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Soil Survey of Hamilton County, Nebraska

By

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and
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Nebraska Soil Survey

Bureau of Chemistry and Soils

In Cooperation with the University of Nebraska
State Soil Survey Department of the Conservation and Survey Division

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SOIL SURVEY OF HAMILTON COUNTY, NEBRASKA

By A. W. GOKE, U. S. Department of Agriculture, in Charge, and W. H. BUCKHANNAN
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COUNTY SURVEYED

Hamilton County is in the southeastern part of Nebraska. Platte River forms its northwestern boundary. The county includes an area of about 538 square miles, or 344,320 acres.

Hamilton County is in the physiographic region known as the Nebraska plain. In general, the land is level or undulating, sloping slightly toward the east, and is dissected by a few streams that flow eastward and by Platte River Valley that extends in a northeasterly direction across the northern end of the county. The elevation above sea level ranges from 1,660 feet in the eastern part to 1,900 feet in the western part.

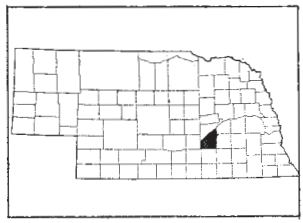

FIGURE 1.—Sketch map showing location of Hamilton County, Nebr.

As the slope is slight, erosion along the larger streams and the formation of drainage ways on the original plain are not rapid. Irregular-shaped belts of eroded land, ranging from a few rods to a quarter of a mile in width, flank both sides of the valleys of the smaller streams. The drainage ways are shallow and have not materially affected the original surface of the plain. In areas in which the surface is naturally very flat drainage is poor and a few depressed areas are wet.

Platte River has eroded a slightly deeper valley than the other large streams. This valley lies at an average depth of about 100 feet below the general level of the county. Its slopes are sharply dissected, except where the soils are very sandy. This eroded land is marked by sharp spurs and deep intervening ravines. In most places the higher part of the slopes is more dissected, sandy areas on the lower part sloping more gently and having a smooth undulating surface. The tributaries of Platte River are few and extend but a short distance into the uplands, as the divide between Platte River and the drainage ways toward the east lies a short distance back of the bluffs of Platte Valley.

The larger streams within the county are bordered by rather wide belts of alluvial land. These areas are level or undulating and their surfaces are broken mainly by the main stream channel, which follows a tortuous course down the valley, and are only slightly modified by old channels, depressions, and cut-offs. In the western part of the county considerable material has washed in over the bottoms from the adjacent uplands, but in the eastern part little material

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has been deposited on the surface, as the streams are more deeply intrenched and carry off the excessive sediments that are brought into the valleys. Most of these valleys are well drained.

In general, the surface of the Platte Valley bottom ranges from level to undulating and slopes slightly toward the stream, and the bottom lands include both well-drained and poorly drained areas. The terraces, as a rule, are well drained, as they are above overflow and form strips of land between the first bottoms and the valley slopes. The lower bottoms are poorly drained, owing to the slight depth to the water table, which in many places lies within 3 feet of the surface.

The first permanent settlements in the county were made in 1866, chiefly along the larger valleys. Most of the early settlers came from Missouri, Iowa, Illinois, Ohio, and the New England States. Later, immigrants came from Germany, Sweden, England, and Russia, and most of the land on the open prairies was taken up. The Danes settled principally in the northeastern part of the county; Swedes in the northwestern part; Irish, Bohemians, and Germans in the southwestern part; and Russian Mennonites in the southeastern part.

The census of 1920 shows a total population of 13,237. Of this number, 77.6 per cent were classed as rural. The average density of the rural population was 19 persons to the square mile. The population is fairly uniformly distributed over the county but is less dense on the Platte Valley bottom lands and on the rough broken lands. Aurora, the county seat and largest town, had a population of about 3,000 in 1927. Other trading centers are scattered throughout the county.

Hamilton County has direct railroad connection from Aurora to Omaha, Lincoln, and other important cities of Nebraska, which provide good markets for farm products, especially livestock, dairy, and poultry products. These products furnish the chief source of revenue for the people of the county. Most of the wagon roads in the rural districts are of dirt construction but are kept in good repair. The main roads between the principal towns are graded and many of them are surfaced with gravel. Very few farmers are more than 6 miles from a shipping point. The main highways are extensively used by transportation companies, and bus lines operate on fixed schedules across the county. Trucks are used to transport farm products to market or to distribute merchandise to the different markets in the county. Many farmers truck their livestock to market.

Telephone service reaches all parts of the county, and a large proportion of the farmers enjoy the advantage of rural mail delivery.

Well water is of excellent quality and, in the uplands, is obtained from tubular wells averaging 100 feet in depth. The wells in the valleys are shallower, ranging from a few feet to 50 feet.

CLIMATE

The climate of Hamilton County is characterized by wide seasonal variations. The winters are cold and the summers are warm. Spring is usually cool with considerable rain, which often continues to early summer. In dry springs there is sometimes considerable wind. In such seasons crops are late and small-grain yields are frequently low. Small grains seem to give better yields following moderately cool

wet springs. Sometimes unusually cool weather occurs in the summer, accompanied either by very little or considerable precipitation. The fall season is usually long, with moderate temperature and a few periods of rainy weather.

The average date of the last killing frost, as recorded at York, in York County, is April 29 and of the first, October 7, giving an average frost-free season of about 160 days. The latest killing frost recorded occurred on May 27 and the earliest on September 12.

The mean annual precipitation of 27.89 inches is favorably distributed for crop production. The greater part of the rainfall is uniformly distributed during the growing season and very long periods of drought are uncommon. Short periods of drought frequently prevail during late July or early August, at which time corn is at its most critical stage.

About half the average annual snowfall of 27 inches comes during February and March. Snow has been known to occur in every month between September and May.

The prevailing wind is from the northwest, but in late July and August the wind is mostly from the south, especially during very dry and warm weather. During dry springs it is sometimes very strong and causes considerable drifting of fine soil material. The proportion of sunshiny days is large.

Table 1, compiled from records of the United States Weather Bureau station at York, in York County, gives the more important climatic data for Hamilton County.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at York, York County, Nebr.*

[Elevation, 1,633 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1894)	Total amount for the wettest year (1908)	Snow, average depth
	° *F.*	° *F.*	° *F.*	*Inches*	*Inches*	*Inches*	*Inches*
December	27.6	70	−23	0.83	0.19	(1)	5.0
January	25.0	67	−28	.58	.16	0.45	4.3
February	26.6	80	−31	1.18	1.00	1.53	6.9
Winter	26.4	80	−31	2.59	1.35	1.98	16.2
March	38.8	91	−11	1.24	1.00	.49	5.6
April	51.8	98	14	3.06	2.13	1.12	2.4
May	61.3	102	21	4.00	1.33	6.59	.6
Spring	50.6	102	−11	8.30	4.46	8.20	8.6
June	72.2	110	38	3.98	4.16	10.94	0
July	77.1	112	44	3.79	1.32	8.38	0
August	75.8	112	39	3.26	.33	5.28	0
Summer	75.0	112	38	11.03	5.81	24.60	0
September	67.2	107	26	3.10	1.35	1.04	(1)
October	54.5	94	10	1.90	1.61	2.40	.8
November	39.8	97	−4	.97	.15	1.11	1.8
Fall	53.8	107	−4	5.97	3.11	4.55	2.6
Year	51.5	112	−31	27.89	14.73	39.33	27.4

[1] Trace.

AGRICULTURE

Hamilton County comprises an area of 344,320 acres, 98.2 per cent of which, according to the 1920 census, is divided into farms. The farms average 179.7 acres in size, and 162.5 acres is improved land. Most of the farms range from 160 to 240 acres. The larger farms are in the valleys, perhaps because land there is cheaper than elsewhere and because so much of the land is untillable and it has been necessary to add more tillable land from time to time.

The farm buildings include a farmhouse, barns, poultry houses, and a few minor buildings. In the northern part of the county where farming operations are conducted on a more diversified scale, the farm buildings are larger and more numerous. Modern labor-saving implements are used for cultivating and harvesting the crops. Cornfields are cultivated with 2-row machines. Much land is prepared for wheat with tractor-drawn plows, harrows, and drills and is harvested with tractor-drawn binders. Hay is cut and stacked by machinery. According to the 1920 census, all farm property per farm was valued at $37,156, and of this amount 81 per cent was represented by land, 9.1 per cent by buildings, 3.6 per cent by implements, and 6.3 per cent by domestic animals. The average land value was $167.45 an acre in 1920, but values have decreased since that time. Prices vary with location, kind of improvements, and diversity of crops which can be grown. Well-improved and well-located farms occurring on well-drained soils that have moderately friable subsoils and deep black surface soils have the highest values.

The census of 1920 showed that 45.6 per cent of the farms were operated by owners, 53.7 per cent by tenants, and 0.7 per cent by managers. The owners of the rented farms live for the most part in the towns of the county.

