SOIL SURVEY OF ST. LOUIS COUNTY, MISSOURI.

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DESCRIPTION OF THE AREA.

St. Louis County, Missouri, is located in the east-central part of the State, south of the confluence of the Missouri and Mississippi Rivers. The boundaries of the county, with the exception of the western boundary and about 10 miles on the southern boundary, are formed by the Missouri, Mississippi, and Meramec Rivers, which flow on the north, east, and south, respectively. The frontage on the Missouri and Mississippi Rivers is about 70 miles. The area surveyed, which includes St. Louis County and St. Louis city, has an area of 564 square miles, or 360,960 acres. Of this the city of St. Louis occupies 61 square miles.[1]

FIG. 11.—Sketch map showing location of the St. Louis County area, Missouri.

On account of its position between the large rivers, the physiographic features of St. Louis County differ more or less from those of the surrounding region. The county lies at the northeast base of the Ozark uplift, and is bordered on the north and east by the glaciated areas of the Kansan and Illinoian epochs, respectively. In general, the soil and surface features, although they resemble much of northern Missouri, probably bear a closer relation to the Mississippi border region of the Ozark uplift. It is only in the southwestern part of the county, however, that the surface has typical Ozark characteristics, and in general the topography is less broken than in any Ozark border county. It averages much smoother than in Jefferson and Franklin Counties to the south and west, but closely resembles the upland part of eastern St. Charles County.

The upland surface has a general slope from west to east. The main axis or watershed has an elevation of about 700 feet above sea level. This divide extends from the high ground near Stratmann west to Creve Coeur, south to Clayton Road, and west to Ellisville and the county line, and is approximately marked by the Manchester Road. The greater part of the Mississippi flood plain has an elevation between 400 and 420 feet above sea level. The Missouri and Meramec flood plains are slightly higher. The average elevation of the upland is between 500 and 600 feet. The maximum difference in elevation therefore ranges from 250 to 350 feet. At the Eads Bridge, St. Louis, zero of the gauge is taken at 380.23 feet above mean sea level.

[1] The area of agricultural land included in the city of St. Louis is negligible, and the statistics given in subsequent chapters refer solely to St. Louis County.

The upland part of St. Louis County is readily divided into three topographic regions, the eastern upland, Florissant Basin, and Meramec Highlands.

Approximately two-thirds of the county, including all the territory east and north of a line from Kirkwood to Ellisville and Bellefontaine, is a gently rolling plain with a general slope to the east. There are no extensive level areas, but the surface everywhere is gently rolling, which gives to the landscape a pleasing appearance. All of the land is admirably suited for tillage operations as well as for home sites. Even the bluffs bordering the river valleys rarely rise to heights of more than 100 feet, and are not so dissected as to give any considerable areas of broken land. The streams have broad, shallow valleys bordered by gentle slopes. Minor variations of the surface are the sink-hole areas in the northeastern part of the county west of Ruegg and in the southern part of the county south of St. Louis city. South of Jefferson Barracks the surface is so pitted with numerous sinks as to give a distinctly rough and broken character to the land. Minor sink-hole areas lie northeast of Carondelet Park and southeast of Maplewood within the St. Louis city limits.

The most prominent topographic feature is the Florissant Basin or Valley, in the northeast part of the county. This oval-shaped basin, with its longitudinal axis extending northeast and southwest, is about 4 miles wide at the north end near Florissant and tapers to a blunt end about 1 mile in width north of Overland Park. The floor or central part is almost level, with a slight slope to the center. The sides are long, gentle slopes, which in places have somewhat the form of broad, sloping terraces. The generally favorable surface and the productivity of the soils make this basin the most valuable agricultural section of the county.

The third topographic region of St. Louis County is the rough, hilly area bordering the Meramec River, beginning west of Kirkwood and extending to the west county line. The northern edge is marked by the Manchester Road. This region is completely and deeply dissected. The bluffs bordering the Meramec River are high and precipitous. From Meramec Highlands to a short distance south of Gravois Road the hill belt averages a little over 1 mile in width. The region south of the river, between Valley Park and Fenton, is rolling to moderately hilly, and all of it is suited for easy cultivation. West from Valley Park to the county line the surface is extremely rugged, rock outcrops are numerous, and, aside from the valleys, there is little agricultural land. An interesting feature of this region is the abandoned valley extending from Eureka to a short distance west of Allenton. It is probable that Fox Creek formerly occupied this valley, but later cut through the narrow barrier and entered the valley of the Meramec.

The northwestern part of the county, west of Bellefontaine and north of the Manchester Road, is hilly and broken, but the slopes are more gradual and contain fewer rock outcrops than the Meramec hill region, because the descent from the divide to the river flood plain is longer, and also because the surface has been modified by eolian deposits. Most of this region is not too steep for cultivation. It is intermediate in its topography between the Meramec hill country and the gently rolling upland of the eastern part of the county.

The drainage of the entire county flows through short streams into the Missouri, Mississippi, and Meramec Rivers. The divide between these three systems is not a striking topographic feature and rises above the general upland level only at isolated points, as at Stratmann and near Ballwin. The divide between the Meramec and Missouri systems is marked by the high ground followed by the Clayton Road from Altheim to Ellisville, and from thence west to the county line along the Manchester Road. The streams flowing into the Meramec and Missouri Rivers in the northwestern part of the county have nearly everywhere cut through the soil mantle down to the bedrock. The stream beds consist of gravel, are bordered on one or both sides by steep, stony bluffs, and in their general characters resemble the beds of the Ozark streams. The streams emptying into the Missouri River in the northeastern part of the county and into the Mississippi River have not cut through the loess mantle and have mud bottoms and mud banks. This is well illustrated by Coldwater and Maline Creeks. The River des Peres and Gravois Creek have at several places cut down to and into the bedrock, but only to a shallow depth.

In general, the surface features of the upland have reached maturity, the process of dissection is essentially complete, the divides are narrow, and minute dissection is prevented by ready percolation and the relatively low altitude of the upland above the large stream valleys.

The flood plain along the Missouri River is on the St. Louis side, from near the west line of the county to a short distance east of the St. Charles bridge. The meandering valley of the Meramec River averages from one-half to 1½ miles in width. It is characterized by numerous terraces of varying altitude, the larger and higher of which lie above ordinary overflows. The Meramec River, like most Ozark streams, has clear water of remarkable purity.

The numerous sinks occurring in the northern and southeastern parts of the county serve as drainage ways for the territory in which they are located. The great majority of the sinks have openings at the bottom and are dry, but in a few the openings have become closed and the depressions are filled with water. Sinks vary in size from 50 to several hundred feet in diameter and up to 5 acres in extent.

St. Louis County is more densely settled, perhaps, than any other equal area in the State, as it comprises all the outlying suburbs of St. Louis city. About 1880 the territory adjacent to the city began to develop along suburban lines and now the eastern half of the county is, to all intents and purposes, a city on a very large scale. It is composed almost wholly of suburban residences, small farms, and gardens. Practically all the territory between the city limits of St. Louis and Kirkwood and Bridgeton on the west, and Ferguson on the north, has long been laid off and plotted into town lots or small tracts for gardening.

In the period from 1840 to 1870 a large number of Germans settled in the county, and they and their descendants comprise by far the largest proportion of the rural population at the present time. The total population of the county (not including St. Louis city) is 100,737, an average of 234 per square mile. The rural population, including towns with less than 2,500 inhabitants, is 69,590. Webster Groves, Maplewood, University, Kirkwood, Clayton, Ferguson, and Uniondale have populations ranging from 1,315 to 9,474.

The city of St. Louis has a population of 772,897, and the total population within its industrial district is more than a million.

Owing to the attractive natural conditions in the southwestern part of the county, mainly in the rough, hilly sections along the Meramec River, much of the land is occupied by summer homes. These are located on the hilltops and along the river banks. From Valley Park to the west, for a distance of 6 miles or more, much of the hill and valley land along the river is used as sites for summer homes.

The natural products of St. Louis County consist mainly of limestone and clay. High-grade limestone occurs in readily accessible deposits in all parts of the county and is extensively quarried for building and industrial purposes. The sandstone of the western part of the county is used for the manufacture of glass. The clay from deposits in and near St. Louis city is used in making brick and pottery products, one of the most important industries of the city. The manufacture of cement is carried on extensively. The proximity of Illinois coal fields, the abundance of water, and the central location with respect to markets, raw materials, and shipping facilities, all combine to make St. Louis one of the most important industrial centers in the United States.

The excellent hard roads ramifying all of the county make the marketing of farm products comparatively easy. Practically all produce is marketed in St. Louis by means of wagons and motor trucks. The most distant parts of the county are not more than 25 miles from St. Louis.

Land values show a wide variation, ranging from near the lowest to the highest in the State. It is probably more difficult to give an accurate estimate of land values in St. Louis County than in most others on account of the great and rapidly growing city that is a part of it. In fact, a very large part of the best land is not available for agricultural purposes, although occupied apparently for that purpose, much of the land being held on speculation in view of the prospects of the growth in population of St. Louis city. It is frequently leased to market gardeners and dairymen at a nominal rent. Prices are no indication of the quality of the land. Distance from city and character of improvements have a great influence on prices, which range from as little as $50 in the more distant and less improved parts of the county to several thousand dollars an acre near the city. The highest-priced farming land is included in the Florissant Basin, where prices range from $300 to $800 an acre. The trucking lands in the southern and central parts of the county have a somewhat lower value. The lowest-priced land is represented by the rough, stony timber land bordering the Meramec River in the southwestern part of the county, which sells for $25 to $100 an acre, except where it includes favorable sites for summer homes.

CLIMATE.

The climate of St. Louis County is more nearly like that of the Ozark region than that of the northern part of the State. The average annual temperature is 55.6° F., compared to 54° F. for the State. January is the coldest month. During the summer months the mean temperature is 76.7° F., and in none of the winter months does it drop below 31° F. Frequently in winter the temperature falls below the freezing point at night and rises above it during the day. Periods without thawing usually do not last longer than three or four days.

The summer maximum temperatures usually reach 95° F. and occasionally exceed 100° F. During some winters the minimum temperatures scarcely reach zero, while in others they fall 10° or 20° or more below. The maximum range for this section, so far as known, is from −22° to 107° F.

The average date of the last killing frost in spring is April 6, and of the first in fall, October 24. The latest recorded killing frost in spring occurred on May 14, and the earliest in fall on September 30. The average length of the growing season is about 200 days.

The wind of greatest frequency is southerly. Storm winds are prevailingly from the northwest or southwest. Wind velocities are lower on the average than in the northern part of the State. The mean velocity is 10.7 miles per hour, being highest in March, 12.4 miles, the lowest in August, 8 miles.

The average annual precipitation is 37.20 inches, but ranges from a minimum of 23.38 to a maximum of 68.83. The rainfall of the growing season, April to September, is considerably more than half the annual precipitation. The normal distribution is very favorable to growth of crops, the May-June maximum being especially desirable for corn and fruits. June and July have the greatest variability of rainfall. The mean relative humidity is 70. The snowfall averages less than 15 inches at St. Louis, and is somewhat smaller than for the northern part of the State.

The following tables give the essential details of the climate, as shown by the records of the Weather Bureau stations at St. Louis and Oakfield. The latter reflect the conditions in the western part of St. Louis County.

Normal monthly, seasonal, and annual temperature and precipitation at St. Louis.

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1871).	Total amount for the wettest year (1858).
	°F.	°F.	°F.	*Inches.*	*Inches.*	*Inches.*
December	35.5	74	−14	2.23	1.17	8.52
January	31.0	77	−22	2.27	2.53	3.42
February	33.5	84	−18	2.75	2.92	2.12
Winter	33.3	84	−22	7.25	6.62	14.06
March	43.5	90	3	3.43	1.27	3.96
April	56.1	91	22	3.52	0.49	6.07
May	66.5	94	32	4.24	3.15	10.64
Spring	55.4	94	3	11.19	4.91	20.67
June	75.1	102	44	4.47	2.51	6.69
July	77.7	107	55	3.43	1.64	8.03
August	77.2	106	52	2.66	3.55	2.87
Summer	76.7	107	44	10.56	7.70	17.59
September	70.0	102	37	2.91	0.25	3.86
October	58.4	94	24	2.41	2.07	7.73
November	43.4	85	5	2.88	1.83	4.92
Fall	57.2	102	5	8.20	4.15	16.51
Year	55.6	107	−22	37.20	23.38	68.83

Normal monthly, seasonal, and annual temperature and precipitation at Oakfield, Franklin County.

[Elevation, 793 feet.]

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1901).	Total amount for the wettest year (1909).	Snow, average depth.
	F°.	F°.	F°.	*Inches.*	*Inches.*	*Inches.*	*Inches.*
December	34.2	74	−16	2.06	5.01	2.65	4.2
January	31.9	76	−21	2.41	1.07	3.01	6.0
February	32.4	85	−21	2.34	1.84	4.05	7.2
Winter	32.8	85	−21	6.81	7.92	9.71	17.4
March	45.0	92	0	3.71	3.02	3.80	5.4
April	55.8	90	18	4.08	3.17	5.93	1.0
May	65.5	96	31	4.99	2.04	7.38	.0
Spring	55.4	96	0	12.78	8.23	17.11	6.4
June	77.3	105	41	4.37	1.18	4.01	.0
July	78.0	112	51	4.08	.49	9.00	.0
August	77.0	110	47	3.82	2.30	.47	.0
Summer	77.4	112	41	12.27	3.97	13.48	.0
September	69.9	105	30	3.86	.72	6.82	.0
October	58.5	93	19	2.95	3.00	3.23	.2
November	46.3	84	9	2.75	1.26	4.90	.8
Fall	58.2	105	9	9.56	4.98	14.95	1.0
Year	56.0	112	−21	41.42	25.10	55.25	24.8

Droughts of short duration are common in late summer. They come at a time when early spring vegetables have been harvested, and when the more hardy summer crops can withstand adverse conditions. As a rule, more damage is done by high temperatures, which blight the blooms, than is caused by the deficiency in rainfall. Tomatoes, peppers, and similar crops are most frequently affected. The fall rains usually come in September and are sufficiently early to permit the successful growing of the fall crops. On some of the truck farms irrigation systems have been installed in order to make possible the successful growing of the more tender vegetables throughout the summer season. For the larger and hardier garden crops irrigation is rarely needed. All the soils, on account of their fine texture and deep, open structure, are retentive of moisture.

In general, the climate of St. Louis County, being continental, is subject to wide variations. In most years the rainfall is ample. The climate is moderate, pleasant, and healthful, and well suited to a large variety of crops.

AGRICULTURE.

The agricultural development of St. Louis County, owing to the inclusion of a large city and suburban population, differs from that of every other county in the State. Agricultural progress has been favored because the county contains a large area of fertile soil, and also because it occupies a strategic geographical position with reference to the commerce of the United States. It is but natural that an intensive agriculture should prevail, in an effort to secure the largest possible return from each acre. A large part of the county is

no longer available for agriculture, and with the extension of the city and towns the area of agricultural land is constantly decreasing. At the present time about 73 per cent of the county is in farms, and about 57 per cent of the total land area is improved farming land. Many of the farmers do not depend solely on the farm for a livelihood, but spend part of their time at other work than farming.

The county is a region of small farms devoted primarily to trucking and fruit growing, except in the western and northern parts more remote from the city, where the type of farming is more or less general and dairying is important. With increasing distance from the city there is a gradual change from an intensive to an extensive system. But there are few farms that are not devoted in part to the production of vegetables, fruit, or dairy products for the city market. All types of farming are practiced, but for the most part a combination of trucking and general farming prevails. The field crops are grown for sale, for subsistence, principally to feed work stock and dairy cows, and for the purpose of maintaining the productiveness of the soil. Some dairying is carried on, and fruit is grown in certain localities, but the principal source of income is the truck crop.

