, especially, may not do as well as on the types with heavier subsoils.

The Cass fine sandy loam is the most extensive bottom-land soil in the county. About 60 per cent of it is under cultivation, this proportion representing the better drained area. Corn is the principal crop, followed by wheat and oats. There is a small acreage of alfalfa. The uncultivated land is valued as pasture and for wild-hay production. Cattle and hogs are fed on most farms, and the corn and hay crops are largely consumed on the farm. Sweet corn makes a rank growth, and on a few farms this crop is grown in small fields for seed. Corn yields vary greatly, depending upon the season. The average yield for a period of years is probably about 25 bushels per acre. Small grain does not give as good results as on the heavier soils of the bottom lands and upland. The yields of wild hay average about $1\frac{1}{2}$ tons per acre. The surface soil of this type has a loose, loamy structure, and is easily plowed and tilled. Level cultivation is generally practiced in growing corn.

Farms composed largely of the Cass fine sandy loam, with average improvements, have a selling price of about \$75 an acre.

CASS CLAY LOAM.

The surface soil of the Cass clay loam is a dark-drab or black, slightly plastic clay loam, underlain at shallow depths by coarse sand and fine gravel. Over most of the type the surface soil consists of 2 or 3 inches of black fine sandy loam or silty loam, underlain by dark-drab, stiff clay to a depth of 6 to 15 inches. There is generally a sharp change to the porous, coarse subsoil, only 1 or 2 inches of sticky fine sandy loam or medium sand intervening in places. A considerable part of the type consists of a dark-drab, sticky, plastic clay which becomes hard and compact and cracks in dry periods. Some of the areas contain patches, a few acres in extent, of fine sandy loam and fine sand, which could not be mapped separately because of their small size. The surface soil of the Cass clay loam is generally well supplied with organic matter, and in a few places there is a surficial layer of 3 or 4 inches of mucky loam. The clay is calcareous enough to effervesce freely with acid. Small alkali spots occur in places.

This type occurs widely distributed in the first bottoms of the Platte River, where it occupies narrow, elongated depressions representing old river channels which have been partly filled with silt. The subsoil material is identical with that on the floors of the present channels. The type is poorly drained and is more subject to overflow than other types of the bottoms. In wet periods ground water frequently rises to the base of the clay, or within 12 or 15 inches of the surface. The type lies only 4 or 5 feet above the stream channels.

On account of its poor drainage very little of this type has been placed under cultivation and it is valued chiefly as hay and pasture land. In most places it supports a heavier growth of grasses than the lighter textured types. In the few fields under cultivation fair yields of corn and oats are obtained in dry years. The soil is somewhat sticky when wet and tends to become hard and cloddy.

Landowners consider this type to rank at least as high as the Cass fine sand in agricultural value, but to be somewhat inferior to the other bottom-land types, such as the Cass fine sandy loam and the Lamoure soils.

Artificial drainage is necessary to improve this soil and make it suitable for profitable farming, but throughout most of the type this is impracticable on account of its slight elevation above the stream channels.

LAMOURE FINE SANDY LOAM.

The Lamoure fine sandy loam consists of a very dark brown or black, loose fine sandy loam, with an average thickness of about 12 inches, overlying a subsoil of dark grayish, moderately compact fine sandy clay which becomes somewhat coarser and more friable with depth, changing at 3 or 4 feet to a loose, porous, medium and coarse sand. The essential difference between this type and the Cass fine sandy loam is the heavier character of the subsoil to a depth of 3 to 4 feet. The surface soil generally has a fairly high content of organic matter and both soil and subsoil effervesce with acid, indicating a rather high content of lime. The depth to which the dark-colored fine sandy loam extends ranges from 10 to 20 inches. There are also minor variations in texture, some of the included soil consisting of very fine sandy loam and fine loam.

The Lamoure fine sandy loam occurs in narrow strips conforming in direction to the general northeast courses of the present and old channels of the Platte River. It is rather widely distributed throughout the whole extent of the first bottoms. It has a nearly level surface, but on the whole lies at a slightly higher elevation than the associated Cass fine sandy loam and clay loam, and has somewhat better drainage. The ground-water level in years of normal rainfall is about 5 feet below the surface.