The domestic animals on the farms include horses, mules, beef cattle, dairy cattle, and a few sheep, goats, swine, and chickens. Draft horses and mules are raised. The popular breeds of horses are Percheron and Belgian. Three or four teams, some of them mules and some horses, are kept on most farms. Since the use of tractors has increased, farmers keep as few draft animals as possible.

The beef and dairy herds are mostly of grade animals, many of which are crossed with purebred Herefords and Shorthorns. Holstein and Guernsey are the favored breeds on the larger dairy farms. Most farmers keep five or six cows to supply the family with dairy products and to have a small surplus for sale. The value of dairy products in 1919 was $319,947.

Very few sheep are raised. The largest herds are in the rougher sections. A few farmers ship in sheep during late fall, pasture them on fields of rape, and later bring the animals into the feed yards to be finished for market.

Between 30 and 40 hogs are raised on most farms. The leading breeds are Duroc-Jersey and Poland China. A large part of the corn crop is fed to hogs.

Poultry is a valuable asset on most farms and on many farms includes turkeys, ducks, and geese in addition to chickens. The Plymouth Rock, Leghorn, and Wyandotte are the principal breeds of chickens.

The number of domestic animals in the county on January 1, 1920, was as follows: Horses, 12,464; mules, 1,313; beef cattle, 17,978; dairy cattle, 9,503; sheep, 10,182; goats, 25; swine, 52,064; chickens, 181,909; and other poultry, 2,428.

The main items of farm expense in 1919 included labor, reported by 70.7 per cent of the farmers, with an average expenditure of $347.52 a farm; feed, reported on 75 per cent of the farms, with an average expenditure of $825.32; and fertilizer, reported by only two farmers, with an average expenditure of $155. At present labor is plentiful except during corn husking and harvesting seasons. On most farms the labor is performed by members of the family. Many farmers are endeavoring to cut expenses by reducing the number of work animals, using tractors during the rush seasons. All available barnyard manure is applied to the land.

Table 3 gives the acreage and production of selected crops in stated years.

TABLE 3.—*Acreage and production of principal crops in Hamilton County, Nebr., in stated years*

Crop	1879		1889		1899	
	Acres	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*
Corn	28,296	1,041,003	121,578	5,807,895	137,175	3,382,050
Oats	5,812	119,197	51,635	1,563,328	50,990	1,586,380
Wheat	64,994	601,287	2,941	35,064	48,920	661,950
Rye	981	11,182	478	7,798	4,304	63,590
Barley	5,153	71,020	680	16,850	1,982	49,260
Potatoes		25,865	1,568	148,486	1,622	176,980
		Tons		*Tons*		*Tons*
Hay, all kinds	7,563	9,519	31,168	32,345		
Tame hay[1]					7,606	13,382
Wild hay					11,946	10,945
Alfalfa					1,513	3,335
Coarse forage					675	1,753

Crop	1909		1919		1924	
	Acres	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*
Corn	114,777	3,304,274	97,651	2,730,560	110,941	3,134,519
Oats	24,815	611,156	25,595	849,418	30,260	893,686
Wheat	82,578	1,840,270	100,808	1,244,599	73,928	1,621,614
Rye	16	275	1,014	15,599	727	10,093
Barley	277	6,633	5,609	139,008	7,631	172,669
Potatoes	989	88,137	633	29,737	487	50,178
		Tons		*Tons*		*Tons*
Hay, all kinds					33,552	52,743
Tame hay[1]	26,663	51,047	24,054	48,357	28,028	
Wild hay	9,731	10,988	5,505	5,753	5,524	
Alfalfa	12,835	33,489	21,396	44,413	23,307	
Coarse forage	288	777	4,989	10,681		

[1] Includes alfalfa.

The principal cereal crops of the county are corn, wheat, oats, rye, and barley. The average yield of corn is about 30 bushels to the acre, although yields as high as 50 or 60 bushels are reported from the better soil areas. The dent varieties are generally grown, Reid Yellow Dent, Iowa Silvermine, and Iowa Goldmine being the favorites. Wheat is a cash crop. Turkey is the principal variety. Kherson is the principal variety of oats. Oats are considered an unprofitable crop, but they are usually grown in the rotation and

are used as feed for work animals, for which purpose they are considered especially valuable during the hot summer months. Rye is grown on the sandier soils of the county, mainly for pasture.

Alfalfa and the native prairie grasses are the chief hay crops in Hamilton County. The native prairie grasses grow chiefly in low wet depressions in the uplands or along the Platte Valley bottoms. The native grasses yield from 1 to 2 tons of hay to the acre. Alfalfa and sweetclover are important crops. Many farmers have from 3 to 5 acres in alfalfa. The crop is cut for hay about three times in ordinary seasons, and total yields range from 2 to 8 tons to the acre. Some seed is produced and sold to local buyers. Several varieties are grown, but Grimm seems to be the hardiest and best survives the extremely cold winters. Sweetclover is grown mostly on the sloping lands which are subject to erosion. The crop is grown both for hay and for pasture for a few years, and is then plowed under as a green-manure crop. The yellow and white varieties are grown principally.

Very few vegetables are grown on a commercial scale, but almost every farm includes a garden where enough vegetables for home use are produced. A few farms include a small fruit orchard consisting mainly of apples, a few plums, and cherries. Most of the fruit for home use is purchased at the local markets.

The source of farm income depends on the proportionate acreage devoted to cash and to subsistence crops. In sections of the county where corn is the principal crop it is sold for cash. Wheat is a cash crop in all sections of the county, and where it is the predominant crop the farm income from this source is greater than from any other. Other crops grown in conjunction with wheat provide feed for the livestock. Some of the corn, oats, alfalfa, and other crops is sold for cash, but they are mainly fed to livestock.

The feeding of crops to livestock and sale of livestock have many advantages over the sale of crops. One is that larger returns can frequently be obtained when market prices for crops are comparatively low. Also, some crops that can be raised cheaply can not be easily disposed of on the market but can profitably be fed to livestock, and the sale of dairy and poultry products and livestock provides a more uniform distribution of the farm income throughout the year. On the other hand the greater part of the income of the grain farmer is obtained at one time of the year, and he must rely entirely on one source of income. If failure of the main crop occurs considerable hardship is experienced by the farmer.

Livestock feeding varies in importance with the size of the farm, location, the kind of feed available, and the kind of livestock fed. On the average-sized farm the livestock which are fed for market have been bred and raised on local farms. Hogs predominate on such farms, as corn is the principal feed which is grown in abundance. In addition, a few cattle are fed in order to dispose of such roughage as alfalfa, corn fodder, and other minor crops. On the larger farms, those comprising 240 or more acres, both cattle and hogs, which are shipped in from the Western States as feeders, are kept. On these farms most of the land is devoted to corn, oats, and alfalfa. The corn is fed either as silage or fodder or the stalks are pastured after the husking season. Such extensive feeding operations are carried on mostly in parts of the county where a large diversity of crops is

grown or where corn is the predominant crop. Many of the farms are favorably located along the valleys, where trees serve as windbreaks, affording considerable protection to the livestock during the cold winter months. Good shelter is an important item to consider in extended feeding operations during the winter.

The kind of feed available determines the kind of livestock to be fed. Along the Platte Valley, in the region of pasture and hay land, the pasture provides range for large herds of cattle and the hay land provides roughage during the winter when the livestock are fed in the feed lots and finished for market. As very little corn is grown in this locality, hog feeding is not favored. Sometimes cattle that have been pastured for the summer are shipped to near-by markets at the end of the grazing season, and the hay is sold to local buyers. Many farmers own large tracts of land in the Platte Valley and use the adjacent uplands for the production of grain and other necessary feed.

Dairying and poultry raising have increased in importance during the last few years. The demand for dairy products has made prices attractive, and the sale of butter and cream brings a steady income throughout the year. Near the towns and larger trading centers of the county farmers have expanded their dairying operations, and dairying has become a major industry. On these farms, the crops grown are those particularly suitable for feeding dairy cattle. Corn is fed either in the form of fodder or silage, and considerable land is devoted to forage crops and alfalfa. In other sections dairying is carried on as a side line.

A small proportion of the grain is fed to poultry. Where chickens are raised in large numbers, especial attention is given to the kind of feed suitable for profitable poultry raising. The principal poultry feed consists of wheat, corn, and ground alfalfa meal.

The methods of growing corn, wheat, oats, and alfalfa are practically the same throughout the county. Corn is usually grown on land that was seeded to wheat, but some farmers plant corn on land that had been seeded to corn the previous year. The land for corn is plowed during late fall or early spring and is then harrowed twice in order to develop a smooth seed bed. Later, early in May, it is planted to corn, usually by the checkrow method in order that the crop can be cultivated in two directions, thus eliminating as much as possible the growth of weeds. The crop is cultivated at intervals, usually three times, during the growing season until the corn tassels. The corn is picked from the stalk, leaving the husks and stalks in the field to be pastured by livestock during the winter. Some of the corn is cut with a binder and put in silos or shocked in the fields for use as fodder during the winter.