The three main reasons for this type of agriculture are the great demand for vegetable products in a large city, the adaptability of the soils to a wide range of crops, and the fact that the farmers are of a class naturally given to intensive methods. The type of farming for the various sections is determined mainly by the character of the soil, distance from market, and general surface features. The western part of the county has a more rolling surface and is not so well suited to cultivation as the smoother eastern part. Moreover, the soil of the latter has a higher average productivity and more desirable physical properties. The soils of the Florissant Basin are less well drained, less early, and less easily handled, and are therefore not so well suited to most truck crops, but admirably adapted to the extensive growing of cereal crops. In the Meramec Highlands there are wide areas with practically no agriculture, for the reason that the topography is steep and rough and the soils mainly of an unfavorable character for crop production. Much land is also occupied by the residences and grounds of those who own country estates and are not engaged in farming.

Intensive methods are used in all farming operations. This is indicated in some degree by the high average yields of crops, which are higher than for any other county in the east-central part of the State. For example, the average yields of the staple crops from 1911 to 1919 were as follows: Corn, 30 bushels; wheat, 16 bushels; oats, 29 bushels; hay, 1.26 tons. The system of farming in the eastern half of St. Louis County accords exceptionally well with the soil adaptations and the advantages offered by the unusually good transportation and markets. Vegetables can be put on the St. Louis market in the best condition, and the same is true of dairy and poultry products.

Agriculturally, St. Louis is one of the oldest counties west of the Mississippi River. During the pioneer stages a general type of farming prevailed, but the trucking industry was established early and has kept pace with the general development of the county. At the present time St. Louis County ranks very high in the State in the total value of agricultural products.

The general trend of agriculture is indicated by the following table, compiled from the Federal census reports:

Acreage and yield of leading field crops, census years 1879 to 1919.

Year.	Corn.		Wheat.		Oats.		Hay.	
	Acres.	*Bushels.*	*Acres.*	*Bushels.*	*Acres.*	*Bushels.*	*Acres.*	*Tons.*
1879	47,062	1,893,425	47,883	908,838	8,037	177,773	21,055	17,765
1889	35,470	1,417,382	38,670	859,487	8,856	244,753	39,372	53,699
1899	44,034	1,645,740	51,557	827,340	4,273	131,360	31,613	39,897
1909	35,809	1,287,233	48,468	920,242	2,148	46,941	28,876	34,229
1919	27,252	769,966	64,654	1,160,823	4,668	97,506	24,654	34,433

Wheat has been grown since the first settlements were made, and over the greater part of the county it still remains the principal staple cash crop. It is grown on all of the different soil types of the county as a matter of necessity in the present system of farming. For a period comprising the last nine years the average yield is 16 bushels per acre, which is 3 bushels higher than the average for the State. The acreage in wheat in 1919 was 64,654 acres, although the average pre-war (1914) acreage was not much over 50,000 acres. Wheat is grown most extensively in the Florissant Basin, but it is also the leading crop on all the bottom soils. Most of the crop is grown without the use of fertilizer, except in the western part of the county, where fertilizer is used with very satisfactory results. Frequently land is used for wheat two to four years in succession. With proper fertilization and the growing of clover at frequent intervals, this practice may not be objectionable, for land is likely to wash less when in wheat than when planted to corn. At present too much dependence is placed on clover to maintain the fertility of the wheat lands. There is a greater need of a judicious use of fertilizer, particularly on fields where wheat is followed by clover. Applications of 150 to 200 pounds of acid phosphate or any fertilizer rich in available phosphorus should give good returns, especially on the thinner and more worn soils.

Next to wheat, corn is the most important crop. In 1919 it was grown on 27,252 acres, with an average yield of 28.3 bushels. During the 10-year period 1905 to 1914[2] the average annual area in corn was 37,700 acres and the average yield 34.8 bushels. The decrease in acreage is due mainly to the increased area devoted to wheat. Corn is grown in all parts of the county, but most extensively on the alluvial soils and on the better lands in the northern part. Very little corn is sold from the farm. On much of the thinner upland the yields are unprofitable without the use of manure or fertilizer.

Oats are of minor importance in St. Louis County. For 1919 a total of 4,668 acres is reported, but this is above the normal area devoted to this crop. Yields average about 30 bushels per acre, but are variable, depending on the season. In general the oat crop is not a profitable cash crop, but is of value in a rotation and as a nurse crop for clover. It is used mainly for feed on the farm.

Rye is a minor cereal crop, which is grown on approximately 1,000 acres each year, mainly as a cover crop and green manuring crop. Rye should be grown much more extensively, particularly on some of the poorer hill land, as a protection against erosion and also as a

[2] Missouri Crop Review for 1915.

green manure. It has considerable value as a winter and early spring pasture crop, particularly on dairy farms.

Cowpeas and soy beans do well on all the soils, although it would doubtless be profitable to fertilize these crops on certain soils when they are grown entirely for hay. Cowpeas are rather tolerant of acid soil conditions and will thrive where clover fails, and therefore are well suited for planting on the poorer uplands, mainly for soil improvement. A total of 712 acres was grown in 1919.

Sorgo (saccharine sorghum) is grown both for sirup and as a forage crop, mainly on the hill land in the western part of the county. The fields are generally small, varying from one-half acre to 10 acres, and yields range from about 75 to 200 gallons of sirup per acre. Sorgo thrives best on the low-lying moist soils, but produces a better grade of sirup when grown on the thinner upland. A mixture of cowpeas and sorgo produces a large quantity of forage.

St. Louis is one of the leading clover counties in the State, largely because most of the soils are well adapted to the crop, and also because the German farmers depend on it to a large extent to maintain soil fertility. It is the only legume that is commonly grown. On the larger farms it forms part of the regular rotation, but on many of the smaller farms it is grown at irregular times on land that is run down and in need of building up. Yields vary from 1 to 2½ tons of hay per acre. In the western part much of the crop is thrashed for seed. In favorable years there is little difficulty in getting a stand, but it is the prevailing opinion among the farmers that clover is grown with more difficulty than in former years. Even the dark soils in the Florissant Basin no longer produce clover as successfully as formerly. In general, this difficulty can be attributed to lack of lime in the soil and to decreasing fertility. An application of 2,000 pounds or more of ground limestone per acre will usually assist materially in the successful growing of clover. Under the existing type of farming, where a high content of organic matter in the soil is essential, where manure production is limited on account of relatively few cattle, and where most soils are in need of nitrogen, the growing of clover is vital, and the acreage should be greatly extended. The average area of clover per farm is less than 2 acres. Alsike clover is well adapted to land not so well drained, as, for instance, some of the dark soils in the northern part of county and the bench lands along the Meramec River.

The growing of alfalfa receives considerable attention, and 2,712 acres are reported for 1919. It is grown extensively on the Missouri and Mississippi bottoms, but many of the upland types also must be considered good alfalfa soils. In relative adaptability of the several types to alfalfa, the Knox silt loam ranks first, the Memphis second, and the Tama and Clinton third. In the deeper loess soils a calcareous substratum is usually encountered at less depth than in the shallower loess types, and this is an important factor in alfalfa culture. Any soil type well adapted to corn is usually suitable for alfalfa, with inoculation and the addition of lime.

Sweet clover is a legume that should have a place in the agriculture mainly as a soil improver or green-manure crop. It is especially well suited to eroded hillsides, for, because of its deep rooting system, it tends to hold and build up the land. Sweet clover will grow on all the well-drained uplands that contain sufficient lime.

Other hay and pasture grasses are timothy and bluegrass. The former is widely grown, and the hay is used locally. It is a common practice to use run-down land for mowings, and, as might be expected, the yields are small. In general more attention should be given to fertilizing the grass lands.

Bluegrass thrives on all the soils, and a thick sod on pastures and lawns is usually attained without difficulty. The difficulty encountered is in most cases due to heavy shading from trees or to impoverished soil conditions. The problem of maintaining good lawns is a matter of much interest in both county and city. Most lawns need an occasional application of some fertilizer, regardless of the kind of soil upon which they are established. Thoroughly rotted stable manure, or high-grade mixed fertilizers are excellent for lawn grasses and should be applied in winter or early spring. Pulverized limestone is a helpful top-dressing for bluegrass, as the lime corrects the acidity of the surface soil and promotes a vigorous growth of the grass. Such treatment is especially important for sod land on the Muscatine, Marion, and Clinton soils.

Orchard grass is not grown, but ought to have an extensive use in the hilly and stony areas in the southwestern part of the county. On the south slopes orchard grass would thrive better than bluegrass, because it is more resistant to drought. Bermuda grass will grow successfully as a lawn grass, but bluegrass is preferable.

In the agriculture of St. Louis County the trucking industry is of first importance both in the number of people employed and as a source of income. It is estimated that approximately 25,000 acres are devoted to commercial fruit and vegetable growing. According to the census, the total value of all the vegetable products in 1919 nearly equaled that of all the cereal crops, and in some years it is greater. The real importance of the vegetable products is apparent, when it is considered that practically all of the vegetable crop is sold, whereas a considerable proportion of the other crops, excluding wheat and fruits, is consumed on the farm. The conditions that favor the trucking industry are the proximity to a large market and the superior qualities of extensive soil areas for trucking purposes. All vegetables common to this region and climate are grown with success. (Pl. XVIII, Figs. 1 and 2.)

There are three principal trucking districts in St. Louis County. The largest of these includes practically all of the southeastern part of the county—all the territory south of St. Louis city and Webster Groves. In this area most attention is given to staple truck crops, as Irish and sweet potatoes and tomatoes, as well as to the fruits. The second most important region lies immediately north of the city and extends to Spanish Lake. In general, the trucking in this territory is of a very intensive order and is highly developed. Horseradish is one of the special crops which finds here ideal conditions for its growth. (Pl. XIX, Fig. 1.) The third region includes the central part of the county, the territory near Olivette, Stratmann, and Creve Coeur. The smaller vegetables, as well as berries and bush fruits, are extensively grown here. Within the city limits of St. Louis, at the south end, are extensive gardening tracts. More or less trucking is done in all parts of the county, either as a specialty or in combination with general farming. There is practically no commercial vegetable growing under glass, probably owing to rapid transportation,

which puts southern-grown truck on the St. Louis market at lower cost than it can be grown locally under shelter. However, large quantities of hothouse vegetables are now being shipped into St. Louis from northern and eastern points. The development of this line of work in St. Louis County offers many advantages.

A few gardeners make a specialty of only one or two products, but generally a diversity of crops is grown on each farm. This permits a more equitable distribution of labor and a more constant income, and also makes possible a succession of crops, so that the land is used throughout the growing season. Such vegetables as require very intensive cultivation or are for special markets are grown in larger quantity near the city than in the more remote parts of the trucking regions.

The great diversity of truck crops economically produced throughout the county is indicated by the following partial list: Irish potatoes, sweet potatoes, tomatoes, peppers, asparagus, sweet corn, eggplant, peas, beans, onions, parsley, leek, okra (gumbo), spinach, rhubarb. Salad plants: lettuce, celery. Root crops: beets, carrots, radishes, horse-radish, parsnips, turnips, salsify. Cabbage group: cabbage, cauliflower, kale, collards, kohl-rabi. Vine group (cucurbits): muskmelons, watermelons, cucumbers, squash.

Irish potatoes are the most extensively grown truck crop and occupied in 1919 a total of 7,595 acres. They grow on all soils, but do best on rich, mellow soils containing an abundance of humus. Early potatoes are generally planted the latter part of March; they are usually more valuable than the late crop, as they come in before the crop from the Northern States. Late potatoes are being grown successfully on a large scale, and are sometimes more profitable than early potatoes, but the crop is subject to severe injury in dry and unfavorable seasons. The best early varieties are Early Ohio and Irish Cobbler. Good varieties for the fall crop are Rural New Yorker, Sir Walter Raleigh, and a local sort known as Real Irish.

If the ground is not in the best of condition, a crop of clover or cowpeas, turned under the fall before the potatoes are planted, will aid materially in obtaining a good yield. On medium to thin soils which need fertilizer, 300 to 400 pounds of acid phosphate or high-grade mixed fertilizer per acre may be applied in the furrow at planting time. On stronger soils, especially new or sod land, high-priced fertilizers are not so necessary. Much of the well-drained sandy land in the Missouri bottoms is admirably suited for potato growing, but this is used to only a small extent for that purpose.

Sweet potatoes hold second place in area of the vegetable crops. They thrive best on the better parts of the Memphis silt loam, where the subsoil is rather friable and porous. (Pl. XIX, Fig. 2.)

The tomato is also a common crop in the area. It is adapted to a wide range of soil conditions. About 300 bushels per acre is considered an average yield. In most seasons it is a very profitable crop, as it is easily grown and responds to good treatment. In experiments in St. Louis County by the Missouri Agricultural Experiment Station the yield of tomatoes was increased from 100 to almost 300 per cent by the use of highly phosphatic mixed fertilizer or acid phospate alone. Such treatment also increased the earliness of the crop from two to four weeks. The results indicate that the tomato grower can prof-

itably increase the yield and earliness of the crop by the use of at least 250 pounds per acre of these materials.[3]

Of the great variety of vegetables grown in the county, a relatively large proportion is usually found on each farm. Early and late crops of vegetables are produced, and an effort is made to have marketable material throughout the growing season. A succession of crops is therefore practiced for the more quick maturing types. Thus, lettuce or spinach grown in spring is followed by beans, which in turn are followed by fall potatoes. By this means farm labor is well distributed through the greater part of the year.

Because of the uniformity of the soils over most of the trucking districts, and because the physical properties of the soil are such as to be suited to all the crops grown, there is little done to adapt crops to soils. There is probably no soil material better suited for general crop production than the brown loess. Not only is it well supplied with plant food, but its textural properties are almost ideal. It is retentive of moisture, well drained, porous, so as to permit good root growth, warms up early in spring, and responds readily to manurial treatment. These are the essential factors that make possible the successful growing of a great diversity of crops, and also make easy the adoption of a succession of crops. There is, however, a recognition that some crops have certain preferences or requirements. Thus, the cabbage group and peppers prefer a cool, moist soil, and, therefore, these crops are frequently grown on the bottoms of sink-hole areas and on the alluvial types. The Bremer silt loam offers superior opportunities for the growing of all vegetables that require a rich, moist soil.

The growing of vegetables on an intensive basis and on high-priced land makes it essential that the market gardener operate on land of high productiveness. Vegetables as a class require much richer soil than farm crops. Land capable of producing excellent farm crops will ordinarily produce only fair yields of most vegetables. Moreover, tilled crops are grown practically all the time during the growing season. The frequent stirring of the soil promotes a large loss of nitrogen and organic matter by oxidation. The necessity of supplying large and frequent additions of manure is therefore apparent. Applications of 10 to 20 and even 30 tons per acre are not at all uncommon. In general, the quantities used and the frequency of application depend on the quantity available. Comparatively little manure is produced on the smaller farms because of the few animals kept, a large proportion being obtained from stables in the city and the stockyards in East St. Louis. An effort is usually made to manure all the land each year, but on the larger farms this is not always possible on account of the insufficient supply. In such cases it has been found that better results are obtained by spreading the manure out thinly over a relatively large area than by applying it heavily to a small patch, unless particular crops demand heavy applications.

Under the existing conditions, where manure is hauled from the city at all times of the year, the loss of this material is considerable. It is a common practice to haul manure from cars or from the city and to place it in great piles along the roadside or in fields, leaving

[3] Bulletin 169, Mo. Agr. Expt. Station.