The Lamoure fine sandy loam is considered one of the more valuable bottom-land soils for general farming. About 90 per cent of it is under cultivation. Corn, wheat, oats, and alfalfa are the principal crops, with corn far in the lead. Most of the corn and hay produced is used to feed cattle, hogs, and sheep. The average productiveness seems somewhat above that of the Cass fine sandy loam. Corn yields show the wide variations characteristic of the county as a whole, ranging in different years from 20 to 50 bushels per acre. Wheat yields 15 to 18 bushels per acre. This type, like the other bottom-land soils, seems to be less well adapted to wheat than the terrace and upland soils, and the grain is 8 or 10 days later in maturing. Where a fairly good stand of alfalfa is obtained the seasonal yield is about 3 tons per acre.

The soil is easily plowed and maintained in good tilth. It is usually plowed to a depth of 6 to 8 inches. Checking and level cultivation are practiced to a much greater extent than listing in the growing of corn. Over the greater part of the type land values average about \$100 an acre.

LAMOURE SILT LOAM.

The surface soil of the Lamoure silt loam is typically a very dark brown or slaty-black, mellow silt loam, 8 to 12 inches deep. The upper subsoil is a moderately compact, brownish silty clay loam or clay, and is underlain at 20 to 30 inches by a yellowish or grayish, more friable, very fine sandy loam. Porous, medium or coarse sand is encountered at depths of $3\frac{1}{2}$ to 5 feet. The soil is high in organic matter and appears black when wet. The type is generally calcareous to a depth of 3 feet. As mapped the Lamoure silt loam includes some developments of very fine sandy loam and fine loam which can not be accurately differentiated on the map.

The Lamoure silt loam is confined to the first bottoms of the Platte River, where it occurs north of the Middle Channel in Alda, Wood River, and Jackson Townships. Like the other soils of the first bottoms, it occurs in comparatively narrow strips. The land is nearly level, but water rarely stands on the surface for any considerable time, and most of the areas are sufficiently well drained for successful farming.

Practically all the type is under cultivation. It is regarded as one of the more durable and productive soils for general farming. The average yield of corn for a period of 8 or 10 years is about 30 bushels per acre, of wheat 20 bushels, and of alfalfa, for all cuttings, about 3 or $3\frac{1}{2}$ tons. The soil under ordinary moisture conditions is loose and mellow, and easily plowed and cultivated. It is slightly sticky when wet and tends to clod, but the clods subsequently break down readily. The land is valued at about \$100 an acre.

LAMOURE CLAY LOAM.

The Lamoure clay loam consists of a black, slightly plastic, heavy clay loam, grading at 6 to 10 inches into a dark-drab or slaty-black, heavy, compact clay which becomes lighter colored with depth and changes to sticky sandy clay or sandy loam at about 3 feet. A substratum of coarse, porous sand is encountered at depths ranging from 3 to 4½ feet. Both soil and subsoil seem to be a little more calcareous than in the case of the other bottom-land types. The calcium carbonate occurs in very small particles rather than in large concretions. There is characteristically a 1 or 2 inch layer of soft, ashy soil on the surface when dry. This type differs from the Cass clay loam principally in the greater thickness of the clay layer. Both soils have a substratum of porous sand and gravel. In the areas where the clay loam and clay mantle is shallowest the plant growth differs conspicuously, in both wet and dry years, from that in the areas of deeper soil.

The Lamoure clay loam occupies low-lying, level situations and narrow depressions in the first bottoms along the Platte River. It occurs in several small, widely separated areas, principally in Washington Township east and south of Grand Island.

Much of the land is poorly drained, and the growth of crops is frequently retarded by excessive moisture. The soil, however, is durable and productive, and the greater part of the type is under cultivation. Corn is most successful, yielding 25 to 30 bushels per acre except in wet years. On account of its slightly plastic and sticky nature, the soil when wet is difficult to plow, and tends to clod.