Oats are seeded on land which was planted to corn the previous year. The common practice is to thoroughly disk the land twice, in order to cut up the cornstalks and to provide a good seed bed. After the surface has been harrowed smooth, the oats are broadcast or drilled in during the early part of April or the latter part of March. The crop is harvested about the middle of July. It is cut with a binder, shocked in the field, and later stacked or threshed and the grain stored in bins. The straw is carefully stacked for use as feed during the winter when very little feed is required for work animals.

Many farmers prefer to stack the bundled grain for a period, as this practice seems to preserve the feeding quality of the straw.

Wheat is usually grown on land that has been previously devoted to oats, and in some sections of the county, especially where this is the predominant crop, the same land is used for growing wheat for three or four years. The wheatland is plowed during the latter part of the summer, immediately after the preceding crop has been gathered. In recent years the common practice has been to plow as early as possible in order to allow sufficient time for the soil to get in good condition for the next crop. Early plowing helps to conserve soil moisture by destroying the weeds which grow on the stubble fields, and it also provides opportunity to catch more of the moisture that may fall before seeding time. The wheat crop is usually seeded early in September. A good seed bed and plenty of moisture are important in producing a successful crop. Unless sufficient moisture has been stored to a depth of a few feet below the surface crop yields are invariably reduced the following season. The crop is gathered during the middle of July. Most of it is threshed from the shock, and some of the grain is stored in local bins, but most of it is hauled to local elevators and shipped to distant markets.

Many important factors are to be considered in the production of alfalfa. The acreage of land devoted to this crop each year depends mainly on climatic conditions. If the season is dry, very little alfalfa is seeded. The crop is seeded either in the fall or spring; many farmers prefer fall seeding. If plenty of moisture falls during late August and September alfalfa makes a rapid growth, attaining sufficient size to survive the winter. Many farmers, as soon as the wheat crop is cut, clear the acreage of land desired for alfalfa of shocks and plow it immediately and frequently disk and harrow it in order to conserve as much moisture as possible before seeding time. Alfalfa requires a firm seed bed so that the tiny seeds, coming in contact with moisture and soil, may germinate quickly. In many places where the surface soil has been packed in tracks made by wheels of machinery or the feet of horses, alfalfa is found growing when it has failed to obtain a stand on other parts of the field. Some farmers make a practice of inoculating the surface soil with commercial bacteria or with soil obtained from land on which alfalfa has been grown. Alfalfa is usually cut for hay as soon as the first blossoms appear. After the hay has cured in the windrow or shock it is stacked in the field by modern machinery. The crop is usually cut about three times during the season. If the growing season is longer than usual, a fourth cutting can be made, but some farmers prefer to allow the last crop, which is very short, to stand, as it is thought that this will protect the plant roots during the winter.

No definite farming system which has as its object the maintenance of soil productivity is followed. Practically no fertilizers are used or any definite crop rotation followed. Where a diversity of crops is grown and much livestock is kept on the farm, soil fertility is maintained to more or less extent. Where farming is more diversified rather definite crop rotations are practiced. For instance, it is common practice to follow wheat with corn rather than to plant corn on the same ground two years in succession. Some

of the cornland is used for oats, which are well suited to such a rotation. Thus it may be seen that by planting corn after wheat the cornfield may be shifted to different parts of the farm, and oats following corn will provide land on which wheat may be easily grown. A few farmers have tried to eliminate oats from the rotation and have seeded wheat between the corn rows, but this practice has not proved so successful as seeding wheat on freshly plowed land. Farmers prefer to grow oats, as it is valuable feed for work animals.

All manure that collects in the feed yards is distributed over the fields. It is practically the only fertilizer used. Alfalfa increases the nitrogen content of the soils, but as a very small part of the average-sized farm in Hamilton County is planted to alfalfa very little benefit is derived from this source. A few fields are planted to wheat for several years in succession. This practice has been engaged in especially in large recently reclaimed poorly drained areas.

SOILS AND CROPS

Nearly all the land in the county, except the slopes and first bottoms of Platte River Valley, where a considerable acreage is being used for pasture and hay land, is devoted to the growing of crops. The principal crops, according to acreage, include corn, wheat, oats, alfalfa, barley, and prairie hay. Those of less importance are rye, cane, Sudan grass, potatoes, sweetclover, garden vegetables, and fruits.

The census of 1920 indicates that a greater acreage was devoted to wheat in 1919 than to any other crop. Ordinarily corn occupies the largest acreage. Most of the wheat is grown on broad flat areas, especially on Crete, Butler, and Fillmore silt loams. Wheat, barley, and oats are grown on 75 or more per cent of the farmed areas of these soils, the remainder of which is devoted to corn. The acreage of oats is more equally distributed over the county than wheat or corn because it is an important feed crop and also because it fits well into the rotation between corn and wheat. Corn occupies the greater part of the farmed land in a belt bordering the northern edge of the plain, including areas of Colby fine sandy loam and Colby very fine sandy loam. It also predominates in the valleys of the larger streams on soils of the Judson and Waukesha series. Prairie hay is cut chiefly on the steeper valley slopes, which are occupied by the slope phase of Hastings silt loam. This is also the chief crop in some of the more poorly drained upland depressions occupied by the Scott soils, in local areas too poorly drained for cultivation throughout the bottom lands, and on the sandy Valentine soils. Alfalfa is grown in all parts of the county, chiefly in small fields. It is used to a large extent in crop-rotation systems. Over the county as a whole from 40 to 50 per cent of the land not used for wheat is devoted to corn and the remainder to a variety of crops. This is especially true where Hastings silt loam is the dominant soil.

On the basis of their economic utilization the soils of the county may be separated into four broad groups, general-farming soils, small-grain soils, corn soils, and prairie-hay soils. The first group in this broad classification includes soils which are equally suited to all

crops common to the region. Concerning the other three groups it is to be clearly understood that the crops assigned to them in this broad classification are not the only ones grown. In fact, nearly all the crops common to the region can be grown more or less successfully on most of the soils in any group. In each of the last three groups, however, certain crops return higher yields than others during most years and are therefore grown more extensively. The higher returns from one crop than from another are not necessarily the result of extremely favorable soil conditions for that particular crop but may be owing to a greater ability of one crop than of another to adapt itself to the conditions under which it must grow.

These different soil groups include soils with certain common characteristics. As a result of an abundant content of organic matter, the soils of the county as a whole are uniformly dark colored, except in areas where erosion has been so severe as to remove the original dark surface material and in very poorly drained areas where lighter-colored material in the lower part of the topsoil has been brought up by cultivation. Each soil group has certain predominant soil characteristics.

In the following pages the individual soils of the county are described, their relation to one another is shown, and their influence on the agricultural development and farming practices of the county is discussed. The location and area occupied by each of the soils recognized in the county are shown on the soil map accompanying this report. Their acreage and proportionate extent are given in Table 2.

TABLE 2.—*Acreage and proportionate extent of the soils mapped in Hamilton County, Nebr.*

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Hastings silt loam	193,280	56.1	Hastings silt loam, slope phase	44,160	12.8
Hall silt loam	1,024	.3	Colby very fine sandy loam, broken phase	5,440	1.6
Crete silt loam	22,528	6.5	Nuckolls loam	320	.1
Fillmore silt loam	12,032	3.5	Cass very fine sandy loam	3,776	1.1
Butler silt loam	2,752	.8	Cass sandy loam	1,600	.4
Scott silty clay loam	1,024	.3	Sarpy sand	896	.3
Colby very fine sandy loam	13,632	4.0	Valentine fine sandy loam	2,752	.8
Colby fine sandy loam	7,552	2.2	River wash	1,024	.3
Waukesha silt loam	13,632	4.0			
Waukesha fine sandy loam	2,880	.8			
Judson silt loam	14,016	4.1	Total	344,320	

GENERAL-FARMING SOILS

The group of soils classed as general-farming soils includes only two soil types, Hastings silt loam and Hall silt loam.

The crops that are predominantly grown on soils of other groups seem to make as good, often much better, growth on the principal general-farming soil, Hastings silt loam. The predominance of certain crops on the different soil groups is owing to their ability to overcome or avoid the unfavorable soil conditions that materially affect the growth of other crops. Corn makes a more uniform growth and produces larger average yields on these soils than elsewhere except on corn soils in the valleys. Small-grain crops also make a more uniform growth and produce slightly better yields,

even in abnormally dry seasons. Farmers recognize that the moisture which has penetrated the subsoil in late fall greatly influences crop yields in the following season. If little moisture remains in the subsoil in late fall and there is very little rainfall in spring, the crop yield is comparatively greater on the general-farming soils than on most of the other soils in the county. Alfalfa is the principal hay crop on the general-farming soils.

In parts of Hamilton County where a diversity of crops is grown on soils in the general-farming group, no limiting factor in crop growth, due to the character of the soil, causes a preference for the growing of any one crop. Hastings silt loam and Hall silt loam, with their deep dark surface soils, are very productive soils, as shown by the luxuriant growths of natural vegetation and corn and other crops. These soils contain all the elements necessary for proper growth and development of many different crops. The friable subsoil allows absorption of large quantities of moisture to a considerable depth and also allows normal root development so that crops can avail themselves of nearly all the moisture that the soil contains. Corn and alfalfa, which require an abundance of moisture, are able to make better growth than on soils with heavy claypan subsoils.