FIG. 1.—TRUCK FARM, WITH A VARIETY OF TRUCK CROPS.

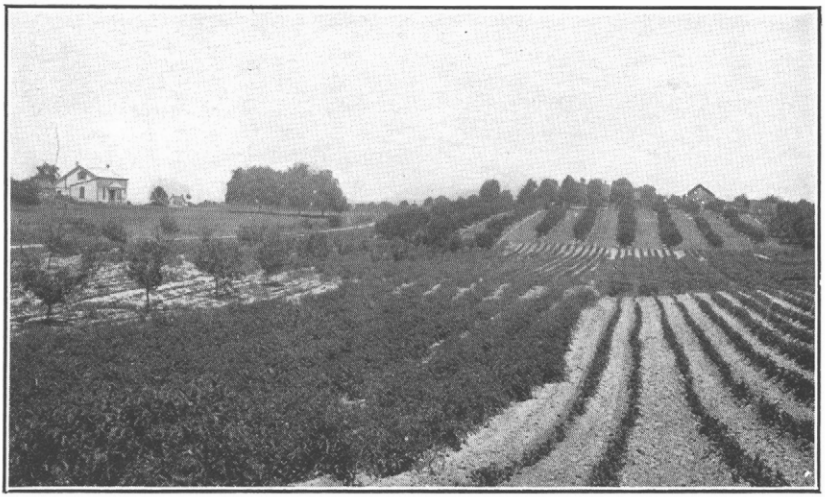

FIG. 2.—TRUCK CROPS ON MEMPHIS SILT LOAM, IN THE SOUTHERN PART OF THE COUNTY. VEGETABLES AND BUSH FRUITS GROWING BETWEEN ORCHARD TREES. SHALLOW SINK HOLE IN CENTER.

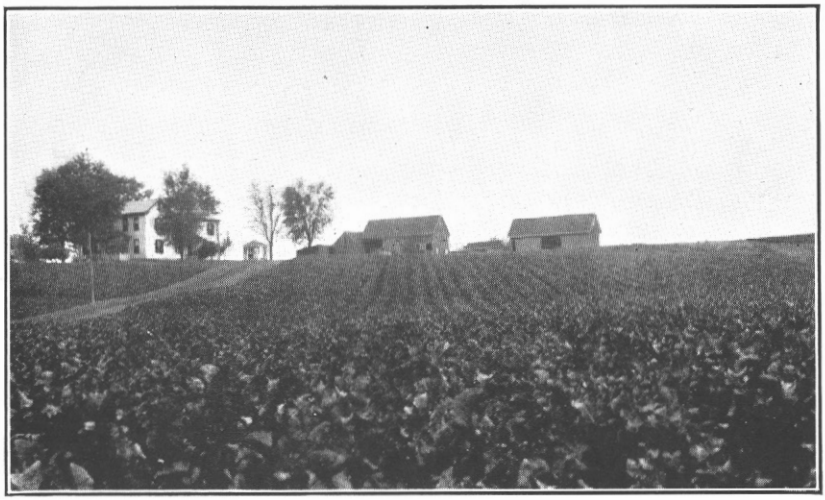

FIG. 1.—FIELD OF HORSE-RADISH ON MEMPHIS SILT LOAM, NEAR FERGUSON.

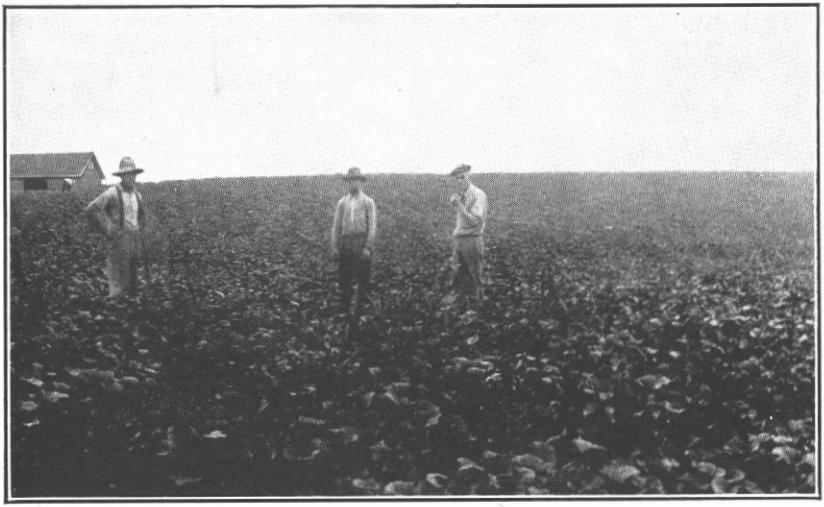

FIG. 2.—FIELD OF SWEET POTATOES ON MEMPHIS SILT LOAM.

it there for weeks. Such practice is wasteful and should be avoided if possible. A ton of ordinary barnyard manure contains about 10 pounds of nitrogen, 2 pounds of phosphorus, and 8 pounds of potassium. The Missouri Experiment Station[4] found that in five months (from May to October) 26 per cent of the nitrogen, 19.15 per cent of the phosphorus, and 34.89 per cent of the potassium were lost from manure placed in a pile on the ground. In general, the greatest proportion of fertility is conserved when the manure is applied before it has weathered a great deal and is plowed under immediately. When it is necessary to store manure, it is best placed in flat piles 3 to 4 feet in depth, packed down thoroughly. Such manure will rot considerably and can be used for many vegetables where compacted manure is preferred. For some vegetables, however, a thoroughly compacted manure is necessary for best results. With the extension of the trucking industry there is a steadily increasing demand for manure. The substitution of truck and tractor for the horse in both city and country is resulting in a decreased supply. Materials other than manure must therefore be relied upon to a certain extent. The amount of organic matter and nitrogen obtainable from crop refuse is small at best. The judicious use of cover crops in connection with more extensive use of commercial fertilizers must be more widely practiced in trucking regions in order to maintain the productiveness of the soil. When the manure must be hauled a great distance, it is frequently more economical to plow under green crops. Cowpeas and soy beans are well adapted to this purpose in St. Louis County, because a good crop can be grown for plowing under by planting after early vegetable crops are removed. Hairy vetch may be used in some cases. Rye is a valuable winter cover crop. It thrives even on poor soils, and if used for soil improvement should be turned under early in spring before it has jointed to any extent. If rye is allowed to head out before turning under, the soil is robbed of moisture and the decay of the rye will be slow.

The use of commercial fertilizers is as yet very much neglected in St. Louis County, and particularly by the vegetable gardeners. Less fertilizer is used than in any other equally important trucking district in the country. The average annual amount used during the last 10 years is less than 100 tons. Mixed fertilizer should be used much more extensively as a reinforcement for manure, or as a substitute when manure is not available.

The loess soils of this region are naturally low in phosphorus, and this element is added in relatively smaller proportion than either nitrogen or potassium through manure. Profitable returns are obtained from the use of either acid phophate alone or fertilizers high in this ingredient. The use of acid phosphate is even more profitable in vegetable growing than in general farming. For quick results it is superior to bone meal. Not only does it increase yields, but hastens maturity, which is a valuable factor for the market gardener.

Potassium is abundant in the loess soils of St. Louis County, as it is in loess soils most everywhere. Soils well supplied with organic matter generally have enough available potash for good plant growth. However, root crops that are heavy feeders on potassium are often

[4] Mo. Agr. Expt. Sta., Bul. No. 166, Handling Farm Manure.

benefited by addition of this element. On such crops it should be used in mixed fertilizers containing 2 to 4 per cent potash, with 2 or 3 per cent nitrogen, and 10 or 12 per cent available phosphoric acid.

The use of limestone is growing rapidly among both farmers and market gardeners. With the exception of the river-bluff land, most of the upland soils show a lime requirement varying from 500 to 4,000 or even 6,000 pounds of ground limestone per acre. It is necessary for the best growth of nearly all vegetables that the soil be free from acid. Potatoes, sweet potatoes, tomatoes, sweet corn, turnips, carrots, and melons are some of the crops which grow well on a soil that is more or less acid. For crops needing lime, from 1 to 3 tons per acre should be applied the first time; after that 1 ton every four to six years will usually suffice. The above statements refer to limestone pulverized to pass a sieve with 10 meshes to the inch. If hydrated lime is used, one-half to one-third less may be applied.

St. Louis County is one of the leading fruit counties in the State. Apples, peaches, pears, cherries, grapes, bush fruits, and strawberries are all produced in large quantities. The total area of apple orchards is estimated at more than 700 acres. There are only a few large orchards, the great majority ranging in extent from 1 to 15 acres, with 4 acres an average for the county. The acreage of peaches is somewhat larger than that of apples. Both apples and peaches may be grown in all parts of the county, but the peach crop is very uncertain because of late spring frosts. Cherries are grown most extensively in the southeastern part of the county, as also are grapes. The most important center of the bush fruits, such as blackberries and raspberries, is in the central part of the county. The total acreage of orchards and small fruits in the county exceeds 2,000 acres.

In normal seasons the growing of the various fruits is more profitable than the growing of vegetables, yet the fruit industry receives far less attention and has not reached as high development as it warrants. Probably less than 50 per cent of the orchards are sprayed or properly pruned. The excellent opportunities for fruit growing in this region have not been fully appreciated. The suitability of the loess soils for fruit production is generally recognized. The Knox and Memphis silt loams are especially desirable for this purpose, as the deep, porous subsoil permits good root development and the trees make a more vigorous growth, live longer, and produce better fruit than on most soils. The local market and shipping facilities are not excelled anywhere. Moreover, much of the best fruit land is available at relatively low cost, so that the initial cost of establishing orchards is comparatively low.

Aside from dairying, the live-stock industry is of relatively little importance in St. Louis County. On account of the prevailing intensive farming practices and the lack of pasture land on the average farm, the raising of cattle and hogs in large numbers is not practicable. Most of the beef cattle are found in the western part, in the region of general farming. Here, too, a few sheep, horses, and mules are raised. According to the 1920 census, there were in the county 6,437 horses, 3,822 mules, 12,166 cattle, 1,295 sheep, and 22,717 hogs.

The majority of the cattle are of the dairy breeds. Dairying is an important industry, not only in the county but also within the limits of the city. There are numerous large dairy farms in the county. Many farmers keep several dairy cows for the sale of milk, and this

practice probably should be extended. A considerable part of St. Louis County is better suited to dairying than to general farming, yet less than 20 per cent of the milk used in the city of St. Louis is produced within the county. The Union soils in particular are well suited to grass and pasture. There has been a tendency to decrease the number of dairy cattle, but this is largely an adjustment to existing economic conditions.

The farm equipment in St. Louis County is such as might be expected in a highly improved region. However, the equipment on the average truck farm is comparatively simple and consists of few implements. Much of the work connected with vegetable growing is done with one-horse tools. A large part of the work is hand labor, but this could be reduced by the use of improved machinery. The cultural methods, however, are of the best. Careful preparation of the land, the use of all the manure available, and the careful handling of the crops combine to make the farm operations successful.

Farm improvements do not always give a true impression of the degree of prosperity. Many of the units are of such small size that they require intensive and careful handling to produce a livelihood and leave little for profit. Approximately 500 farms contain less than 10 acres each, and more than half of all the farms contain less than 50 acres each. It would seem desirable that each farm be of sufficient size to have a pasture and permit the keeping of some live stock. The general appearance of the farms indicates a high average condition of thrift and prosperity.

The area of St. Louis County is 350,720 acres and of St. Louis city 39,040 acres. According to the 1920 census, 72.7 per cent of the land outside the city is in farms, which is 6.6 per cent less than in 1910. About 78 per cent of the land in farms is classed as improved. The unimproved farm land is unsuited for agricultural purposes and is of value mainly for timber and pasture. The average size of the 3,735 farms in the county is 60.7 acres. In general, the larger farms are found in the western and northern parts of the county. According to the 1920 census, 60 per cent of the farms are operated by owners, 37.4 per cent by tenants, and 2.6 per cent by managers. The great majority of tenants pay cash rent. The average value of land and buildings per farm is approximately $12,200. There are reported 244 farms in St. Louis city, with a total of 3,408 acres.

Since much of the land in the county is sufficiently rolling to be subject to rather severe erosion, more attention should be given to checking the annual loss due to this cause. The value of growing cover crops, such as rye, during the winter months on hill land has already been pointed out. Most of the sloping land has such a gradient that it can be easily terraced. In the trucking districts, where the field units are rather small, the presence of terraces would not seriously interfere with cultivation. Contour cultivation and planting is also to be recommended. Of much value, too, would be the installation of soil-saving dams in stopping large washes, particularly in the more rolling areas of the Knox and Memphis soils.

In the Florissant Basin is much land that can be improved by tiling and ditching. A dredge ditch through Coldwater Creek bottom is under consideration and is essential to make this land agriculturally profitable. The main Basin soils can easily be drained by tiling, and this should result in larger crop yields, particularly in wet

seasons. The laying of tile drains on the seepy slopes throughout the upland region would also be beneficial.

Although the agriculture of St. Louis County is in a comparatively high state of development, there are certain lines along which improvement is needed. One of the greatest needs at present is a more intelligent study of commercial fertilizers. Admitting the necessity of the use of commercial fertilizers, as a supplement to stable manure, the manurial requirements of the different soils and different crops must be carefully studied if the best results are to be obtained. At present too much dependence is placed on manure alone to maintain the fertility of the soil. It is quite evident that many of the soils are mainly in need of phosphoric acid and the use of large quantities of manure, without balancing it with phosphorus, is in part an economic waste. This applies both to grain farms and market gardens. The outlay for fertilizers need not be a large one, but can profitably be much larger in intensive market gardening than in general farming. The particular fertilizer and the quantities to use must to a large extent be determined from field trials by the individual farmer, as general rules can not always be applied, because of the many different kinds of soils and crops and other purely local conditions.

There is need for growing more leguminous crops in order to supply more nitrogen and organic matter to the soil, constituents that are most lacking in practically all the upland soils of the county. Under present conditions many farmers are unable to obtain sufficient stable manure for the needs of their land. Clover, practically the only legume at present grown, is not always well adapted to the trucking system of farming, although much could be done with other green manures properly handled. In general, clover fields are pastured too close to be of the greatest benefit to the land. Such crops as soy beans and cowpeas might be profitably grown and substituted to a certain extent for clover.

Agricultural lime should be used much more extensively in St. Louis County. The increasing difficulty experienced in growing clover must be attributed to the acid condition of many of the soils. Throughout the county there are vast deposits of limestone well suited for agricultural lime. The St. Louis, Kimmswick, and Burlington formations all consist of high-grade stone. Ground limestone is probably the best form of lime to use.

It is recognized in a general way that definite relationships exist between the character of the soil and the yield and quality of its plant products. This is of special significance to the vegetable and fruit grower, though in common practice such distinctions in planting are exceedingly rare. The quality of quick-maturing vegetables is largely governed by the character of the soil. Some crops, such as cabbage and celery, thrive better on moist, rich soils than on the light and well-drained areas, which are better suited to tomatoes and potatoes. There is need of an adjustment of the special agricultural industries to the soils on which they are most certain to flourish.

The land in cultivation has already passed the maximum, and the area is steadily decreasing, owing to the expansion of St. Louis and the other towns in the county. The time is probably not far distant when all the territory within a radius of 6 miles of the St. Louis city limits will be taken for home sites and cease to be of agricultural sig-

nificance. Approximately 50,000 acres of the land in farms is forested land and is nonarable. This includes the rough, stony, and hilly land in the southwestern part of the county. Some of it has a slight value for pasture and fruit growing, but its greatest value is for park and recreation purposes. It would seem desirable that much of the nonagricultural land along the Meramec River be brought under public control and used for park and forest reserves.