In the following table are shown the results of mechanical analyses of samples of the soil and subsoil of the Lamoure clay loam:

Mechanical analyses of Lamoure clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
372439.....	Soil.....	0.0	1.4	1.4	7.0	24.9	44.7	20.8
372440.....	Subsoil.....	.4	2.6	2.3	11.0	21.4	36.4	25.9

SUMMARY.

Hall County is situated in the south-central part of Nebraska. It lies on the eastern slope of the Great Plains region. The surface is nearly level or only slightly uneven and gently undulating, without any marked relief. The elevation of the county ranges from about 1,820 feet to 2,100 feet above sea level. The county covers an area of 528 square miles, or 337,920 acres.

The Platte River flows northeast across the county in a broad, shallow valley, and receives practically all the drainage. The South Loup River touches the extreme northwest corner of the county. Natural drainage throughout the greater part of the county is adequate for successful farming.

The population of the county in 1910 was 20,361, of which 49.3 per cent was classed as rural. The urban population is confined to the city of Grand Island, which had 10,326 inhabitants in 1910. Wood River, Doniphan, and Cairo are locally important trading centers.

Hall County has good transportation facilities, and there is an extensive system of public roads, reaching all the farming communities.

The mean annual rainfall is 29.45 inches. The precipitation is highest from May to August. Summer droughts are frequent, and crops are occasionally injured. There is a normal growing season of 163 days.

Agriculture in Hall County consists mainly of grain growing, with the raising and feeding of live stock as an important coordinate industry. Wheat occupies the greatest acreage and is the principal income crop. Corn occupies an acreage only slightly smaller than that of wheat, and is the principal subsistence crop. Alfalfa and oats rank next in acreage. Cattle, hogs, and sheep are fed for market.

In 1910, about 95 per cent of the area of the county was in farms, and 87.3 per cent of the farm land was improved. There were 1,627 farms in the county, with an average size of 196.5 acres. Over 56 per cent of the farms were operated by owners. The average value of all property per farm in that year was \$17,682. The average selling value of farm land at present is about \$100 an acre.

Uplands comprise 31.6 per cent of the total area of Hall County. The upland soils are derived principally from a Pleistocene formation consisting of yellow silt, known as Plains Loess. First-bottom, alluvial soils bordering the Platte River cover 22.5 per cent of the total area of the county, and terrace or second-bottom soils practically all the remainder. There is a small aggregate area of terrace and first-bottom land along the South Loup River, in the extreme northwestern part of the county. Silt loam soils predominate throughout the county.

The predominating upland soils, derived from the yellow silt and sand of the "loess," are classed in the Grundy, Marshall, and Colby series. A considerable area of soil is derived from wind-blown deposits, and is classed in the Valentine series. The Scott series is mapped in poorly drained depressions in the Grundy and Marshall soils, and the Gannett series in similar situations in the Valentine soils.

The Grundy, Marshall, and Colby soils are highly productive and well adapted to general farming, and practically their entire area is under cultivation to the staple crops. The Scott soil is of little or no agricultural importance. The Valentine soil supports a good growth of native grasses, and is used mainly for grazing. The Gannett soils are naturally poorly drained. They are used mainly as pasture land and for wild-hay production, but part of their area is cultivated.

The terrace soils are classed in the Judson, O'Neill, and Hall series. These soils on the whole are very desirable general-farming types, and they are largely under cultivation. They have in general a mellow, loamy structure, are well drained without being subject to erosion, and have a smooth surface well suited to the use of labor-saving machinery. Some of the areas of looser soil are subject to drifting in places, and in some of the lower lying situations the drainage is at times deficient.

The first-bottom soils are classed in the Cass and Lamoure series. The Cass fine sand is somewhat droughty and is not an important agricultural soil, but the Cass sandy loam is largely under cultivation. About 60 per cent of the Cass fine sandy loam is cultivated, the remainder being poorly drained. The Cass clay loam is in general poorly drained and it is used mainly for pasture. The Lamoure soils are desirable and productive types, largely under cultivation.

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