Lack of available moisture, however, is a limiting factor in the growth of alfalfa after a period of four or five years. This fact has been established through the investigations of the Nebraska Agricultural Experiment Station.[1] The lack of moisture apparently can not be owing to the character of the soil material but to the insufficient moisture furnished by the annual rainfall of the region.

Hastings silt loam.—The surface soil of Hastings silt loam, to a depth of about 12 inches, is very dark grayish-brown or black friable silty loam or silty clay loam, containing an abundance of organic matter. When moderately dry the soil develops an excellent tilth. The surface soil is easily penetrated by cultivating implements. If it becomes cloddy through plowing when too wet, there is no difficulty in reducing the clods and providing a good seed bed. The upper part of the subsoil is brown and is composed of material slightly heavier in texture than the surface soil but is not compact. It breaks into large easily crushed structure particles and is readily penetrated with a spade. Between depths of about 36 inches and 60 inches, the material is loose, floury, and uniform in structure. Below 60 inches an abundance of lime has accumulated in concretions and in finely disseminated form.

Hastings silt loam is the dominant soil on the uplands of Hamilton County and covers more than 56 per cent of the total area. It occupies the broad flat or gently rolling interstream divides where the silt mantle has not been removed by erosion.

The areas range from nearly level to moderately rolling. Drainage is well developed. Surface run-off is rather rapid on the steeper slopes, and small patches of the soil are beginning to erode, but very little of the soil is badly gullied.

A very large proportion of this soil is under cultivation, and the small remainder is utilized for pasture and hay land.

[1] KIESSELBACH, T. A., RUSSEL, J. C., and ANDERSON, A. THE SIGNIFICANCE OF SUBSOIL MOISTURE IN ALFALFA PRODUCTION. Jour. Amer. Soc. Agron, 21: 241–268, illus. 1929.

Corn, wheat, alfalfa, and oats are the leading cultivated crops. Corn yields from 20 to 50 bushels to the acre, averaging about 30 bushels; wheat yields from 15 to 30 bushels to the acre, with an average of about 18 bushels; and alfalfa, the chief hay crop, gives an average yield of about 2½ tons to the acre.

Hall Silt loam.—A less important member of the general-farming group is Hall silt loam of the river terraces. The surface soil consists of very dark grayish-brown silt loam high in organic matter. The soil breaks up into a mellow seed bed under a wide range of moisture conditions. The upper subsoil layer, which begins at a depth of about 12 inches and ranges in thickness from 18 to 24 inches, is dark grayish brown, moderately compact, and heavier in texture than the surface soil. There is, in most places, a transitional layer below this compact layer, consisting of friable light grayish-brown silt loam or heavy silt loam. Beneath this is the layer of highest lime concentration, consisting of very light grayish-brown, loose, structureless silt or silt loam which crushes readily into a loose fine powder. Lime occurs abundantly both in powder form and as concretions. The amount of lime and its depth below the surface vary somewhat with local conditions.

Hall silt loam occurs on terraces along the larger streams that cross the county. Areas of this soil are nearly flat, with a gentle slope downstream. Drainage is good but is nowhere excessive. The greater area of the soil is not subject to stream overflow. A small part may be flooded in periods of exceptionally high water, and some areas receive the discharge from small streams emerging from the upland.

This is one of the most productive soils in the county and is nearly all under cultivation. As it covers only a little more than a thousand acres, it is not important agriculturally. Crop adaptations and yields are about the same as on Hastings silt loam.

SMALL-GRAIN SOILS

On the soils of the small-grain soil group, the effects of unfavorable conditions for the growth of other crops, especially corn, are strikingly revealed. On small patches of soils with heavy claypan subsoils, in fields consisting mainly of corn soils, corn grows less vigorously than in other parts of the field. Early in the season, the difference is not so apparent as it is during the latter part of the season, especially after an extremely dry period. During seasons of normal rainfall, corn makes rapid growth on all parts of the field, but after a very dry spell, in those areas underlain by claypan, its growth is stunted to such an extent that the stalks are very short, the leaves become pale, and the ears are short and imperfectly developed. During abnormally wet seasons many parts of the field underlain with a heavy claypan layer are too wet for cultivation, and as a consequence, cultivation is delayed and the weeds grow so large that they can be destroyed only by hoeing. If the areas are plowed while wet, the soil does not scour well and can not be turned over sufficiently to cover the weeds that grow near the cornstalks. However, corn is grown on all farms, regardless of the character of the soils, in order to obtain feed for livestock.

In soils of the small-grain group the heavy claypan subsoil is almost impervious to moisture, and although the moisture in the surface soil is abundant when rains are frequent, the surface soils are not deep enough to retain sufficient moisture for the requirements of the corn plant throughout the season. This is especially true of the Fillmore and Scott soils. As the crop roots can not easily penetrate the claypan layer, they can not obtain moisture from the underlying layers to maintain growth through a period of drought. The moisture supply of the surface soil is soon exhausted unless it is frequently replenished by rain.

Wheat and oats make a better growth than corn on the small-grain soils, because these crops usually make their maximum growth during the early part of the season when rains are frequent and are usually matured before dry weather occurs. At the season when corn is sometimes retarded in its growth by unfavorable weather conditions the small-grain crops are usually being harvested. The surface soil of the small-grain soils is usually sufficiently productive and contains enough moisture for proper growth and development of small grain.

Crete silt loam.—The most important soil in the group of small-grain soils is Crete silt loam which makes up nearly 59 per cent of the area of the group. The surface soil is very dark grayish-brown or almost black mellow silt loam 16 inches thick. In uncultivated areas the surface soil consists of the following three layers, differing mainly in structure: A surface mulch from one-half to 2 inches thick, a faintly plated or laminated layer, and a granular layer. In cultivated fields these layers become mixed and the structure is destroyed.

Below the dark-colored surface layers is a brown compact heavy upper subsoil layer, which continues to an average depth of 36 inches. It has a large clay content and is plastic or waxy when wet but very hard and tough when dry. Crete silt loam is readily identified by the brown color and density of this claypan. The dense clay is penetrated by very few plant roots. As stated before, the claypans in this and the other small-grain soils, with their impenetrability and their limited water supply for plants, give the short-rooted crops an advantage over other crops on these soils.

The lower part of the subsoil is composed largely of loose, grayish-yellow silty clay loam or silt loam which contains an abundance of lime. The lime is commonly most abundant in the upper foot and decreases gradually with depth. Below this zone of lime concentration is the loose yellow floury silt from which the soil has weathered.

Crete silt loam is fairly uniform throughout the areas of its occurrence, but there are some variations of minor importance. This soil differs from Hastings silt loam in having a more compact upper subsoil layer. The two soils merge so gradually into each other that in many places it is necessary to draw arbitrary lines in separating them on the soil map.

Crete silt loam occurs on smooth uplands where drainage ways have not developed. The surface of the areas ranges from nearly level to gently undulating and is locally modified by shallow valleys and slight depressions. This soil has not covered the lowest parts of the upland, but surrounds areas of Scott or Fillmore soils which occupy the deepest parts of the depressions.

Nearly all the Crete silt loam has surface drainage adequate for crop production. The heavy compact subsoil prevents free underdrainage, but there is nearly everywhere sufficient slope to carry off the moderate rainfall of the region and small-grain crops seldom suffer from excessive moisture. During periods of prolonged drought the deeper-rooted crops, particularly corn, suffer from lack of of moisture.

Crete silt loam is used for wheat, corn, oats, and alfalfa, ranking in the order named. Small patches of vegetables and forage crops are grown on most farms for home consumption.

The yields of all crops vary widely with the seasons and state of improvement of the land. Wheat yields range from 5 to 30 bushels, with an average of about 15 bushels; the average yield of corn will probably not exceed 22 bushels; and alfalfa yields range from one-half to 2 tons to the acre. In favorable seasons both corn and alfalfa make as large yields on this soil as on the soils of the general-farming group.

Fillmore silt loam.—The surface soil of Fillmore silt loam is commonly very dark grayish-brown or black silt loam ranging from 6 to 14 inches in thickness. Where well developed, it is made up of three layers similar to those of Crete silt loam in appearance, but all are thinner. The lower part of the surface soil may range in color from almost black to light gray, depending on drainage conditions. Where the soil is well drained the layer is very dark, but where it is poorly drained it may be almost white.

Beneath the variable topsoil is the upper subsoil layer consisting of dense black clay ranging from 12 to 24 inches in thickness. Iron stains and small round iron concretions are common in this material.

The lower subsoil layer has a high lime content. The material consists of structureless grayish-brown silt, which becomes lighter and more flourlike with depth. The lime is scattered throughout this layer in the form of concretions, spots, and splotches, being most abundant in the upper part but continuing in finely disseminated form to a depth of 6 or 7 feet below the surface.