The enlargement or shifting of the trucking areas will consist of an encroachment on the land now used for general farming. The whole northern part of the county, including the Florissant Basin, is especially well suited for fruit and vegetable growing. It has the same natural and market advantages as the present trucking districts.

St. Louis City is thus favorably situated in that it will always have at its border a region of superior character that can supply much of the fruit and vegetable needs of the city. This is a condition of great importance to the city dweller and the vegetable grower alike. A good market and low marketing cost are essential to a successful trucking industry.

In general, it may be said that the agricultural practices followed in the county are fairly well adapted to the existing conditions.

SOILS.[5]

The greater part of the upland of St. Louis County was originally covered by a silty material called loess, which in its unaltered state presented nearly everywhere uniform physical properties. The differences that now exist in the soils derived from this material have been produced by the common soil-forming processes, which include weathering, leaching, aeration, oxidation, and the accumulation of organic matter. These agencies have acted in like manner, but with greater or less intensity, upon the less uniform soil materials, such as the alluvium deposited by the streams and the products of decomposition of limestone, sandstone, and shale rocks that are exposed in the southern and western parts of the county. Soil development has not, however, reached the same stage, even on similar parent materials, but differences have been brought under the influence of varying conditions of topography, vegetation, and drainage. One of the most important factors in the development of soils is the influence of forests, which in this region determines the color and many other important features of the soil profile.

Differentiation of the soils of St. Louis County may be made on the basis of their most striking characteristic into light-colored and dark-colored soils. The dark color of the latter group is due to the presence of black organic matter, which is derived chiefly from the decay of grass roots, and which, except in the case of poorly drained or alluvial soils, requires a prairie condition for its rapid accumulation. Under the conditions of moisture and temperature prevailing in this region, such an accumulation is invariably present in soils of treeless areas. On the other hand, soils of well-drained areas long

[5] St. Louis County adjoins Franklin County on the west. In certain cases the soil maps of these counties do not appear to agree along the boundaries. This is due to changes in correlation resulting from a fuller knowledge of the soils of the State.

The Knox silt loam, as mapped in Franklin County, is now subdivided into the Knox silt loam and the Memphis silt loam The Clarksville stony loam of Franklin County is now called the Baxter stony loam, and parts of the Huntington silt loam of that area are now mapped as Genesee silt loam.

covered by forests are light colored, as they do not accumulate any large quantities of humus, and if black organic matter was originally present it will have been destroyed under forest conditions.

The soils of the forested areas in this county have a tendency to develop a characteristic profile, which may be regarded as the final result of the existing agencies of soil formation. The surface soil to a depth of 5 to 7 inches has a yellowish-gray, grayish-brown, or light-brown color and a silty floury structure, but it grades downward into a lighter gray or almost white floury silt loam. This is underlain, at depths varying from 14 to 20 inches, by a granular compact clay or silty clay, the color of which is brown mottled with gray or, more rarely, a solid brown. The carbonates have been so largely removed to depths of more than 3 feet that there is no effervescence with acid.

The profile just described is characteristic of smooth forested divides and flat terraces, where the soil has lain in its present position for a considerable period of time without being subjected to any serious effects from erosion. It does not characertize the soils that are formed on material recently accumulated or on the eroded stream slopes. This distribution leads to the conclusion that the profile here described is that of the mature soil of the region, or at least the one in the most advanced stage of development in the area. The soils of the Marion series have this profile best developed, but the Robertsville soils on the terraces have reached a stage almost as far advanced.

The mature profile is developed over only a small part of the county. The most extensive area lies on the flat divide in the vicinity of Kirkwood, coextensive in its distribution with the Marion silt loam.

On the more rolling areas, the soil profile varies in accordance with the conditions of drainage, leaching, and aeration. The surface soils are not greatly different from those of the Marion group described above, being a brown or grayish-brown silty material. The subsoil is a compact, granular, friable, silty clay loam having a smooth, yellowish-brown color. Soils having this profile occur on the rolling to sharply rolling stream slopes, where free surface and subsoil drainage have resulted in a complete oxidation of the entire soil profile. With this group may be placed the soils of the Memphis series and the shallow soils of the Union and the Baxter series.

Between this group and the Marion group are soils which, by reason of their topography and drainage conditions, are intermediate in their stage of development, and the soil profile represents a transition between the two. The prevailing grayish-brown soil is underlain by a light-brown silt loam horizon. At depths of 16 to 20 inches a brown, compact, granular subsoil is encountered. A more friable horizon begins at depths of 24 to 30 inches, which has a brown or grayish-brown color with usually a slight mottling of gray. The soils of the Clinton series are representative of this stage of development.

Another extensive group of soils has a profile consisting of a brown or grayish-brown surface layer underlain by a brown or yellowish-brown friable silt loam or heavy silt loam. This differs from the profile of the Memphis group in that it has not developed a compact subsoil, a condition that may be due to the shorter time that the soil material has been exposed to weathering. With this group may

be placed the Knox silt loam of the upland and the Lintonia silt loam of the terraces. The Knox silt loam has been developed from the loess along the Missouri River, which is supposed to be younger and less leached of its more soluble constituents. The Lintonia silt loam has been derived from silty materials that were deposited within comparatively recent times over colluvial slopes and terraces.

The areas of dark-colored upland soils are coextensive with the areas that were in prairie at the time of the first settlements, or upon which a sparse tree growth had established itself only within comparatively recent times. As land was eroded and better drainage was provided, a forest growth spread over the surface, and a marked change was brought about in the processes of soil formation. It is almost certain, therefore, that at the time of the first settlement of the region by white men these prairies, which owe the dark color of their surface soils to the presence of black organic matter, were fast disappearing before the invasion of the forests. The remaining prairies are found in Florissant Basin, where an abundant moisture supply has favored a heavy grass vegetation. These remnants of prairie soils are not strongly dark colored in their surface horizons, and in some of the areas mapped they barely come within the classification of dark-colored soils. One of these upland series has dark-brown soils underlain by brown or yellowish-brown material somewhat heavier in texture than the surface soils, but not compact. The lower part of the soil profile is a more friable yellowish-brown silty clay loam. Soils of this group include the Tama series on the upland and the Waukesha on the terraces.

The soils of another group have profiles consisting of dark-colored surface layers underlain by black or brown and gray, mottled, heavy subsoils. These soils have been developed under conditions of inadequate drainage. With this group may be placed the Wabash soils of the lower stream bottoms and the Bremer series of the terraces.

Intermediate in its stage of development between the two dark-colored groups described above are the soils of the Muscatine series. The surface soils are dark brown, underlain by brown heavy silt loam or silty clay loam, which pass into mottled gray and brown silty clay loam in the lower part of the 3-foot section.

The Cass soils are dark colored and the Sarpy are light colored in the surface soils, and both have sandy and gravelly subsoils. These soils would belong with the well-drained groups were it not for the fact that the water table is quite near the surface.

In the process of soil formation many of the differences in the parent material are modified or obliterated, so that in many cases the relation of the soil to parent rock is not evident. On the other hand, some soil characteristics are due directly to the character of the parent materials, and other characteristics, including those developed by differences in topography and drainage, are determined in part by geological formations and the composition of the parent rocks.

The rocks of St. Louis County are mainly limestone, shale, and sandstone, belonging to the Carboniferous, Devonian, and Ordovician ages. The older or lower strata are rarely exposed and only in the western part of the county. The St. Peters sandstone outcrops at various places, but is of no importance in this area as a source of

soil material. Other formations of the Ordovician period are the Joachim, Plattin, and Kimmswick limestones. These are relatively pure, thick-bedded limestones, that weather into stone-free soils. The Carboniferous (Mississippian series) includes the Burlington, Keokuk, Spergen, and St. Louis limestones as its most important members. Excepting the St. Louis, these formations are found chiefly in the southwestern part, and outcrop in many ledges in the hilly sections where the loess has been eroded away. Chert is not present in the Spergen, but is more or less abundant in the other formations. The St. Louis limestone forms the country rock of a considerable area in the eastern part of the county. It has an average thickness of about 300 feet, which is thicker than that of the other limestones. Great numbers of sink holes are developed in the limestone, and sinkhole topography may be said to be characteristic of the St. Louis formation. In the northeastern part, north of Kirkwood and east of Creve Coeur to the Mississippi River, the shales and clay of the Pennsylvanian series are the prevailing formations. These beds are rarely exposed, but are of significance in their influence on the surface features of the region. The more nearly level surface overlying the soft rocks has a profound effect on the soil. The clay beds give rise to one of the most important industries in the area, that of brick and pottery manufacture. The presence of the Florissant Basin within the region of the shales and clay would suggest its structural origin.

In the southwestern half of the county the several formations are exposed and give rise to areas of upland soil; however, because most of the limestones are somewhat alike in their hardness and purity, and because all have been subjected to the same weathering agencies, they have given rise to rather uniform soils that have been correlated with the Union series, the soils of which are characterized by a brown surface soil and reddish-brown clay loam subsoil.

The formation that comprises by far the greater part of the upland, and is the principal source of soil material in the area, is the yellowish-brown to buff silty deposit known geologically as loess. This material, supposedly of eolian origin and deposited during glacial or Pleistocene times, was spread over the entire area to a depth varying from almost nothing to 60 feet or more. The deposit is thickest on the bluffs bordering the Missouri and Mississippi Rivers. Receding from the bluff line, the loess gradually becomes thinner, and over most of the interior or central part of the county it is only 10 to 20 feet in depth. In the western and southern parts, where the surface is broken and erosion is active, all or most of the loess has been removed, and the soils are derived in part from limestone. It is evident that the original loess deposit was thinnest in the higher western part and thickest in the regions of lower altitude. In general, it is thicker along the Missouri River, and has retained more of the typical bluff characteristic, than along the Mississippi River.

The texture of the loess is coarsest along the river hills and becomes finer in regions more remote from the streams. This variation, however, reaches its full range within a distance of 2 to 3 miles from the outer edge of the deposits. As a rule, the bluff soil along the Missouri River, where it is thickest. is coarser than that along the Mississippi River.

The generally accepted explanation of the origin of loess on uplands near great river valleys is that it is a wind-blown dust derived from alluvial deposits developed by climatic conditions accompanying the glaciation of adjacent regions. The area including St. Louis County, on account of its position between the two large rivers, received relatively thicker deposits of loess, spread over a larger area, than any other county in the eastern part of the State. It is evident, too, that more of the material was taken from the Missouri River Valley than from the Mississippi, because of the prevailing westerly winds. In brief, the loess is a blanket formation conformable to the preexisting topography, and nearly everywhere of sufficient depth to determine the character of the upland soils and to influence, in large measure, the alluvial types along the local streams.

As already explained, the factors that have been most active in determining the character of the various soils are topography, vegetation, and moisture conditions. Where the surface is level or nearly so, the agencies of weathering have acted without interruption and have reached full expression. Here erosion has been least active, the surface soil has become considerably leached, and there has been an uninterrupted filtration of clay from the surface into the subsoil, so that the latter has become rather compact. The soils on the level areas have lost a greater proportion of their more soluble constituents and have subsoil conditions less favorable to plant growth than those with very porous subsoils. Soils of this kind are represented by the Marion silt loam, and to a lesser degree by the rolling phase of the same type.

Where the surface is moderately rolling and the surface drainage good, weathering could not bring the soils to their full development. Such soils have been leached less and have less compaction in the subsoil. Depending on the steepness of slope and the depth of the material, there are differences in degree of weathering that the loess has undergone. These differences distinguish the Clinton, Memphis, and Knox silt loams. The Clinton occupies the gently rolling areas, where the loess mantle is relatively thin. The Memphis occurs on more rolling land with a thick loess covering. The Knox represents the deep deposits on the river hills and shows least weathering.

In the Clinton and Memphis soils the surface soil is generally very light colored and has a low content of organic matter. It is also probable that the light color of the surface soils indicates a degree of leaching considerably greater than has occurred in the material at a greater depth. This suggests a larger proportion of siliceous material and a proportionally lower content of the mineral elements of fertility in the surface soil. With respect to lime this is known to be true, and doubtless is applicable in some degree to the other readily soluble but equally important constituents. The content of phosphorus is rather low. Loess material in Missouri is normally rich in potassium, but this element is present in only moderate quantities in the brown upland soils in the area, and this probably is indicative of the loss by leaching that has taken place. To this same cause must be ascribed the absence of lime carbonate in the surface of all the soils. Under favorable physical conditions all of the brown soils respond readily to the addition of organic matter, indicating that the

loess as a whole is comparatively rich in mineral plant food. The weathered part particularly is similar in general appearance and physical properties to the deep loess deposit in the northwestern part of the State, which constitutes the parent material of soils of strong fertility and high agricultural value.

The lower part of all the deeper deposits of the loess is calcareous. This difference in the lime content between the deep and shallow phases of the loess is observable throughout the county, and the upper limit of the presence of lime indicates the depth to which leaching has extended. In general the deep loess along the Missouri River has a higher lime content than that along the Mississippi River.

Under unfavorable drainage conditions organic matter accumulated in large quantities and imparted a dark color to the soil. Such conditions prevailed in the Florissant Basin and on the level areas within the present city limits of St. Louis. To this group of dark loessial soils belong the Tama and Muscatine types. They differ mainly in character of the subsoil, which in the former is a brown, friable silty clay loam, and in the latter is a grayish-brown or drab plastic clay loam.

The grayish-brown soils mapped in the hilly region in the southwestern part of the county are derived mainly from limestone, and are classed in the Union and Baxter series.

There are numerous and extensive areas of second bottoms or terraces in St. Louis County that give rise to several distinct types of soil. Where these soils occur along streams, they represent old alluvium, but in the Florissant Basin they probably represent colluvial material or lake beds. In either case they are the result of water action. The factors that have brought about the differences in these soils are the same as those that have acted on and modified the upland soils.

The older terrace soils, or those that have been leached most, are classed in the Robertsville series. They have gray surface soils and a heavy, compact subsoil, and are similar in structure to the Marion series. Where moisture conditions favored the accumulation of organic matter, the dark-colored terrace soils prevail and are included in the Bremer and Waukesha series. The Elk and Lintonia soils are brown second-bottom soils similar to the upland Memphis silt loam.

The alluvial or first-bottom soils reflect to a marked degree the character of the material from which they are derived. The bottom land along all the local streams, and to a less extent along the Meramec River, consists largely of reworked loess, washed down from the adjoining uplands. The soil material is remarkably uniform and is characterized by a brown color and a mellow, silty texture. It is correlated with the Genesee silt loam. In occasional areas, where poor drainage existed, the material has been changed and given rise to the gray soils of the Waverly series and the dark-brown soils of the Huntington series. Sandy loams have an extremely limited development along the Meramec River in the county, although its swift current and frequent widespread floods afford suitable conditions for development of sandy types of soil if the materials for their formation were within reach of the stream. The prevalence of brown

silt loam along the Meramec River suggests that the loess-covered hills are the source of much of the alluvial material.

The alluvial soils along the Missouri and Mississippi Rivers are very complex and show little or no relation to the local upland soils. They vary in texture from fine sandy loam to very heavy clay. The lighter type is usually some shade of brown or grayish brown, with a tendency to darker colors as the texture becomes finer and the depth increases. The lower substratum nearly everywhere is a fine sandy loam, and this insures thorough aeration and underdrainage to all of the types, even the deep and heavy clay soils. The light-colored bottom soils belong to the Sarpy series, and the dark-colored types are included in the Wabash and Cass series. The Sarpy series is rather extensive and is the predominating series along the Missouri River. A sharp separation of the several types is not always possible or practicable, and only their general limits are indicated. The differentiation of the surface deposits into several types of soil is an attempt to express in terms of soil the very irregular occurrence of the different sediments. Each overflow may cause a wide variation in the material deposited. This is especially true of the lighter types developed near the channel, and frequently the interior areas of clay soil, whose origin is the result of long continued deposition from "back water," may be invaded by currents carrying so much sand and silt that the character of the surface is soon changed.