Fillmore silt loam occurs in shallow basinlike depressions throughout the more level uplands. Owing to the flat and basinlike position of the soil, surface drainage is poorly established, and the claypan subsoil prevents free underdrainage. Water accumulates in the depressions after heavy rains and disappears slowly by evaporation. The surface soil is not so continuously moist as is that of Scott silt loam, and nearly half the total area of this soil is under cultivation. The other part, which includes most of the larger areas, is in native sod and is used for hay meadows and pastures. The farmers find it more profitable to plant this soil to wheat than to corn. Western wheatgrass and grama grass make a good growth, and sorghums do fairly well.

Butler silt loam.—The surface soil of Butler silt loam is very similar to that of Fillmore silt loam. Its average thickness is greater, however, being about 15 inches. The upper subsoil layer consists of very dark grayish-brown or black heavy compact clay, in most places as dense or nearly as dense as the Fillmore claypan. On account of slightly better drainage conditions, no iron concretions have been formed in this layer. The lime layer begins at a

depth of about 36 inches below the surface and is from 30 to 50 inches thick. Lime disappears at a depth ranging from 6 to 8 feet.

Butler silt loam occurs principally in two areas in Monroe Township, occupying a shallow basinlike valley at the headwaters of North Fork Big Blue River. The soil is transitional in structure and drainage conditions between Crete silt loam and Fillmore silt loam. Surface drainage in places is not well established, and the claypan restricts underdrainage. This soil is better drained than Fillmore silt loam and crops suffer only in years of exceptionally heavy rainfall. On adequately drained areas, crop yields equal or slightly exceed those obtained on Crete silt loam, but the average is slightly lower.

Scott silty clay loam.—Scott silty clay loam has been subjected to poorer drainage than either the Butler or Fillmore soils. Its topsoil closely resembles that of Fillmore silt loam. Its claypan layer, however, is much thicker than those in the Butler and Fillmore soils, in many places extending to a depth of 5 or 6 feet. The claypan layer is more thoroughly leached and is steel gray or bluish gray instead of black as are the Fillmore and Butler claypans. The excessive moisture in the Scott soil has removed all lime to a depth below 10 or 12 feet. This soil, although closely associated with the soils classed in the small-grain group, is seldom used for the production of small-grain crops except after it has been artifically drained. Most of the land remains in pasture or is used for the production of native hay.

CORN SOILS

The group of soils classed as corn soils may be divided into two subgroups, one of which includes the soils of an upland belt in the northern part of the county, and the other soils which occur chiefly on well-drained terraces in the valleys. The upland subgroup of corn soils includes Colby fine sandy loam and Colby very fine sandy loam.

The subgroup of corn soils occurring only in the valleys includes Waukesha silt loam, Waukesha fine sandy loam, and Judson silt loam. Waukesha silt loam is most continuously developed along the valleys in the eastern half of the county; farther west, near the heads of the valleys, Judson silt loam is the predominant soil. Waukesha fine sandy loam occurs only on the terraces in Platte Valley.

Soils of the valley subgroup of corn soils are much better suited to corn than the soils in the upland subgroup. In fact, corn on the valley soils does as well as on any other soils in the county and frequently better. Small-grain crops also do well, but the higher moisture content of the valley soils often causes these crops to produce a rank vegetative growth at the expense of the grain. Moreover, small-grain crops grown in the valleys have comparatively weak stems, many of which break, allowing the grain to lodge. Corn, on the other hand, requires much more water than small grains and is benefited by the higher moisture content prevailing in the valley soils.

Soils of the upland subgroup of corn soils are more or less sandy and low in organic matter. Corn therefore does not yield so well as on some other soils in the county, but it does better than other grain crops and for this reason is grown most extensively. Small grains

are often injured by soil drying and drifting, which expose the shallow root systems. Moreover, the rather loose sandy soil allows moisture to escape by percolation beyond the depth of small-grain root penetration, and if the soil moisture is not frequently replenished by precipitation the crops suffer. Corn, on the other hand, is not so greatly affected by the sandiness of the soil, because its root system penetrates deeper into the soil mass and secures moisture from greater depths and larger areas than the roots of small-grain crops.

Colby very fine sandy loam.—The most extensive soil in the upland subgroup of corn soils is Colby very fine sandy loam. The surface layer of this soil to an average depth of about 7 inches is grayish-brown or rather dark grayish-brown loose very fine sandy loam. With depth the material gradually becomes lighter in color and finer in texture, and at a depth of about 12 inches it grades into a grayish-yellow very fine sandy loam subsoil. This layer is underlain at a depth of about 24 inches by light-gray or almost white very fine sandy loam. The surface soil contains a very small proportion of lime, but the subsoil is highly calcareous and lime concretions are abundant in many places below a depth of 30 inches.

This soil occurs in an almost continuous strip along the slope to Platte River. The surface ranges from almost level to steeply rolling, and drainage is everywhere good. In many places on the steeper slopes it is excessive and erosion is a serious problem. In the more nearly level areas the surplus moisture is readily absorbed by the loose, porous surface soil, and it passes off by underdrainage. The soil is fairly retentive of moisture but does not withstand drought so well as Hastings silt loam on account of its lower content of organic matter.

More than half the area of Colby very fine sandy loam is under cultivation, mainly to corn, wheat, oats, rye, and barley. Corn leads in acreage. Owing to lack of uniformity in this soil in different places, it is difficult to give a correct statement as to average yields. Corn yields range from 12 to 50 bushels, with an average of less than 20 bushels to the acre. The average yield of wheat over a period of years will not exceed 12 bushels, but in favorable seasons from 20 to 30 bushels is obtained on the better land. The average yield of oats is about 20 bushels, of rye 15 bushels, and of barley 20 bushels to the acre. The uncultivated part of this soil, including the steeper slopes along drainage ways, is included in pasture land. The grazing of beef cattle is practiced to some extent on the rougher areas.

Colby fine sandy loam.—Colby fine sandy loam differs from Colby very fine sandy loam mainly in the coarser texture of its surface soil, in its more porous nature and its greater depth to the silty lime layer. These differences are very slight and have no great influence on crop yields.

Colby fine sandy loam occurs in long irregular areas bordering the Platte River slope. It occupies a position below the smooth upland and above the areas of Colby very fine sandy loam.

Yields of all crops grown on this soil are slightly lower than on Colby very fine sandy loam. The relative acreage of crops on the two soils is nearly the same.

Owing to its looser surface soil, drifting by wind is common on this soil when the native sod is broken, and careful management is required in handling the soil.

Waukesha silt loam.—The most important soil agriculturally in the valley subgroup of corn soils is Waukesha silt loam. The surface soil of Waukesha silt loam is very dark grayish-brown friable silt loam, from 12 to 15 inches deep. It contains a large proportion of organic matter and in a moist condition appears almost black. The subsoil is brown or grayish-brown moderately compact silty clay which commonly becomes slightly lighter in color and more friable with depth. The change from soil to subsoil is very gradual both in color and in texture. A characteristic of this soil is the absence of lime within 3 feet of the surface but lime may occur below 4 feet. The lower part of the surface soil and the upper part of the subsoil are granular.

Waukesha silt loam occurs in long strips following the larger streams of the county. In places the areas are more than a mile wide. The streams meander from side to side breaking up the areas and detracting somewhat from the agricultural value. Except for these channels, areas of this soil are nearly smooth with a gentle slope down the valleys and toward the streams.

The soil is well drained as the slope is generally sufficient even on the flatter areas to carry off the surplus moisture.

Owing to its comparatively small extent, this soil is not so important in the general agriculture of the county as the more extensive upland soils. It is, however, very fertile and stands drought well. Crop yields are slightly higher than on any of the upland soils as crops on this soil are more favorably situated to obtain moisture. The soil is adapted to a wide range of crops, but on account of the high average yields of corn that crop holds first place in acreage. Corn yields from 35 to 50 bushels, wheat from 15 to 30 bushels, oats from 20 to 35 bushels, and alfalfa from 3 to 4 tons to the acre.

Waukesha fine sandy loam.—A vertical section of Waukesha fine sandy loam appears similar to Waukesha silt loam. A sufficient quantity of fine sand is present, however, to change the character of the soil to a slight degree. The surface soil is very dark grayish-brown fine sandy loam. The brown subsoil is not so heavy in texture as the subsoil of Waukesha silt loam, but the clay content is sufficient to render the material sticky. Beneath this layer the material is fine sandy loam and is uniform to a depth of many feet. The lime has been leached from Waukesha fine sandy loam at all depths.

This soil occurs mainly in two long narrow areas along the Platte Valley lying between the slopes of the Colby and Valentine soils and the flood plains of Platte River. The greater part of the land is never covered by water during floods.

Waukesha fine sandy loam occupies smooth terraces with a gentle slope toward the river. The slope as well as the porous subsoil contribute to adequate but not excessive drainage. The subsoil is sufficiently heavy to be retentive of moisture.

This soil ranks very slightly below Waukesha silt loam in agricultural value. The relative acreage in the different crops is very nearly the same as on Waukesha silt loam, and yields are only very slightly lower.

Judson silt loam.—Judson silt loam consists of very dark grayish-brown or black material that extends to a depth of 48 or more inches

without any great change in color or texture. The material contains large amounts of organic matter and is very friable.

The subsoil continues to a depth of 5 or more feet. It is slightly lighter in color than the surface soil but in other respects is similar. This soil developed on stream sediments washed down in comparatively recent times from the silty soils of the uplands and deposited over gentle slopes and stream valleys.

In Hamilton County, Judson silt loam occupies the upper valleys of the larger streams that flow across the county. As a rule, it is the dominant alluvial soil reaching from the headwaters downstream for several miles, then giving way to Waukesha silt loam.

Drainage is excellent as the open-structured though not porous subsoil allows the ready absorption and retention of moisture.

Owing to its high organic-matter content, good moisture conditions, and favorable structure and texture, this soil is highly valued.

The principal crops are corn, oats, and alfalfa. Corn has by far the largest acreage as this is considered an almost ideal corn soil. Yields range from 20 to 50 bushels, depending on the season, but the average yield is probably higher than that of Waukesha silt loam. Oats yield from 20 to 40 bushels and alfalfa from 2 to 3 tons to the acre. The minor crops are rye, barley, sorghum, and Sudan grass. Wheat is a cash crop but is sown on only a small acreage.

PRAIRIE-HAY SOILS

The group classed as prairie-hay soils includes the slope phase of Hastings silt loam, Nuckolls loam, Colby very fine sandy loam, broken phase, the poorly drained Cass and Sarpy soils, the sandy Valentine soil, and river wash.

From the following descriptions it is evident that these soils are not, as a whole, well suited to cultivated crops. However, none of them is unproductive, and in certain localities each one is used for corn, alfalfa, or sweetclover, and excellent results are obtained. As the soils occupy only a small total area and since the greater part of them is either too poorly drained, too steeply sloping, or too sandy for crop production, most of the areas are used for hay land.

Hastings silt loam, slope phase.—Hastings silt loam, slope phase, differs from typical Hastings silt loam mainly as a result of erosion. The dark-colored surface soil has been removed by erosion to such an extent that in places some of the layers of the dark soil are thin or absent. All gradations occur between the thin soils of the steep and badly eroded slopes and the typical soil on the smooth areas. Erosion has not proceeded, however, so far as in the Colby soils, as this phase of Hastings silt loam has a very dark-colored soil of greater or less depth.

The surface soil of the slope phase, which probably averages between 6 and 7 inches in thickness, consists of very dark grayish-brown silt loam. It is underlain by grayish-brown silt loam which is more coherent than the surface soil. The lower part of the subsoil is gray or grayish-yellow silt loam having a smooth floury feel. In most places lime occurs at 2 feet or less below the surface.

This soil occurs in long narrow strips ranging in width from a few rods to more than half a mile, bordering the larger drains and creeks. The total acreage is more than 44,000 acres.

The surface of this soil ranges from almost level over small areas to steeply sloping and blufflike. The level areas are on small divides between drainage ways. The narrow strips along the stream valleys have moderate or steep slopes and are rather deeply eroded in places. On the steeper slopes the uneven surface makes plowing and harvesting of crops rather difficult and detracts from the agricultural value of the land.

About 40 per cent of this soil is in cultivation and the remainder is in pasture. Corn is the principal crop, with sweetclover, alfalfa, sorghum, and Sudan grass next in importance. The minor crops are oats, rye, barley, and wheat. Yields vary widely from place to place, depending on the character of the soil and the surface features. Yields of all crops are lower than on typical Hastings silt loam. The pasture land produces a good growth of grama grass, western wheatgrass, and bluestem.

Colby very fine sandy loam, broken phase.—The broken phase of Colby very fine sandy loam has a surface soil consisting of grayish-brown or dark grayish-brown very fine sandy loam. The surface layer varies in depth and color with the relief. It rarely exceeds 8 inches and ranges from that depth to a mere film. In places the surface soil has been entirely removed by erosion, exposing the light-colored material. The upper part of the subsoil is grayish-brown loose very fine sandy loam to an average depth of 16 inches. Below this is loose nearly white calcareous silt.

This soil occurs along the short streams that descend from the level upland to the Platte River flood plains. These streams are cutting rapidly, and areas of this soil have for the most part a sharply rolling surface.

Only a very small proportion of the land is under cultivation. The greater part is used for pasture. Its value for cultivation and grazing is slightly lower than is Hastings silt loam, slope phase.

Nuckolls loam.—Nuckolls loam is a soil of minor importance in this county as it covers only about one-half square mile. The surface soil is very dark grayish-brown loam, 8 inches or less in depth. The depth and color of the surface soil varies with the degree of slope. The subsoil is light reddish-brown or light-red heavy silt loam or clay loam containing a small amount of coarse sand. The upper part of this layer is rather compact but at a depth of 3 feet the material is friable. Lime is abundant below 3 feet.

This soil occurs on stream slopes where erosion has exposed a reddish material. The surface ranges from gently rolling to steep. Only a small proportion of the land is cultivated. Corn is the usual crop, but yields are low. The uncultivated part is used for pasture and has about the same value for this purpose as the rougher parts of the Colby soils.

Cass very fine sandy loam.—Cass very fine sandy loam is one of the well-watered soils. The natural grass vegetation makes a luxuriant growth forming a dense turf over the surface. The 8-inch surface layer is very dark grayish-brown or almost black very fine sandy loam. It grades into more friable grayish very fine sandy material which does not contain quite so much fine material as the surface layer. This material continues downward to a depth of about 20 inches to the sand and gravel substratum. The substratum and

the gray layer beneath the surface soil are saturated during the greater part of the year.

Cass sandy loam.—Cass sandy loam has a surface soil consisting of dark grayish-brown or black sandy loam. It differs from Cass fine sandy loam only in the coarser texture of its surface soil. The subsoil material is loose sand and gravel very similar to the subsoil of the very fine sandy loam member.

Sarpy sand.—Sarpy sand occurs in flood plains along the streams and in places is subject to frequent overflows. The surface soil is shallow, light colored, and poorly supplied with organic matter. The subsoil consists of very coarse gray incoherent sand and gravel. The water table is near the surface, and the subsoil is wet more or less continuously.

Valentine fine sandy loam.—Valentine fine sandy loam occurs chiefly in the northern part of the county on slopes leading to the Platte River alluvial lands. The soil is composed of loose incoherent sand, of which the first few inches have been slightly darkened by organic matter. The areas are rather unstable, have low moisture-retaining powers, and are considered very droughty. Wherever this sandy soil is so located as to derive considerable moisture from underground seepage or a high water table the land is commonly used for hay meadows.

River wash.—River wash, which may be classed with this group of soils, has very little value. It consists of beds of sand, gravel, or silt deposited in the flood plains. Much of the land is bare and is added to or taken from in every period of high water. Wherever the material has been stationary for a sufficient length of time it is covered by a growth of shrubs, weeds, and coarse grasses.

SOILS AND THEIR INTERPRETATION

Three principal factors—the parent material, the soil-forming agencies that have acted on this material, and the length of time these agencies have acted—determine the development and distribution of soils in a given region.

The dominant surface formation in Hamilton County and the one from which most of the soils, either in situ or otherwise, have weathered is light grayish-yellow, calcareous, siltlike material known geologically as Peorian loess. It is fairly uniform in its physical and chemical properties. In a few places the light-colored loess has been removed by erosion, exposing either gray, loose, incoherent sand or reddish, slightly sandy, loesslike materials, both of which have weathered into soil. The soils developed from these sandy or reddish materials, however, are comparatively inextensive.

The regional soil-forming agencies, chief among which are the prevailing climate and vegetation, are uniform, especially the climate. Hamilton County is in the tall-grass prairie region of the United States, and the soils as a whole have developed under climatic conditions favorable for the rapid decay of grass roots and the accumulation, especially in the topsoils, of much black well-decomposed organic material.

The effectiveness of the climatic and vegetative agencies in transforming the parent geologic formation into soil in a given locality depends on the topographic and drainage conditions under which

the soils have developed in that locality and the length of time the soils have been subjected to undisturbed weathering. Most of the differences in the soils of Hamilton County are directly related to differences in the surface features which control the quantity of water entering the soil and the rapidity of surface run-off.

The soils on level or depressed areas where surface drainage is slow or absent have been subjected to the largest amounts of water and show well-marked characteristics, chief among which are more or less advanced stages of leaching, especially in the topsoils, and the translocation of clay into the subsoils. On the more rolling areas leaching and the transfer of clay into the subsoils is much less pronounced, in most places scarcely noticeable. The topsoils, however, especially on the steeper slopes, have been thinned or otherwise modified by the more or less constant removal of the weathered soil material through erosion.

Throughout the county slight or pronounced variations in the character of the parent material, differences in the amount of water entering the soil, and differences in the rapidity of surface run-off have resulted in the development of a number of distinct soils.

Throughout the uplands those soils which have been least disturbed by erosion owe their characteristics chiefly to differences in drainage conditions. They include the Hastings, Crete, Butler, Fillmore, and Scott soils, which, in the order named, have developed under increasingly poor drainage.