These alluvial types are all inherently fertile and show few signs of exhaustion, although cropped almost continuously to grain for many years.

In the classification of soils for the purpose of mapping, they have been grouped into series on the basis of a common origin and of similarity in color, structure, and topography. The soil type, the unit of soil mapping, is a subdivision of the series on the basis of difference in the texture or the relative proportions of silt, clay, and various grades of sand of which it is composed. Twenty-four types, representing 19 soil series, and Rough stony land and Riverwash, have been differentiated in St. Louis County.

In using the soil map it should be remembered that the change from one soil type to another, particularly in the uplands, is rarely distinct, but consists rather of a gradual transition, sometimes extending over a considerable distance. This is particularly true of the boundaries between the Knox, Memphis, and Clinton types. The difference between some of the types is not indicated by a difference in the surface soils or in topography, but is based on the structure of the subsoil. Thus the Tama and Muscatine soils differ mainly in the character of the subsoils. Within the city of St. Louis and in the larger towns the natural soil conditions have in many places been altered by building operations, and because of the difficulty of making careful examinations the soil boundaries in a few places represent only an approximation of the correct boundary.

The following table gives the names and the actual and relative extent of the soils mapped:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Memphis silt loam	103,104		Sarpy very fine sandy loam	6,592	1.8
Hilly phase	7,808	31.4	Cass clay loam	5,696	1.6
Sink-hole phase	2,240		Sarpy silt loam	5,632	1.6
Clinton silt loam	47,616	13.2	Elk silt loam	5,376	1.5
Union silt loam	30,016	8.3	Muscatine silt loam	4,480	1.2
Genesee silt loam	25,728		Riverwash	3,776	1.0
Black-subsoil phase	3,328	8.0	Huntington loam	3,456	1.0
Marion silt loam	7,296		Waukesha silt loam	3,136	.9
Rolling phase	9,728	4.7	Sarpy loam	3,072	.9
Rough stony land	15,104	4.2	Wabash silt loam, poorly drained phase	2,368	.7
Baxter stony loam	13,568	3.7	Sarpy fine sandy loam	2,112	.6
Knox silt loam	13,120	3.6	Lintonia silt loam	1,472	.4
Waverly silt loam	8,704	2.4	Bremer clay loam	1,216	.3
Tama silt loam	8,448	2.3	Wabash clay	1,408	.4
Bremer silt loam	5,312	2.2			
Gray phase	2,560				
Robertsville silt loam	5,376		Total	360,960	.....
Slope phase	1,792	2.1			
Dark-colored phase	320				

MEMPHIS SILT LOAM.

The Memphis silt loam is the most extensive and most important soil in the county. It is the prevailing type in the eastern and northern parts, and in general it is coextensive with the deeper loess deposits, from which it is derived. (Pl. XX, Figs. 1 and 2.) It is a part of the loess hill land that occurs in a more or less continuous belt along the Mississippi River Valley.

The surface soil is a brown or grayish-brown silt loam. This grades at 8 to 12 inches into a subsoil of brown, slightly heavier silt loam. Below 20 inches the subsoil is a brown silty clay, rather plastic when wet, and compact and crumbly when only moderately moist. The lower subsoil normally contains less clay and more silt than the upper subsoil, and the structure is more friable. In places there are a few mottlings, brown stains, and gray streaks, but in general the soil section to a depth of 2 feet or more is characterized by a uniform brown color. Near the bluff line the soil has a deeper brown color and a more silty texture than in the areas more remote from the rivers. On the rolling land the soil is darker than on the more nearly level areas. On the latter the soil generally is grayish brown and the subsoil yellowish brown. These variations range from those resembling the Clinton soils on the one side to those resembling Knox on the other. In general, the Memphis silt loam in the southern part of the county, south of St. Louis city, averages darker in color and heavier in texture than in the northern part. This is probably due to the more active erosion in the southern part, owing to the more rolling surface and the numerous sink holes. The brown soil variation appears to be somewhat more productive than the lighter colored soils.

The boundaries between the Memphis, Clinton, and Knox soils are rather arbitrary. The general difference between the Memphis and Knox types is that the latter has a deeper and siltier soil and a more rolling surface. The Clinton is lighter in color, has a more compact and mottled subsoil, and is less productive.

The stage of weathering of the Memphis silt loam is indicated by the rather heavy and compact subsoil, which persists even on the bluffs bordering the river valleys. It is only on some of the higher hills that the silty texture prevails to a depth of 3 feet or more. The calcareous substratum, however, does not lie too deep to have a favorable effect on deep-rooting crops. Lime concretions are found in the lower strata. The soil has not weathered to the extent that it will not retain vertical walls in cuts and ravines, a feature characteristic of deep loess.

The topography of the Memphis silt loam is gently rolling to moderately hilly, but all of it is well suited to cultivation. It is much smoother than the same type in other parts of the State. In the southern part of St. Louis city the land is pitted by numerous small sinks that tend to give the surface a rather broken appearance. Drainage is everywhere good.

The loose, silty texture of the soil makes it susceptible to erosion, which is accentuated by the use of the land for the production of intertilled crops. The soil is porous, however, and absorbs and holds much water, which tends to reduce the run-off. Winter cover crops, such as rye, should be grown to protect the soil from washing. Terracing should be practiced, and is especially suited to this land because the fields are small.

The Memphis silt loam is well supplied with the mineral plant-food elements. The physical properties of the material are also highly favorable to the conditions that make for a productive soil. As is characteristic of most loess soils, there is a deficiency in humus and nitrogen, and for the best results a consistent maintenance of the content of organic matter is necessary. This is indicated by the large yields obtained from those fields that have received liberal applications of manure.

The Memphis silt loam is the principal trucking soil of the county. This type of farming has developed not only on account of the favorable location with regard to market, but also because the soil is peculiarly well adapted to fruit and vegetable growing. It is fertile, early, well drained, easily worked, and responds readily to manurial treatments. All vegetables, except those that require a cool, moist soil, do well. The excellence of the brown loess for fruit growing is generally known. This industry is of great importance, but offers many opportunities for expansion. Clover and alfalfa grow well on most of the land, but are greatly benefited by lime on the more level fields. The type is superior as a wheat soil, and also is well adapted to corn. Wheat yields range from 15 to 30 bushels per acre. Manure is depended on exclusively as a fertilizer.

The more extensive growing of clover for green manure, and the use of a phosphatic fertilizer is recommended. Areas that show an acid reaction should receive from 1 to 2 tons of ground limestone. Trials made by the Missouri Agricultural Experiment Station indicate that good returns are obtained by the use of phosphatic fertilizers, but the thing of primary importance is to keep the soil well supplied with organic matter.

In places it is difficult to get a stand of red clover because of winter freezing. In such places it is usually possible to get a catch of alsike clover. Alfalfa is grown with success, but does best on the rolling land near the river bluffs. Where corn, or any tilled crop, is grown

on the same land 2 or more years in succession, washing takes place even on comparatively gentle slopes. Consequently careful rotation and intelligent cultivation are necessary.

Memphis silt loam, sink-hole phase.—The Memphis silt loam, sink-hole phase, includes an area of about 2,000 acres in the northeastern corner of the county that is so thickly pitted with sink holes as to make cultivation impracticable. The soil is the same as that of the typical Memphis silt loam, except that as the result of erosion it is shallower on the slopes. The majority of the sinks have good drainage and are dry. They are too small to have flat bottoms that can be cultivated, and the narrow ridges between the sinks are too small for cultivation. Practically all of the area is used for pasture, to which it is best suited.

Memphis silt loam, hilly phase.—The belt of hilly country bordering the Meramec Valley and extending from the Manchester Road to near Butler Lake in the southern part of the county, has been correlated as Memphis silt loam, hilly phase. This entire area is covered with a deep mantle of soil material, and because of its relatively high position and proximity to the Meramec River has become thoroughly dissected. The country is a series of rounded ridges and narrow hollows. The ridges are easily farmed, but many of the slopes are not well suited to cultivation. It is a region of rather distinct topographic features, and therefore has been indicated separately on the soil map.

The soil material in its general characteristics is thought to be more closely related to the Memphis silt loam than to the Union silt loam. In origin it is mainly loess, but on the slopes residual limestone material enters into the composition. The surface silty layer is light brown to yellow in color. It is deepest on the ridges where erosion is least active. The line of demarcation between soil and subsoil is not distinct. The subsoil is a yellowish-brown silty clay loam, mottled here and there in the lower part. On most of the slopes the subsoil consists of yellow or brown clay, like that of the Union silt loam. In general, the hilly phase averages lighter in color than the typical Memphis soils, but is darker, deeper, and mellower than the Union soils. Because of erosion the soil has been kept fresher, and new surface soil is continually being formed from unleached underlying material. The sloping topography has retarded the development of a compact subsoil, which is friable and porous. For these reasons the soil is as productive as the brown upland soils.

Erosion is everywhere severe, but is controlled largely by contour cultivation and by keeping the steeper slopes in grass. On the slopes a large part of the rainfall runs off, so that crops often suffer from lack of moisture. South and west slopes are most subject to drought.

Practically all this phase is in cultivation, both field crops and vegetables being grown. Yields average about the same as on the typical Memphis silt loam. Most of the farms and fields are small, and rather intensive farming is practiced. For growing fruit this phase is almost equal to the typical soil; it is especially well adapted to bush fruits and grapes.

CLINTON SILT LOAM.

The Clinton silt loam is the prevailing upland soil in the central part of St. Louis County, from Forest Park on the east to Ellisville

on the west. (Pl. XXI, Fig. 1.) The soil is similar in origin and closely related to the Memphis silt loam, but because it has been modified to a greater extent by the action of weathering it has acquired characteristics that make it distinct from the other soils in the area. There is no definite line between it and the brown upland soils, and the boundary is therefore rather arbitrarily drawn.

The surface soil is a pale-yellow to grayish-yellow or grayish-brown friable silt loam extending to an average depth of 10 inches. When moist, the color is brown, but cultivated fields have a gray appearance when dry. The light color is indicative of a low content of organic matter. The surface soil grades quickly into light-brown or yellowish-brown silt loam, which becomes heavier with depth, and passes at 16 to 20 inches into the silty clay subsoil. In places this material extends to depths of more than 3 feet, but normally the subsoil below 24 or 30 inches is a brownish-gray friable silty clay, faintly mottled brown and gray. The substratum is gray-brown clay and consists of moderately weathered loess material. The color and structure of the soil is dependent on the topography. On the more nearly level areas the surface soil averages lighter in color, and the subsoil is more compact and has more mottling. Occasional small iron concretions are present, and in general the soil shows a rather advanced stage of leaching and weathering.

An important variation of the type lies in the moderately hilly region between Altheim and Valley Park, including all of the drainage area of Grand Glaise Creek. Here the surface is more broken than on the rest of the type, and erosion and soil creep have been more active in keeping the soil young. The surface soil is brown, the subsoil is friable and shows little or no mottling, and the general structure of the soil material is similar to that of the Memphis silt loam. These differences are accompanied by a somewhat higher productivity, as indicated by larger crop yields. Because there is nowhere a definite line between this and the typical soil, no attempt was made to indicate the differences on the soil map.

The topography is undulating to rolling, and averages smoother than that of the Memphis silt loam. North of Valley Park the surface is rolling. A few slopes are subject to erosion, but no large areas have been damaged in this way. The natural drainage is good over all of the type, and the subsoil is nowhere sufficiently compact to retard the downward percolation of water. In general, the Clinton silt loam represents the region of shallow loess deposits.

A large proportion of the type in the eastern part of the county is used for town and residence sites. All the type not so used is devoted to general farm and truck crops. The trucking industry is less important than on the Memphis soils, largely because the soil is not so productive. It is also less well suited to deep-rooting crops such as alfalfa. The crops most extensively grown are wheat, clover, corn, and grass. The yields of these vary considerably, depending largely upon the methods of farming and the amount of manure used. Wheat yields from 15 to 25 bushels per acre. Clover will grow everywhere, but liming is necessary for best results, since most of the soil is acid.

Trucking as a specialty, combined with grain growing, is the prevailing type of farming between Olivette and Altheim. Bush fruits are extensively grown with good results. Tomatoes, beans, and potatoes

are the most important vegetable crops. Where the surface is rolling fruit trees seem to thrive as well as on the Memphis soils.

Because of its silty nature, the soil is not difficult to handle and works up into a fine mellow seed bed. It is not as drought resistant as the Memphis, owing mainly to the deficiency of organic matter.

In general, the Clinton silt loam is only moderately fertile and is very low in organic matter. There is need of more extensive growing of clover and other legumes as green manure to supplement the stable manure. The phosphorus content of the soil is low, and the use of phosphatic fertilizers gives good returns, particularly on wheat. Most of the soil is acid; this condition can be corrected by applying ground limestone at the rate of 1,500 to 3,000 pounds per acre. On the more rolling areas the lime requirement is normally lower than on the flats. Both lime and phosphate are especially valuable in obtaining a good stand of lawn and other grasses.

KNOX SILT LOAM.

The Knox silt loam is the typical brown silty loess or river hill land so extensively developed in the river counties in the central and western parts of Missouri. In St. Louis County only that part of the loess soil bordering the Missouri River valley can be classed in the Knox series. It forms an almost unbroken belt from the Halls Ferry Road to the Franklin County line. The belt is widest and has its most typical development at the St. Charles Road.

The surface soil is a brown or grayish-brown, deep, mellow silt loam. In places the texture approaches a very fine sandy loam. The subsoil is a brown to reddish-brown heavy silt loam to silty clay, which extends to a considerable depth. There is no marked tendency toward stratification or the development of soil layers within the 3-foot section. In general, however, the subsoil averages heavier in the western part of the county than in the region northeast of Bellefontaine. The silty and mellow character of the subsoil is the most conspicuous difference between the Knox and the other loess types. Uniform color and coarser texture are other differences. The surface soil as a rule is neutral in reaction, but the lower subsoil in places is slightly calcareous.

The Knox silt loam is derived from the deepest and most recent loess deposit in the county; consequently the material is only partly weathered and has not developed a heavy subsoil. The surface is rolling to hilly, but all the land can be cultivated except along the bluff line from Centaur Station to Creve Coeur, where the bluffs are more or less precipitous. Erosion is rather severe, but the run-off is lessened by the absorptive power of the porous soil. The original vegetation consisted mainly of elm, walnut, oak, and poplar.

The fertility of this soil is generally recognized. More corn is grown and larger yields are obtained than on the other of the brown upland soils. Wheat is the most important crop, and commonly yields 20 to 35 bushels per acre. Clover and alfalfa do better than on any other upland type. The production of fruit or vegetables is small, but the possibilities for fruit growing are exceptionally good. The deep, porous subsoil makes the type especially desirable for all deep-rooting crops.

The Knox silt loam is easy to handle, and its productiveness is easily maintained. The use of fertilizer is of doubtful value, but

FIG. 1.—GENTLY ROLLING TOPOGRAPHY OF THE MEMPHIS SILT LOAM, IN THE NORTH-CENTRAL PART OF THE COUNTY. WHEAT FIELD IN THE FOREGROUND. THIS IS A REGION OF GENERAL FARMING.

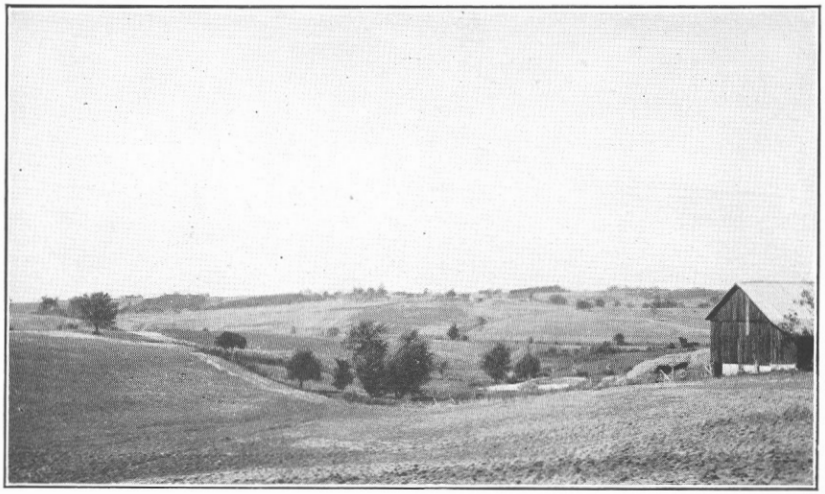

FIG. 2.—FARM LAND, MEMPHIS SILT LOAM, NEAR CREVE COEUR. THIS IS A GENERAL FARMING REGION. WHEAT IS THE LEADING CROP.

FIG. 1.—GENTLY ROLLING LAND, CLINTON SILT LOAM, IN THE CENTRAL PART OF THE COUNTY, USED FOR GENERAL FARMING.

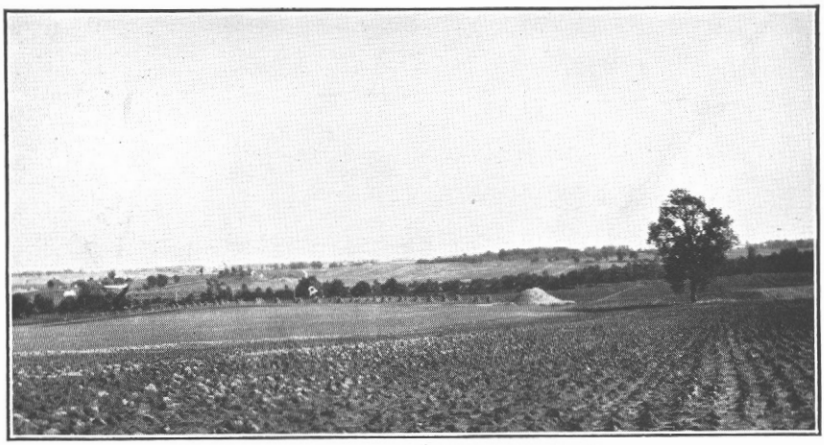

FIG. 2.—GENTLY SLOPING FARM LAND, MAINLY TAMA SILT LOAM, IN THE FLORISSANT BASIN, NEAR BRIDGETON. CORN, WHEAT, AND CLOVER ARE THE LEADING CROPS.

the use of legume crops is essential to supply nitrogen and organic matter, even though the soil is productive under natural conditions. Fresh exposures at great depths weather into productive soil in a comparatively short time.

MARION SILT LOAM.

The Marion silt loam is commonly known as gray ridge land or post oak land. In general, it occupies the highest upland, the divides and ridges in the western and southern parts of the county. It occupies remnants of the original loess plain, and therefore is the oldest and most thoroughly weathered soil in the county. The largest area is the extensive flat ridge extending southward from Kirkwood.

The surface soil to a depth of 5 to 7 inches is a light-brown to grayish-brown silt loam, grading with depth into a lighter gray or almost white silt loam, slightly heavier in texture than the surface material. The subsoil, beginning rather abruptly at 18 to 20 inches, is a gray or grayish-brown clay to silty clay, which is friable and highly mottled in the lower subsoil. Small black iron concretions are scattered throughout the soil section, but are most numerous in the light-gray subsurface layer. Much of the type has a gray-brown surface soil and a yellow-gray silty clay subsoil, highly mottled. In places the soil is brown or light brown, like that of the Clinton, but the subsoil is gray. This variation has a more undulating surface than the typical soil and is somewhat more productive.

The surface of the Marion silt loam is level to very gently rolling. Any pronounced variation from this topography is accompanied by a change in the color and structure of the soil. The surface drainage is fair, but the internal drainage is deficient. The imperviousness of the soil is due to compaction rather than to cementation of soil particles. The subsoil apparently also retards the capillary movement of moisture and the circulation of air, thus interfering with normal growth of crops in dry seasons. This is considered a cold-natured soil on which crops are apt to be backward in spring. It dries out rapidly during dry weather in summer.

The soil is derived from the weathering of loess under conditions of deficient drainage which brings about the differences between this material and the other loess types.

The Marion silt loam is a soil of low natural productiveness and one of the poorer soils in the county. Wheat, the principal crop grown, rarely gives profitable yields without the use of fertilizer. Corn succeeds only where the land is heavily manured. Peaches do fairly well, giving better results than apples. With heavy manuring tomatoes and other acid-tolerant crops do fairly well. Clover is grown with difficulty; timothy is better suited to this land. Next to organic matter, the greatest need of the soil is lime, of which 2 to 4 tons are required to correct the acidity. The use of acid phosphate will also give good results, especially on wheat and clover.

Marion silt loam, rolling phase.—The Marion silt loam, rolling phase, is a yellowish-gray to grayish-brown mellow silt loam, grading at a depth of 8 to 12 inches into pale-yellow or light-brown silt loam.

The subsoil below 20 inches is gray or yellowish gray friable silty clay, highly mottled brown and yellow. In small spots the soil pro-

file is like that of the typical soil, grayer in color, with a drab clay subsoil. In general, however, the line of demarcation between the several soil horizons is not as distinct and clearly defined in this phase as in the typical Marion silt loam, indicating a less advanced stage of weathering of the phase. In the eastern part of the county, in the vicinity of Spanish Lake, much of the rolling phase occupies shallow depressions and valleylike areas that are filled-in sink holes. The soil material is loess, which has acquired its present characteristics under conditions of incomplete drainage. In these areas the surface soil is mellower and the subsoil is usually heavier and more compact than in the rest of the phase, and its fertility is somewhat higher.

The content of organic matter is low, but the soil is rather mellow and porous and easy to work. Because of these characteristics the effects of dry weather are not as severe as on the typical soil. During wet seasons the lower slopes tend to be seepy.

In general, the rolling phase is intermediate between the Marion and Clinton types. It is somewhat darker than the former, and does not have such a compact or impervious subsoil. It differs from the Clinton in its lighter color and more advanced state of weathering. Small iron concretions are scattered throughout the soil and are most abundant on the lower slopes.

The topography varies from level in the sink-hole areas to gently sloping on the remainder of the phase. The surface drainage is good, but the underdrainage is poor. The phase probably is partly residual, as most of it occurs on low slopes, in the region of shales, and it is likely that weathered shale has entered into the composition of the subsoil in the more shallow places. However, most of the phase is derived from purely loessial material and has acquired its present characteristics by thorough weathering.

The largest areas of the rolling phase occur near Ballwin and south of Clayton. The cultivated parts are used for wheat and grass. Vegetables grow fairly well if good drainage is provided. The phase is more productive than the typical Marion silt loam, but it likewise requires heavy applications of manure or fertilizers to produce profitable yields. The soil is acid, and liming is necessary in growing clover and bluegrass. Highly phosphatic mixed fertilizer on small grains gives good results.

MUSCATINE SILT LOAM.

The Muscatine silt loam is the only dark-colored upland soil in St. Louis County outside the Florissant Basin. The surface soil consists of about 12 inches of dark-gray to nearly black silt loam, the immediate surface being gray when dry. The transitional layer between soil and subsoil is a grayish-brown heavy silt loam that extends to a depth of about 18 to 20 inches. The subsoil is a drab to brownish-gray plastic silty clay or clay loam, with few mottlings, which becomes more plastic and lighter in color in the lower part.

The type occurs in two large areas within the limits of St. Louis City; consequently the boundaries could not readily be established. Included in the type is the shallow valley that extends from near the Union Station on the east to Kings Highway on the west and occupied largely by railroad yards. The type is derived from loess and illustrates the changes wrought by weathering under conditions of poor

subsoil drainage. The level or undulating surface favored the concentration of clay in the subsoil, so that the subsoil averages heavier than that of any of the other loess types. Because of the poor surface and internal drainage, oxidation was retarded, and the natural processes of weathering were entirely different from those which are active where the soil is well drained and aerated. This accounts for the rather large accumulation of organic matter in the soil and the dark color, and the marked changes in the physical properties of the loess material.

The Muscatine silt loam has no agricultural significance, since all of it is used for residence sites. The soil is sour, and the liberal use of limestone will aid greatly in establishing good bluegrass lawns.

TAMA SILT LOAM.

The Tama silt loam is the dark-colored upland soil that covers the sloping sides of the Florissant Basin. (Pl. XXI, Fig. 2.) The surface soil is a deep, mellow, dark-brown silt loam to a depth of 15 to 20 inches. This corresponds to the surface silty layer of the Memphis silt loam. The subsoil is a brown to yellowish-brown, friable, but heavy silt loam. In places the subsoil is a silty clay, and in the more nearly level areas it is mottled yellow and brown. The lower subsoil grades into the partly weathered and mottled yellow clay loam, which extends to an undetermined depth. In general, the surface soil is darker on the lower slopes than near the ridge top. In the southern part of the basin the soil averages a dark gray to brown and is less abundantly supplied with organic matter.

The change from the brown upland soils into the Tama is rather abrupt, but the transition of the latter into the Waukesha is gradual, and both soils are similar in physical properties. This soil, like the Memphis, is derived from loess. The dark color of the soil is due to a high content of organic matter. It is evident that at one time the entire basin area existed under a condition of poor drainage that favored a rank growth of wild grasses which became incorporated in the soil. Because of the sloping surface the development of a clay subsoil, such as characterizes the Muscatine, has been retarded.

The Tama silt loam, on account of its gently rolling surface and mellow structure, is ideally suited to farming; it is the best upland soil in the county. It is located in the region of general farming, and wheat, corn, and clover are the leading crops. Wheat yields range from 20 to 25 bushels per acre. Alfalfa does well. Trucking is successful, but is carried on only in a small way. The soil does not warm up as early in spring as the brown loess types, and therefore is not so well adapted to the growing of certain vegetables. Such crops as cabbage, tomatoes, or horse-radish, which are not grown for early market but require a rich soil, do especially well.

The increasing difficulty of getting a stand of clover on much of the land would indicate that the soil is in need of lime. Tile drainage is recommended for slopes that tend to be seepy. The growing of a legume crop once in a rotation is essential to maintain the organic content when manure is not available in sufficient quantity.

Land values on this type are equal to or higher than on any other upland type in the county.

UNION SILT LOAM.

The Union silt loam occurs over the hilly, stone-free limestone areas in the western half of the county. The surface soil is a brown, yellowish-brown, or grayish-brown silt loam with a depth of 7 to 9 inches. The upper part of the subsoil is a yellowish-brown heavy silt loam, which grades at about 15 inches into brown or light-brown silty clay, becoming heavier with increase in depth. The subsoil below 30 inches is in most places a friable silty clay, mottled yellow and brown. In general, the subsoil approaches reddish brown on the lower slopes and grayish brown in the higher areas.

There are variations in the type that are of agricultural significance. On the wider, flat-topped ridges the surface soil is gray to light brown, and the subsurface is a yellowish-gray silt loam. The subsoil is compact, light-brown to yellow-brown clay, with mottlings in the lower part. This variation approaches the Marion and is not as productive as the typical soil. The rather extensive area of gently rolling land south of Valley Park and south of the Meramec Valley belongs to this variation. On many of the steeper slopes the surface has been removed by erosion, and the surface soil is a rather heavy brown or yellow-brown silt loam to clay loam, grading at 5 to 8 inches into the heavy clay subsoil. Such areas have a lower agricultural value than the deeper soil areas. In places a few chert fragments are scattered through the soil mass, and bedrock lies within 3 feet of the surface. On many of the lower slopes, where there is more or less wash material, the soil is deeper, darker, and more productive. The top soil may be dark brown, and the subsoil reddish brown in color.

In origin the soil is mainly residual from limestone, but it has been modified more or less by loess deposits. Along the northern and eastern limits of the type and on the higher ridges the soil material to a depth of more than 3 feet is mainly from loess. This is indicated by the deeper soil mantle, more rounded topography, and higher productiveness. The hilly country bordering the Meramec Valley east of Valley Park has much loess, particulary on the ridges. In general, the Union soil is lighter in color, heavier in texture in the subsoil, has a more broken topography, and is less productive than the brown loess soils.

The division between the Union silt loam and the adjacent loess types is an arbitrary one. The soil color and the soil profile are very much alike in these different types, indicating that the action of weathering has affected all of the soil to about the same extent. The basis of separation has been the thinner mantle of soil, the more numerous outcrops of limestone, and the more steeply rolling topography of the Union soil.

All of the type is hilly to rolling. The ridges are narrow and the slopes are dissected by numerous draws, so that the cultivated fields are relatively small and irregular, and the surface is too steep to permit the efficient use of heavy farm machinery. Practically all of the type is in cultivation, but much of it is better suited to grass and pasture than to cultivated crops, Erosion is everywhere severe, and slopes that are left bare soon become gullied. As it is difficult to check the development of these ditches, the better practice is to keep the steeper slopes covered with grass to prevent erosion. A good practice where the land is cultivated is to plow in strips following

the contour of the hill, leaving strips of sod between the plowed areas. Where the slopes are more gentle, simply plowing with the contour is sufficient.

Wheat is the most important crop. It yields 10 to 15 bushels without fertilizers, but most of the wheat is sown with fertilizer and yields 3 to 10 bushels more per acre. Corn does not do well, except on the lower slopes. Clover and grass grow almost as well on this soil as on the brown loess soils.

Potatoes are grown only for home use, and berries and small fruits receive little attention outside of the home garden. Apples and peaches are extensively grown in small orchards, with good yields. Peaches thrive better than apples. Dairying is of some importance and is the industry to which most of this soil is best suited.

The supply of organic matter, which is low, may be increased by supplementing the stable manure with green-manure crops, preferably clover. Where the soil is acid, the use of ground limestone is beneficial. Under the present system of farming the land is plowed too frequently, which favors washing and does not permit the frequent growing of clover for building up the soil.

BAXTER STONY LOAM.

The Baxter stony loam type includes all the stony forest land, excepting the Rough stony land, in the western part of the county. The fine soil material is variable, but generally is a grayish-brown to yellowish-brown silt loam, and the subsoil is a reddish-brown clay loam. The lower subsoil consists of brown clay and stone, except where bedrock is reached within the 3-foot section. In general, the fine soil material resembles that of the Union silt loam. Where chert fragments rather than limestone make up the stone material, the soil is gray in color. Where bedrock lies near the surface and on seepy areas, the soil usually is a drab or black clay loam. The stones vary in size from small gravel to large fragments and generally are sufficiently abundant or large enough to make cultivation impracticable. The chert, being extremely hard, has withstood weathering, while the more soluble limestone has largely disappeared.

The type is widely distributed. It occurs on the steep slopes bordering streams and draws and as escarpment areas near ridge tops. All of the slopes are steep and in many places precipitous. With few exceptions this is nontillable land. All of it is forested with oak, hickory, elm, and brush. Occasional areas, if cleared of timber and loose stones, could be converted into pasture land. Orchard grass is suited to the more stony areas, and bluegrass and white clover will thrive where there is enough soil material to hold moisture. Such areas are also well suited to the production of strawberries and grapes.