A common characteristic of the surface horizons in these soils is their dark color which has been imparted by finely divided organic matter derived from the decay of grass roots. The color is not everywhere uniform, nor are the surface soils everywhere equally thick, both color and thickness depending on local drainage conditions. The most striking variations in these soils, however, occur in the subsoils, where moisture differences have produced pronounced differences in the amount of clay present and therefore in the density and compaction of the subsoils. On the basis of the clay component the Hastings, Crete, Butler, Fillmore, and Scott soils may be separated into two broad groups, in one of which only moderate amounts of clay have accumulated in the B horizon which, although more compact than the topsoils, remains very friable and in the other of which clay has accumulated in the B horizon in such quantities that an extremely dense, claypanlike layer has developed. The first group includes only one soil, Hastings silt loam, but this soil comprises about 56 per cent of the land in the county, occurring throughout the well-drained, gently undulating or moderately rolling though not eroded parts of the uplands. The second group includes the Crete, Butler, Fillmore, and Scott soils. Crete silt loam has developed in the more nearly level though not depressed situations and the Butler, Fillmore, and Scott soils in the shallow basinlike depressions throughout the uplands.

The surface features of Hastings silt loam have favored prolonged undisturbed weathering under conditions of good drainage. The characteristics of this soil, therefore, are the direct result of the regional climate and vegetation and the soil may be regarded as having a fully developed regional profile or as being a normally developed soil for the region in which it occurs.

Hastings silt loam has a very dark grayish-brown or black surface horizon that merges, at a depth of about 18 inches, into brownish silty clay loam, slightly more compact than the topsoil but not dense and claypanlike. This material continues to a depth of about 36 inches, below which depth it gradually gives way to light grayish-brown loose friable silt. Calcium carbonate has accumulated below a depth of 50 or 60 inches, producing a layer of higher lime content than occurs in any other part of the solum or in the parent material.

The darkest part of the profile shows three structural layers. From the surface downward these are the surface mulch, the laminated layer, and the granular layer. The surface mulch is about 1 inch thick and consists of structureless fine-textured mineral material in which are large quantities of partly decayed grass débris. The laminated layer, which has developed between depths of about 1 and 5 inches, has a laminated or platy structure, the laminæ being thin and fragile. In this layer grass roots are thickly matted, and well-decomposed organic matter, which thoroughly permeates the laminæ, is abundant. When roughly handled the material breaks into a structureless single-grained or semigranular mass in which only a few of the original laminæ remain intact. The layer is sharply defined under optimum moisture conditions but is scarcely discernible when the soil is extremely wet or dry.

The third layer extends to an average depth of about 18 inches. It has a crumblike or granular structure, the structural units being irregularly angular and ranging from one-sixteenth to about one-eighth inch in diameter. The soil material is very dark, but the organic matter occurs chiefly as a film or coating on the granules and is less abundant than in the laminated layer. The film becomes thinner with depth, and the lower part of the layer is somewhat lighter in color than the upper part. Grass roots are abundant but are not so thickly matted as in the layer above. Insect casts and borings are more or less numerous.

The granular layer, as is indicated from the results of mechanical analyses made by the Bureau of Chemistry and Soils on samples of this layer obtained from a similar soil in Clay County, has a silty clay loam texture. The pH value in the upper part of the granular horizon in the Clay County soil is given as 6.73 and in the lower part as 6.23.

The brownish and moderately compact layer beneath the granular one has a pH value of 6.69 and the zone of maximum carbonate accumulation a value of 7.63. All pH determinations were made on the same profile.

The brownish horizon is penetrated by only a few grass roots, but insect borings and casts are fairly numerous. The structure particles are a little firmer and slightly larger than those in the layer above but do not differ from them greatly in shape.

Throughout the remainder of the soil section, or that part below the brownish and moderately compact layer, the material is very light grayish-brown practically structureless floury silt with an imperfectly developed columnar breakage. The lime in the zone of carbonate accumulation exists both in finely divided form thoroughly mixed with the silt and as scattered hard and soft concretions The concretionary forms practically disappear at a depth of about

7 feet, but the loessial formation from which the soil has weathered contains some disseminated lime.

The upland soils of that group in which a heavy claypanlike layer has developed in the subsoils are mapped as the Crete, Butler, Fillmore, and Scott silt loams.

Crete silt loam has been least affected by excessive moisture and to a depth of about 18 inches is similar to the corresponding part of Hastings silt loam both in the number and character of its layers. Below a depth of 18 inches, however, the dark friable topsoil layers give way abruptly to brown dense clay which extends to an average depth of 36 inches. This clay is plastic and sticky when wet, but extremely hard and difficult to penetrate with digging tools when dry. The material in most places is structureless, but in many places has a fairly well-defined prismatic structure, the structural units being from one-half to three-fourths inch in their longer or vertical dimension. When moist the structure particles in many places have one or more waxy-appearing surfaces caused by the deposition of colloidal material washed down from the layers above. This horizon is penetrated by very few grass roots, and insect casts and borings are scarce.

The claypan gives way abruptly to very light grayish-brown loose friable silt which is seldom calcareous directly below the claypan, though between depths of 4 and 6 feet it contains more lime than a layer of equal thickness in any other part of the solum or parent loess. This highly calcareous layer is commonly known as the lime zone, and, except that a somewhat larger proportion of the lime occurs in concretionary form, it is similar to the corresponding layer in Hastings silt loam. The material beneath the lime zone is light-gray floury silt. This is the loessial formation from which the soil has weathered and, although moderately calcareous, contains no zone of unusual carbonate concentration.

Butler silt loam has been subjected to a little more moisture than Crete silt loam and consequently to a little more translocation of the finer-textured topsoil particles. The material above the claypan is a trifle thinner than the corresponding material in Crete silt loam, and its lower part is in many places lightly sprinkled with gray floury silt, indicating that some of the organic matter has been removed through leaching. The claypan is as dense as or denser than the claypan in Crete silt loam. It is almost black, in contrast with the brown color of the Crete claypan, showing that a large part of the organic matter leached from the topsoil has been deposited, together with the clay, in the subsoil.

In Fillmore silt loam drainage conditions are intermediate between those in the Butler and Scott soils. In few places do the topsoils exceed 6 or 8 inches in thickness. The upper part is usually dark, in many places almost black, and has no well-developed structure. The rest of the topsoil is generally laminated. It varies considerably in color but almost invariably contains more gray material than the topsoil of Butler silt loam and in many places, especially in the more poorly drained localities where soil leaching has been most pronounced, is almost white. The remainder of the soil is similar to corresponding layers in Butler silt loam, except that the black claypan contains scattered round, hard, and black ferruginous concretions from one-eighth to about one-fourth inch in diameter.

Scott silt loam occupies the deepest basins or parts thereof throughout the uplands and has been subjected to more moisture than any of the other soils occurring in depressions. In many of the basins occupied by this soil water remains on the surface a large part of each year. The topsoil does not differ greatly from that of Fillmore silt loam. It is invariably thin and in most places is very dark, but it everywhere contains more or less gray material, especially in its lower part, causing the material to appear slightly lighter in color than the immediate surface layer. In many of the more poorly drained areas the light-colored material is unusually abundant and locally comprises the greater part of the lower topsoil layer as it does in some areas of Fillmore silt loam. In fact, the topsoils of both Scott silt loam and Fillmore silt loam show the effects of poor drainage about equally. The subsoil in the Scott soil is extremely dense structureless gray clay, which is low in lime. It is uniform in color and consistence to a depth below 5 or 6 feet, whereas the subsoils in the Butler and Fillmore soils are not uniform throughout, the upper or dense and lime-free parts being black and the remainder light-colored, friable, and highly calcareous. The Scott subsoil rests on light-gray floury silt similar to that from which the Hastings, Crete, Butler, and Fillmore soils have developed. The excessive moisture has removed all soluble salts to a depth below 10 or 12 feet. The subsoil contains scattered ferruginous concretions similar to those occurring in the black claypan of Fillmore silt loam.

The remaining upland soils in Hamilton County occupy sloping positions. They include a slope phase of Hastings silt loam and the Colby, Nuckolls, and Valentine soils. The first three soils have been subjected to more or less water erosion and the last to wind action. The slope phase of Hastings silt loam has been very slightly modified by surface run-off and differs from Hastings silt loam only in having a slightly thinner topsoil. Otherwise it is fully developed.

The Colby soils are the result of more severe erosion than that to which the slope phase of Hastings silt loam was subjected. Their topsoils are extremely thin and usually light in color. In most places the soil consists simply of unweathered or only slightly weathered Peorian loess, the surface 3 or 4 inches of which has been slightly darkened by organic matter.

The Nuckolls soils have been subjected to about the same amount of erosion as the Colby soils. They have weathered, however, from pale-red, slightly more sandy loess than that from which the Colby soils have developed. The topsoils in most places are dark. In few places do they exceed 5 or 6 inches in thickness, and they rest directly on the reddish parent material, which is known by State geologists as the Loveland phase of loess. This material underlies the gray Peorian loess of the uplands and is thought to be older and more oxidized.