BREMER SILT LOAM.

The soils comprising the floor or lowest part of the Florissant Basin have been classed as second-bottom soils. Whether they are alluvial in origin or represent soil material modified by poor drainage, is hard to determine, but they have characteristics that are similar to several established second-bottom series.

The Bremer silt loam is one of the deepest and darkest soils in the county. The surface soil is a black to very dark brown heavy silt

loam, 12 to 18 inches deep. The upper part of the subsoil is a black to dark-drab silty clay or clay; the lower part is in most places a drab or dull-gray silty clay or clay, showing a few small reddish-brown or gray mottlings. The soil is well supplied with organic matter and is mellow, though rather sticky when wet. Where the type borders the upland, the surface in places has a coating of 2 to 4 inches of dark silty material. In several small areas, such as the area south of Allenton, the surface soil has a silty clay texture.

The Bremer silt loam occupies almost level areas in the Florissant Basin. It probably represents the part of the basin that was submerged longest or existed as a lake bed, where conditions were favorable for the accumulation of much organic matter. The soil material is unquestionably loess, the same as that of the surrounding upland soils, and deposited in the same way.

The Bremer silt loam is one of the most valuable and productive soils in the county. It is held in relatively large farms, and most of it is used for general farming. Corn and wheat are the leading grain crops, with average yields of 50 and 25 bushels per acre, respectively, but tomatoes, cabbage, peppers, and cucumbers are extensively grown. Clover does exceptionally well, except on poorly drained areas, where alsike clover gives best results. This soil offers superior opportunities for trucking, particularly for crops which are not intended for early market, but which require a deep, rich, moist soil.

The greatest need of this soil is drainage. In spring and in wet seasons crops frequently suffer from excess moisture, and the land can not be cultivated properly. Tile drains work successfully, and outlets are easily obtained.

Bremer silt loam, gray phase.—The Bremer silt loam, gray phase, occurs in the northern part of the Florissant Basin and in two areas in the Meramec Valley between Eureka and Allenton and east of Valley Park. In the latter region it is alluvial land. The gray phase is closely related to the main type, but differs from it in that the surface soil is somewhat shallower and lighter in color, and the subsoil is more compact.

The phase is essentially a dark-gray silt loam grading into a lighter gray silty clay loam, which is underlain at about 16 to 18 inches by drab clay. The apparently heavy texture of the material is due to the lower content of organic matter. Since most of the phase borders on small drainage ways, it has better drainage, and a more uneven surface due to erosion, than the typical soil.

The methods of cropping are the same as on the typical Bremer silt loam. The yields are somewhat smaller, and there is greater need of building up the soil by the addition of organic matter. The area near Eureka receives much water from the hills and is in part poorly drained.

BREMER CLAY LOAM.

The Bremer clay loam is a dark-colored soil of the second bottoms in the valleys of the two large rivers. The soil material is a dark-gray to black clay loam or clay, underlain by heavy drab clay. The type occupies the remnants of an old and higher flood plain that at one time bordered the streams. Most of it is used for building sites. The cultivated area is farmed with the adjoining bottom

lands and produces good yields. It is rather difficult to handle and needs more organic matter for best results.

LINTONIA SILT LOAM.

The surface soil of the Lintonia silt loam is a brown to dark-brown mellow silt loam, from 12 to 18 inches deep. The subsoil is a light-brown to grayish-brown, friable, heavy silty clay, faintly mottled here and there with brown and yellow in the lower part. The soil is similar in many characteristics to the Genesee silt loam, but has been modified, particularly in the subsoil, by longer exposure to weathering, which has caused the slight mottling and a greater concentration of clay in the subsoil.

The type occurs along Coldwater Creek and its branches as natural levees and represents the older deposits of these streams. The soil material is derived from the adjoining uplands and consists almost entirely of loess. The belts vary from several hundred feet to one-fourth mile in width and are most extensive in the bends of the streams. All of the type is above overflow. On the inner or stream side it rises rather abruptly as a distinct terrace from the adjoining bottom land. On the outer edge it grades imperceptibly into the darker colored basin soils or is spread as a mantle over the latter.

The Lintonia silt loam compares favorably with the Waukesha and Bremer soils in productivity. The soil is easily worked, well drained, and early, and is preferred to the black soils for truck crops. It is used mainly for corn and wheat, but tomatoes are also extensively grown. It is one of the best soils for clover and alfalfa, and the occasional growing of these crops is the most practical method of maintaining the fertility of the soil. It is rarely affected by drought and in the main is better adapted to the growing of truck than to general farming.

WAUKESHA SILT LOAM.

The surface soil of the Waukesha silt loam varies from brown to almost black in color, but predominantly is a dark-brown, mellow silt loam. The high content of organic matter and the relatively large proportion of silt give the soil a decidedly mellow tilth. The subsoil usually is slightly heavier in texture and lighter in color than the surface soil and averages a dark-brown, friable silt loam, mottled here and there with yellow and brown. In places, however, there is little change in color or texture to a depth of 36 inches.

The Waukesha silt loam occupies the low slopes or poorly defined terraces in the Florissant Basin. It occurs between the lower lying Bremer silt loam on one side and the higher lying Tama silt loam on the other. The boundary between the Waukesha and Tama silt loams is a rather arbitrary one and in places is based on difference in altitude rather than on soil difference. The surface is gently sloping and undulating.

On the higher elevations the soil is brown to dark brown and is lighter in color than on the lower areas, where it closely approaches the black Bremer soils. There are included in the type small areas occupying slight depressions, in which the soil is dark gray and the subsoil a gray-brown silty clay containing a few iron concretions. These areas resemble the Robertsville silt loam, but on account of

their small size they could not be shown on the map. They are the result of poor drainage and can be improved by tiling.

In origin the soil material is loess, either directly deposited by wind or reworked and deposited by water. Much of the surface consists of colluvial deposits from the adjoining slopes. The poor drainage conditions that originally prevailed in this region favored the accumulation of large quantities of organic matter in the soil.

The Waukesha silt loam is one of the best soils in the county. It is adapted to a wide variety of crops, but used mainly for corn, wheat, and clover. It is an excellent soil for truck crops and is well suited to alfalfa. No fertilizer is used.

Liming would probably be beneficial, particularly where clover is not always a success. Tiling would also improve the type, although it is not essential for successful crop production.

ROBERTSVILLE SILT LOAM.

The surface soil of the Robertsville silt loam is a light-gray to yellowish-gray silt loam, which grades at about 10 inches into light-gray or ashy material. The subsoil below 16 to 18 inches is a compact but friable gray silty clay to clay loam, mottled brown and yellow, which becomes siltier and more mottled with increase in depth. The gray color and the distinctiveness of the several soil layers are indicative of the severe weathering and leaching that the soil has undergone. Small black iron concretions are scattered throughout the soil section, but are most abundant in the gray subsurface layer. Locally this soil is called "crawfish land" or "buckshot land."

The Robertsville silt loam occurs in relatively small areas on the terraces or second bottoms along the larger streams in various parts of the county. The largest areas are in the Meramec Valley, east of Eureka and near Valley Park. Most of the type stands from 3 to 15 feet above the adjoining first bottoms and is above overflow. A few areas along the Meramec River occur on low terraces that are inundated during high floods. On these areas the surface soil and upper subsoil are similar to the Waverly silt loam; the lower subsoil is heavier and more compact, but not as heavy as under most of the Robertsville silt loam.

The Robertsville silt loam is not a strong soil. It is injuriously affected by either wet or dry weather, and it needs abundant rains during the growing season to produce good yields. The imperviousness of the lower subsoil seems to retard any deep root penetration. Wheat and oats are the most important crops. The corn crop is rarely profitable. Timothy does well. It is difficult to get a stand of clover except in the most favorable seasons and with the use of manure and lime. Alsike clover generally grows better than red clover. Much of the type is used for pasture and hay land.

Robertsville silt loam, slope phase.—The slope phase of the Robertsville silt loam differs from the typical soil in having a brown soil and a sloping topography. It occupies the lower part of gentle slopes along small streams. This topographic position has permitted the accumulation of varying quantities of wash from the higher slopes, so that the surface soil generally is a brown or grayish-brown silt loam. The subsoil is essentially like that of the typical Robertsville silt loam, although it is less compact and contains fewer concretions.

The soil material is colluvial rather than alluvial in origin. Much of it is derived from loess material, weathered under poor drainage conditions caused by the collection of surface water from the adjoining slopes. Seeps also occur where the shale and limestone lie near the surface. Numerous areas too small to show on the map occur along many of the streams in the smoother parts of the county.

The Robertsville silt loam, slope phase, is not a highly productive soil. It is compact, difficult to work, and late to warm up in the spring, but most of it is superior to the typical Robertsville silt loam. The greater part is used for pasture. Tomatoes and small grains do fairly well. Tiling to remove the seepage water would improve the areas in many places.

Robertsville silt loam, dark-colored phase.—The surface soil of the Robertsville silt loam, dark-colored phase, is a gray to dark-gray silt loam, 10 to 12 inches deep. This grades into a subsoil of lighter gray and slightly heavier silt loam, which at a depth of about 24 inches changes to dark-gray, mottled, friable silty clay. Near areas of the Lintonia silt loam the surface soil is usually gray brown. Where the type borders on the Bremer soils, the surface is much darker than the average. The separation of this soil from the surrounding basin soils is more or less arbitrary, since the soils grade into each other over a wide area. It differs from the typical Robertsville silt loam in that the surface soil is deeper and darker, the subsoil is lighter and less compact, and its agricultural value is higher. Small rounded concretions are scattered through the soil mass.

The phase is mapped in several areas in the Florissant Basin. It normally occurs on flat areas and in the slight depressions between the Lintonia and Bremer soils. It is probable that originally the soil was the same as the Bremer silt loam, but has acquired the present characteristics because of poor drainage.

Wheat is the most important crop. Clover is grown, but not with the same success as on the brown and black basin soils. Tile drainage and the use of lime should greatly improve the productiveness of the soil.

ELK SILT LOAM.

The surface soil of the Elk silt loam is a brown to grayish-brown silt loam, becoming heavier with increase in depth. The subsoil is a light-brown silty clay, fairly compact, and mottled yellow and gray in the lower part. In small included areas, mainly in depressions, the soil is gray, somewhat like the Robertsville soils. In general, the profile of this type resembles that of the Clinton silt loam. Along the stream side of the areas, and on all the high terraces near Bonfils, the soil is brown throughout the 3-foot profile and is similar to the Memphis silt loam.

The type occurs on narrow terraces along the larger streams. It is old alluvium that has been derived from both loess and residual limestone material. The land has the same agricultural value as the adjoining lands, with which it is farmed.

Variations of the Elk silt loam include the region along the River des Peres, north of Forest Park, in the western part of St. Louis, and smaller areas bordering the Mississippi River. In the first location the valley of the river has been graded and filled with soil from the surrounding upland, and the whole has the appearance of a broad

level terrace. Similarly, part of the lowland bordering the Mississippi River has been filled in to resemble a terrace to a height above overflow. The material is mainly brown loess and city wastes.

GENESEE SILT LOAM.

The most extensive and widely distributed alluvial soil in St. Louis County is the Genesee silt loam. It is predominantly brown in color, silty in texture, and reflects to a marked degree the character of the upland soils from which it has been derived. It is many feet in depth, shows no marked difference between soil and subsoil, and as a rule has no true subsoil like that found under older soils. The content of organic matter is higher than in the soils from which it has been derived, especially below the first foot.

The surface soil of the Genesee silt loam is a brown to dark-brown, in places grayish-brown, loose, friable silt loam. Locally this material extends to a depth of several feet, but more commonly at a depth of 12 to 18 inches the color gradually becomes lighter, changing to a light brown or yellow brown, and the texture is a silt loam or silty clay loam.

There are several variations that in general are coextensive with the larger upland types from which the material is derived. Within the region of the Knox and Memphis soils, the Genesee silt loam is a dark-brown coarse silt loam that resembles somewhat a very fine loam in mellowness. The material is very loose and friable and contains much organic matter. The subsoil has the same texture as the soil, but is lighter in color, usually brown, with yellow stains. In the central part of the county the Genesee silt loam partakes more of the character of the lighter colored upland soils; it averages lighter in color and has a heavier subsoil than elsewhere. Thus in most of the type along the River des Peres and its tributaries the surface soil is a light-brown to gray-brown silt loam, and the subsoil is a brown, friable silty clay, with mottling in the lower part. This soil is not as productive as the darker variation and usually is not so well drained because of the lower gradient of the valleys. In the southern part of the county, where the stream currents are rather swift, the bottomland soil is almost uniformly a deep-brown silt loam. Where some of the small gulches issue from areas of the Union and Baxter soils, small quantities of gravel have been carried down into the larger valleys. Along the Meramec River the Genesee silt loam is more varied because it is derived from more varied materials. For the most part it is a dark-brown silt loam, with an occasional small area that is lighter in texture. The large bottom near Butler Lake consists of gray-brown silt loam that approaches the Waverly silt loam in character. In general, the higher or terracelike areas are lighter in color and have a heavier subsoil than the low bottoms, which are usually dark brown.

The Genesee silt loam in the northern and eastern parts of the county is composed principally of reworked loess from the adjoining uplands, but in the region of the Union and Baxter soils and along the Meramec River it is derived largely from the brown soils residual from limestone. As the latter are similar to the loess soils, no great difference is found in the alluvial soil. The content of organic matter deposited with the soil is not due to subsequent accumulation.

The surface of the type is nearly level, with only a gentle slope toward the streams. Areas along the smaller streams are rarely overflowed; along the Meramec River and its larger tributaries overflows occur, but are of short duration. The natural drainage is good.

The Genesee silt loam, because of its high fertility and the ease with which it can be cultivated, is one of the most valuable soils in the county. In productiveness it is equal to the better soils of the Florissant Basin. Most of the type is used in the production of the general farm crops. Corn is the leading crop, with an average yield of 40 to 60 bushels per acre. Wheat and clover are extensively grown. Alfalfa is an important crop where the land is not overflowed too frequently. In the eastern part of the county much of the type is used for truck, such as melons, potatoes, tomatoes, and celery, and large yields are obtained. In view of the adaptability of the soil, and the excellent market facilities, greater attention should be given to these crops.

The soil of this type is early, easily tilled, and rarely affected by drought. Most of the land has been kept under constant cultivation for many years, the natural high productiveness being maintained in part by new material from overflows. It is doubtful if the use of lime would prove profitable. The primary requirement for the improvement of the soil is the incorporation of organic matter by plowing under legumes and stable manure.

Genesee silt loam, black-subsoil phase.—The surface soil of the Genesee silt loam, black-subsoil phase, is a dark-brown to grayish-brown mellow silt loam similar to the surface soil of the typical Genesee silt loam. It consists of comparatively recent deposits of brown loess soil washed down from the upland, and varies from 10 to 24 inches in depth. The subsoil is a black, heavy silt loam that is similar to the surface soil of the Bremer silt loam. The present subsoil represents the original alluvial soil, which has been covered to varying depths with brown loess wash.

The soil occurs along the short tributaries of Coldwater Creek in Florissant Basin and along the small streams with relatively wide bottoms in the northeastern part of the county. It is probable that these valleys originally had poor drainage, which favored the development of the black soils. As the drainage improved and more washing of the uplands developed the present surface material was deposited. The black subsoil is buried to a greater depth in the smaller valleys and near the uplands than in the larger valleys.

This phase is a very productive soil. It is used for general farm and garden crops and produces large yields where good drainage has been provided. It is especially prized for the production of the heavier truck crops.

The greatest need of the soil is better drainage. Although surface drains tend to fill up readily, they appear to be the most practical means of improving the moisture conditions. Tile drainage is successful where proper outlets can be found.

WAVERLY SILT LOAM.

In its typical development the Waverly silt loam is a light-gray to dark-gray silt loam 8 to 12 inches deep, underlain by a silt loam of lighter color. Mottlings varying in intensity from pale-yellow

spots to brownish-black aggregates of iron oxide are usually present. Hard ferruginous concretions, like shot, occur in all the type, but are more numerous on the poorest drained areas. The soil is rather mellow and in places contains a fair supply of organic matter. The material when moist has a plastic, puttylike consistency, and on drying tends to form porous clods. When saturated, the soil is decidedly miry and the subsoil is a sticky, whitish mud.

The above description applies where the type has its most extensive development. Wherever the drainage conditions are more favorable and where there is a brown surface soil, there are few iron concretions, and mottling is confined to the lower subsoil. In general, the soil in areas of the type occurring in the northern part of the county, in the region of deep loess, is darker and more productive than elsewhere.

The Waverly silt loam embraces those areas of light-colored first-bottom soils locally known as "crawfish land." It is most extensive along streams with relatively wide bottoms in the more level section, and all of it is subject to overflow. The soil material is derived from the loessial uplands and owes its character to poor drainage. It is closely related to the Robertsville silt loam, but differs from it in its lower topographic position and the absence of a compact subsoil.

Corn is the most important cultivated crop, with yields that are variable. This soil is not well suited to red clover or truck crops, but timothy does well. Artificial drainage is the first requirement for the permanent utilization of the soil. Open ditches and tile drains give good results where overflows can be controlled. The addition of organic matter in any form will improve the physical condition of the soil, and the use of lime should prove beneficial.

HUNTINGTON LOAM.

The soil of the Huntington loam varies from light-brown to dark-brown loam to fine sandy loam, with a depth of 15 to 20 inches, where it is underlain by somewhat lighter-colored material of the same texture. Some areas show little change in color or texture within the 3-foot section. In places, usually immediately along the river bank, the texture averages a fine sandy loam. Back from the river it is heavier and approaches silt loam. Sandy strata occur at various depths through the soil section. It is characteristic river-front land and is subject to changes due to overflows.

The type occurs in narrow bands, rarely exceeding a quarter mile in width, adjacent to the Meramec River. The soil material is derived largely from the Ozark region to the west. The surface is almost level, marked by slight ridges and benches. The land is subject to overflow, but inundations are rare during the growing season and of short duration, and all of the type is successfully farmed.

Corn, which is the principal crop, yields from 40 to 75 bushels per acre. Good yields have been maintained for long periods without apparent deterioration of the soil. Alfalfa and truck crops thrive where protected from overflow. The land lies too low for the profitable production of orchard fruits. Manure and fertilizer are not used. The tendency of the sandy areas to be droughty is largely offset by the relatively high water table.

SARPY FINE SANDY LOAM.

The group of soils comprising the greater part of the Missouri River bottom belongs to the Sarpy series. The soil material has been brought down and deposited by the river and is not made up of local material, as are the alluvial soils along the small streams in the county. The Sarpy soils range in color from gray to dark brown and the various grades of material composing them are much interbedded and stratified. A feature that particularly distinguishes them from those of the smaller stream bottoms is the presence of a fine sandy substratum, which, providing subirrigation, enhances the agricultural value of the land.

The surface soil of the Sarpy fine sandy loam consists of a light-brown very fine sandy loam, 12 to 15 inches deep, slightly incoherent, and containing a fair amount of organic matter. The subsoil is lighter in color and texture than the surface soil, consisting principally of grayish-brown fine sand. Along the river bank the soil is a loamy sand, somewhat coarser than the average of the type. There are occasional streaks of silt or clay in both soil and subsoil, but the lower subsoil is nearly always a loamy fine sand.

The type is composed of comparatively recent deposits on the front lands of the Missouri River. The surface is in general level, although marked by slight ridges and depressions that roughly parallel the channel. When the river is low, the drainage is good; at high stages of the stream the type is subject to overflow. The area between Creve Coeur Lakes rarely is flooded. With each overflow there may be deposited either sand, silt, or clay, so that the texture of the soil may change from time to time.

The soil is easily tilled and fairly productive. Corn and alfalfa are the principal crops. Melons and sweet potatoes also are well suited to these areas. With a larger content of organic matter the soil would be more coherent, of better tilth, and more resistant to drought.

SARPY VERY FINE SANDY LOAM.

The Sarpy very fine sandy loam embraces the somewhat variable Missouri River bottom soils that consist largely of the finer grades of sand. The surface soil is a brown very fine sandy loam, friable and loose in structure, and containing a relatively high proportion of silt. The content of organic matter is low, so that the physical properties are determined almost entirely by the high proportions of silt and sand. The subsoil below 16 to 24 inches is generally a yellowish-brown very fine sand, with occasional layers of silty clay or sand. The substratum is a loose sand. Variations in the surface soil range from fine sandy loam to loam, the low ridges showing the coarser and the depressions the finer textures. In the area between the Creve Coeur Lakes the soil averages sandier than elsewhere.

The type is distinguished by its light texture and efficient drainage, which insure comparatively easy tillage. It is a productive soil and is highly esteemed for corn, wheat, alfalfa, potatoes, and melons. All the type is in cultivation, nearly one-half of it being devoted to alfalfa. Little or no attention is given to maintaining the productiveness of the soil, which can be improved by the occasional turning under of a crop of clover.

SARPY LOAM.

The Sarpy loam embraces the most variable of the river-bottom soils. It occupies the front lands, composed of comparatively recent alluvium that has not yet acquired permanent soil characteristics. Several areas at some distance from the river and occupying mainly long low ridges are transition areas between other types of the Sarpy series. Practically all the front land of the Sarpy loam is subject to change in character and extent with each flood.

The surface soil varies from a grayish-brown loam or fine sandy loam to a dark-brown rather heavy clay loam. The lighter areas occupy the low sandy ridges, varying from a few rods to one-fourth mile in width, and the heavy soil areas are the narrow swales or depressions between the sand ridges. The subsoil is everywhere a brown, loose, very fine sand or sandy loam. Along the river front the soil and subsoil are essentially alike.

The greater part of the type has a somewhat lower elevation than the other soils of this series, and is therefore more subject to overflow. The natural drainage is good, and the land can be plowed soon after rains or floods. The clay loam and loam areas are more productive than the light sandy areas, which are low in organic matter and less retentive of moisture. Corn is grown almost exclusively. Yields are variable even in favorable years, and range from 30 to 70 bushels per acre. Wheat and alfalfa give large yields when not injured by floods or winter freezing.

SARPY SILT LOAM.

The Sarpy silt loam consists of a brown to grayish-brown silt loam of rather light texture, underlain at about 15 to 20 inches by a brown or light-brown very fine sandy loam to light silt loam, the silt content lessening with depth until in the lower part of the 3-foot section the type usually is a loose very fine sand. On the slight elevations the soil averages a fine loam, but grades to heavy material, in places a silty clay, in the depressions.

The type occurs in the Missouri and Mississippi River bottoms. The surface is almost level. The drainage is good, except for occasional overflows. The deep, porous subsoil permits the plant roots to penetrate to a great depth, and injury from either dry or wet weather is rare.

The soil is warm, early, and easy to cultivate and is adapted to a wide range of crops. Wheat, corn, and alfalfa are the crops grown, but potatoes, melons, and truck crops do well. Aside from the occasional growing of clover and alfalfa, little attention is given to maintaining the fertility of the soil, which has been intensively farmed to grain since it has been occupied.

CASS CLAY LOAM.

The Cass clay loam consists of a dark-brown clay or clay loam, underlain at depths ranging from 12 to 30 inches by light-brown very fine sandy loam or very fine sand. The substratum is invariably a grayish, loose, very fine sand. Silt and very fine sand predominate in the subsoil, which is lighter in color and texture and more open in structure than the surface soil, the sand content being greatest

at the lower depths. The surface soil crumbles on drying out, but is plastic when wet. The type is locally known as gumbo.

The soil owes its origin to comparatively recent depositions of fine sediments from slack water over coarser deposits previously laid down by flowing water, and the thickness of the heavy surface layer varies considerably, being greater in the swales and low flat areas and thinner on the low ridges and near the river. The deeper deposits contain more organic matter and are heavier in texture than the ridge areas. The type is associated with the Sarpy soils, but differs from the latter in that it has a darker color.

The Cass clay loam is confined to the two large river bottoms, with the largest areas at Bonfils, Gumbo, and in St. Louis. It occurs in low swales and depressions, but in places, as at Gumbo, extends over the low intervening ridges. The large area near Bonfils is almost level. Most of the type is subject to overflow during high floods, and the character of the material, particularly on the low bottom near the river, is subject to change. The sandy substratum provides good internal drainage. The large area of Cass clay loam in the northern part of St. Louis has been modified by dumping and by grading for numerous railroad tracks. It is not used for agricultural purposes.

The soil is rather difficult to cultivate, but it will crumble if plowed under the right moisture conditions. Winter plowing and exposure to freezing is beneficial, and the incorporation of organic matter would improve some old lands.

The Cass clay loam is a fertile soil well adapted to corn, wheat, and clover, but because of the difficulty of working the land most of it is used for wheat. Corn is grown almost exclusively on the low areas near the river.

WABASH SILT LOAM, POORLY DRAINED PHASE.

The narrow belt of alluvial soil bordering Coldwater Creek has been classed as Wabash silt loam, poorly drained phase. It is recent alluvium that has always existed under conditions of poor drainage, and consequently is more or less variable and has not assumed definite characteristics. The surface soil consists of a dark-brown to black silt loam containing so much organic matter that it is more or less mucky. The subsoil is similar to the surface soil, but is wet much of the time. In places the soil is almost a muck, but most of it averages a deep, dark, loose silty loam.

This soil occurs in low bottoms averaging only a few rods in width and subject to overflow. The water table stands only a short distance below the surface at all times. The construction of a drainage ditch following Coldwater Creek would destroy a large part of this soil for economic use, but the unaffected areas would have improved drainage.

WABASH CLAY.

The surface soil of the Wabash clay is a black, heavy, sticky clay loam, and the subsoil is a gray or drab clay, with a few brown stains or mottlings. This soil is locally called "gumbo."

The type is mapped in scattered areas in the bottoms of the Missouri and Mississippi Rivers. It is derived from fine sediments

from standing water in old sloughs and abandoned stream beds. These depressions are from 1 foot to 5 feet lower than the surrounding soils. The surface drainage is poor, but owing to the sandy substratum that underlies all the river-bottom soils, the internal drainage is good, and all of the land can be cultivated.

The Wabash clay is a very productive soil and is farmed in conjunction with the surrounding Sarpy soils. Corn is the main crop. The yields range between 40 and 70 bushels per acre. The soil is difficult to handle, but when plowed under favorable moisture conditions it works up into a rather mellow seed bed. Drainage by means of open ditches and tile is the greatest need of the soil. The tile lines must be rather close to be effective, and good outlets can not always be found.

ROUGH STONY LAND.

Rough stony land includes the hilly and stony forest land in the southwestern part of the county. The surface is everywhere so broken and the stone content so high that cultivation is practically impossible. The fine material consists of grayish-brown heavy silt loam, passing abruptly into brown or reddish-brown silty clay, which becomes heavier with increase in depth. In general, the soil material is similar to that of the Baxter stony loam. The boundary between Rough stony land and the Baxter stony loam is an arbitrary one, but the former averages more rugged and has more stone outcrops. The south and west slopes have shallower soil and more stone than the north or east slopes. Many of the ridges and north slopes are almost stone free, but the surface is too sloping to make cultivation practicable. The difference in altitude between ridge tops and valleys in places exceeds 300 feet.

All of this type is in forest, black oak and red oak being the predominating growth. The greatest value of the land is for timber and rough pasture, although small included areas could be used for fruit. Where the Rough stony land borders on the Meramec Valley, it is occupied by club houses and summer homes, particularly between Valley Park and Eureka. It would seem that this land would attain its highest utility if used for park and forestry purposes and as recreation grounds.

RIVERWASH.

The tracts mapped as Riverwash include the low-lying land bordering the main channels of the two large rivers. They are mainly sand bars or recent accretions that lie a few feet above the normal flow of the river and are subject to frequent change in surface conditions through the deposition of sediments with each flood. Most of the material consists of light-colored fine sand, with thin streaks of dark clay or mud. In general, it is material that in time will develop into Sarpy fine sandy loam. Most of this lowland is covered with willow and cottonwood, the latter being found on the higher parts.

SUMMARY.

The St. Louis County area, including St. Louis city, is an irregular shaped area between the Missouri and Mississippi Rivers in the east-

central part of the State. It lies on the northeast edge of the Ozark region, and in its physiographic features resembles the moderately broken Ozark border adjacent to the large rivers. Approximately three-fourths of the county, including the northern and eastern parts, is prevailingly gently rolling. The southwestern part of the county is hilly and not well adapted to cultivation.

A large part of the county adjacent to the city is occupied by suburban residences, small farms, and gardens. The population of the county is 100,737 and of St. Louis is 772,897. Less than 50,000 of population are engaged in agricultural pursuits.

The mean annual temperature is 55.6° F., and the mean annual precipitation is 37.2 inches.

St. Louis County occupies a strategic position with reference to the commerce and industries of the central Mississippi Valley. This situation, together with the large area of fertile soil, favors a high agricultural development. An intensive agriculture prevails, based on trucking and general farming. The trucking industry predominates in the eastern part of the county, more than 25,000 acres being devoted to commercial truck growing. Wheat, corn, and clover are the principal crops where general farming is practiced. Not much live stock is raised, but dairying is important.

About 73 per cent of the county is in farms, and about 57 per cent is improved land. There is a tendency for the farming area to decrease with the growth of the cities and towns.

The county affords excellent opportunities for the extension of the fruit and trucking industries. There is great need for the more general use of commercial fertilizer and lime and the more careful control of soil erosion.

The upland soils of St. Louis County are predominantly brown in color, silty in texture, well drained, easily tilled, and of great depth. The principal soil material is loess, and differences in soil character are mainly due to weathering rather than to origin.

On the level ridges, where weathering and leaching are most advanced, the soils are gray in color and belong to the Marion series.

The upland brown loess soils are classed as the Knox, Memphis, and Clinton silt loams, depending on the degree of weathering that the soil has undergone. The Knox silt loam includes the Missouri River hills. It is deep, loose, and fertile. The Memphis silt loam has a brown surface soil and yellow-brown silty clay subsoil. It is the principal truck and fruit soil. The Clinton silt loam is gray brown in color, has a heavier subsoil, and is less productive than the Memphis soils.

The soils of the Florissant Basin range from black to brown in color. They include the Tama, Waukesha, Bremer, and Lintonia silt loams. All are very productive and well suited to intensive agriculture.

The Union and Baxter soils are derived mainly from limestone and include the hilly country in the southwestern part of the county. They are grayish brown in color, with yellowish-brown clay subsoils. Where not too hilly or stony, they are well suited to general farming.

The gray second-bottom soils closely resemble the gray uplands and belong to the Robertsville series.

The alluvial soils along the smaller streams are dark-brown and gray silt loams and are mapped as the Genesee silt loam and the Waverly silt loam. They comprise some of the most productive land in the county.

The soils in the large river bottoms vary from light brown to black in color, and from fine sand to clay in texture. The Sarpy soils are the most extensive and include all the lighter types. The black soils with poorly drained heavy subsoil belong to the Wabash series, and the dark soil with sandy subsoil is the Cass clay loam.

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