The Valentine soils have developed from gray wind-blown sand deposits, a large proportion of which is quartzitic and extremely resistant to weathering. The lack of stability and the resistant nature of the deposits have greatly restricted soil development, and the Valentine soils consist of gray incoherent sand the surface few inches of which has been slightly darkened by organic matter.

A group of soils including the Hall and Waukesha soils has developed on the terraces or second bottoms of Hamilton County.

These soils have weathered from Peorian loess washed from the uplands and deposited as sediments in valleys when the streams were flowing at higher levels. Subsequent deepening of the stream channels left the deposits considerably above the present flood plains, and prolonged weathering under good drainage has produced the present soils.

The Hall soils have evidently lain in their present position long enough to have received the full impress of their climatic and vegetative environment. Their profile is similar in its major characteristics to that of Hastings silt loam. The zone of maximum compaction is in places a trifle denser than the corresponding zone in the Hastings soil, but this condition is very local and by far the greater part of the Hall soil in Hamilton County shows a profile so closely resembling that of the Hastings soil that the two soils were separated on the soil map on the basis of their physiographic position.

The Waukesha soils differ from the Hall chiefly in the absence of a zone of carbonate accumulation in the subsoil. Whether such a zone has been prevented from forming on account of a larger moisture supply and therefore more thorough leaching in the Waukesha than in the Hall soils or whether the former soils have not weathered long enough for the development of the zone is not known. The absence of a zone of lime accumulation in the Waukesha soils, however, shows that these soils have not received the full impress of their climatic and vegetative environment and that they can not be regarded as fully developed or normal soils in Hamilton County. In more eastern counties of Nebraska and throughout Iowa, where none of the soils has a zone of lime accumulation in the solum, the Waukesha soils are fully developed.

A group of soils, which in Hamilton County is represented by only one type, Judson silt loam, has weathered from materials recently removed from the uplands by surface wash or colluvial action and deposited near the base of the more gradual slopes on narrow valley floors and on gently sloping terraces. The deposits are very dark, having been derived chiefly from the surface layers of dark-colored upland soils. They are of such recent age that they have not developed definite zones or layers of true soil character. Judson silt loam is very dark grayish brown or black, has no definite structure, and is very uniform in color and texture to a depth below 4 or 5 feet. The soil is low in lime.

A few soils in the county have developed on recent sediments deposited by the streams during periods of high water. They occupy first-bottom or flood-plain positions and include the Wabash, Cass, and Sarpy soils. The moist conditions prevailing in the flood plains have favored rank vegetative growth and decay, and all the soils, except those on the most recent and lightest-colored deposits, have dark topsoils. The sediments, however, are so recently deposited that they have not developed into soils having definite layers or horizons. Oxidation and aeration, in many places, have been greatly retarded by excessive moisture, and the surface soils rest directly on the unweathered or only slightly weathered alluvial sediments. The nature of the sediments, therefore, is the controlling factor in determining the character of the flood-plain soils.

The Wabash soils have weathered from the finer-textured sediments, silts and clays, and have moderately compact dark-colored

subsoils. The Cass soils have weathered from the coarser-textured sediments. Their subsoils consist of light-gray incoherent sands and gravels. Both the Cass and Wabash soils have dark-colored, in many places almost black, topsoils. The Sarpy soils differ from the Cass soils only in their lower organic-matter content and the consequently lighter color of their topsoils. They have weathered from the most recently deposited sandy sediments and have accumulated very little organic matter.

SUMMARY

Hamilton County is in the southeastern part of Nebraska. It includes an area of 538 square miles or 344,320 acres. Platte River forms its northwestern boundary. The county is part of a nearly smooth plain that slopes gently toward the east and ranges in elevation from about 1,660 to 1,900 feet above sea level.

The county was first settled in 1866. The population, as given by the census of 1920, was 13,237, of which 77.6 per cent was classed as rural. The early settlers came from the Central States, but later immigrants from several European countries were added to the population.

The climate of Hamilton County is characterized by wide seasonal variations. The mean annual temperature at York, York County, is 51.5° F., and the mean annual precipitation is 27.89 inches.

The principal crops of the county are wheat, corn, oats, alfalfa, barley, and prairie hay. These crops are all grown to some extent in all parts of the county, but certain soils influence the proportionate acreage. Wheat is the dominant crop on the broad flat divides which coincide on the soil map with the areas of Crete, Butler, and Fillmore soils. This is owing to the fact that these soils have a heavy clay subsoil which hinders the growth of deep-rooted crops such as corn. The short-rooted small grains, however, do well. The separation of these three soils was based on the thickness and color of the heavy claypan layer. The surface soils are black and mellow and range in depth from 8 to 20 inches. The surface soil of the Crete soils is about 18 inches thick. It is underlain by a brown claypan layer about 20 inches thick. The surface soil of the Butler soils is about 14 inches thick, and the claypan layer is very compact and is black instead of brown. The Fillmore soils are similar to the Butler, except that the surface soils are only 8 or 10 inches thick. The Scott soils also belong to this group, but on account of poor drainage very little of the soil is cultivated.

Corn is a profitable crop on the mellow well-drained soils of the northern part of the county and on the river terraces. The Colby soils on the rolling upland and the Waukesha and Judson soils on the terraces are the principal soils of the corn group.

A group of soils, the general-farming soils, is suited to all crops of the region. Hastings silt loam is the principal soil of this group. This soil produces good crops of corn, wheat, and alfalfa and is well suited to general farming.

The prairie-hay soils include the slope phase of Hastings silt loam, Nuckolls loam, Colby very fine sandy loam, broken phase, the poorly drained bottom soils of the Cass and Sarpy series, the sandy Valentine soil, and river wash.

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[PUBLIC RESOLUTION—No. 9]

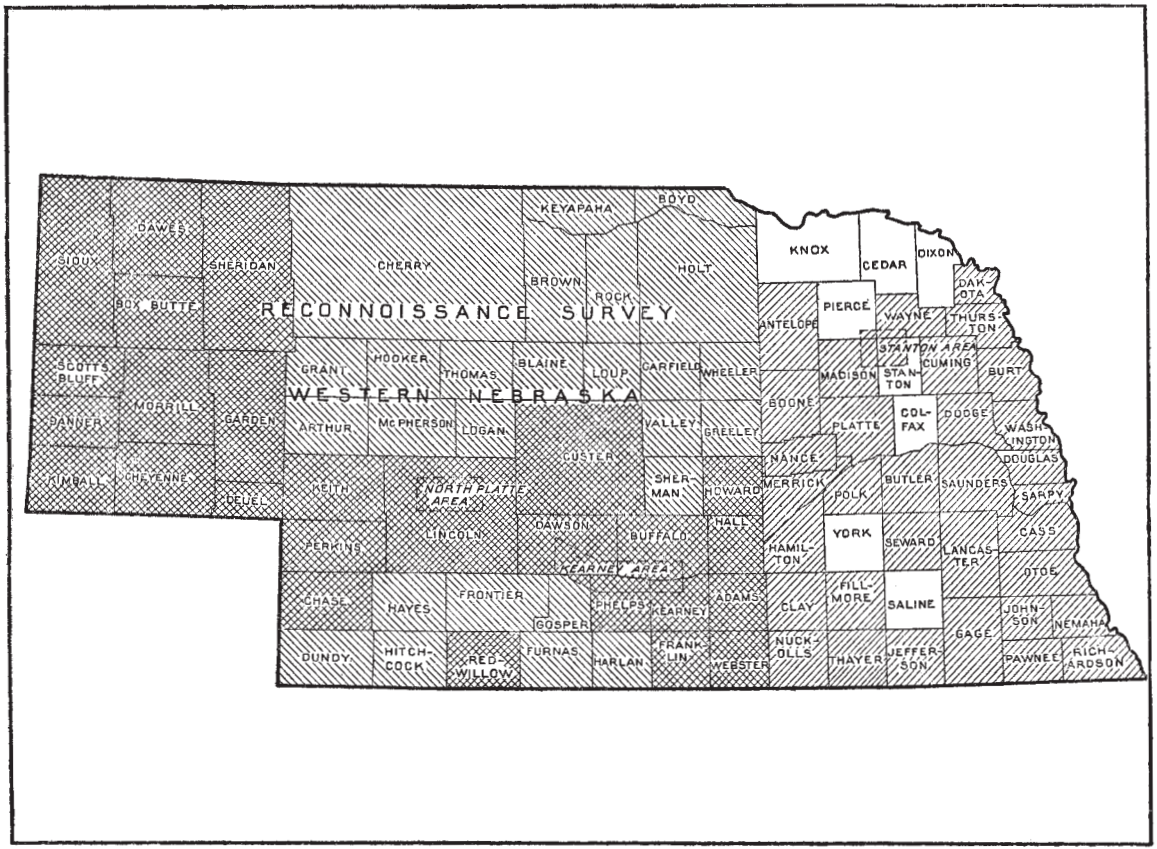
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

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

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

Approved, March 4, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils, and on July 1, 1927, the Bureau of Soils became a unit of the Bureau of Chemistry and Soils.]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WESTERN NEBRASKA
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STANTON AREA
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