SOIL SURVEY OF THE BINGHAMTON AREA, NEW YORK.

By ELMER O. FIPPIN and WILLIAM T. CARTER, Jr.

LOCATION AND BOUNDARIES OF THE AREA.

The Binghamton area occupies the central part of Broome County, which is located in the south-central part of New York, adjacent to the Pennsylvania State line. The area is rectangular in outline and has a width from east to west of 13 miles and a length north to south of

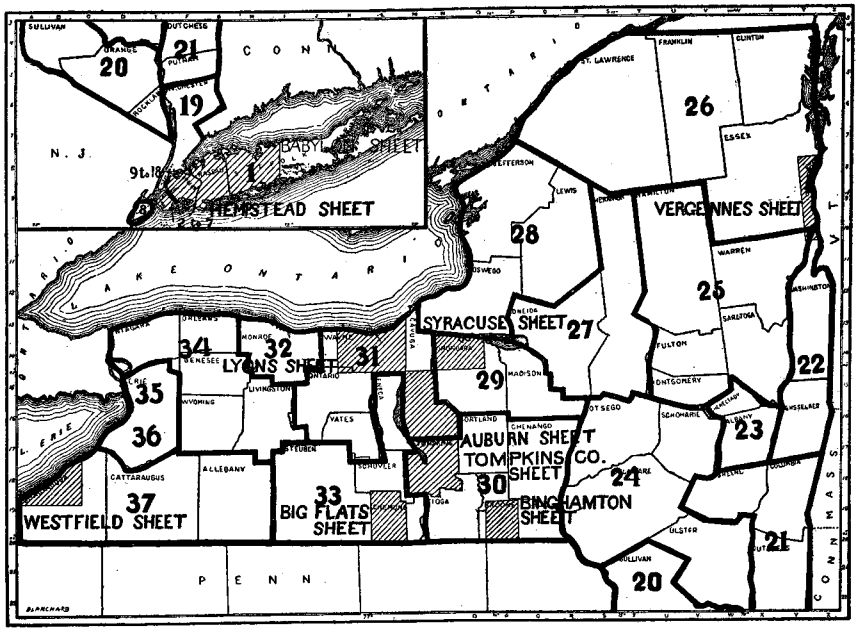

FIG. 2.—Sketch map showing location of the Binghamton area, New York.

nearly 17½ miles. It contains 146,560 acres, or about 229 square miles. It lies between 75° 45′ and 76° west longitude and 42° and 42° 15′ north latitude.

Binghamton, the county seat, has a population of about 45,000, and is situated near the center of the area, at the junction of the Chenango and the Susquehanna rivers. It is on a direct line between New York City, distant 145 miles in an air line, or 207 miles by rail, and Buffalo, about the same distance west.

HISTORY OF SETTLEMENT AND AGRICULTURAL DEVELOPMENT.

The first settlement in the area was made at Chenango, now Binghamton, in 1787, by Capt. Joseph Leonard. Broome County was organized on March 28, 1806, and in 1810 had a population of 6,524. The land came into the possession of the settlers through patents granted to various companies and persons by the General Government, following the custom of the English Government. The land surveyed was embodied in some five or six such "patents" or grants. The policy of the grantees was to promote the sale and settlement of their land. Through the agency of a Boston company many settlers came from Massachusetts, and William Bingham, of Philadelphia, who held a grant of a strip of land 1 mile wide on each side of the Susquehanna River, sent settlers to that region. The population of the county was thus mostly of English extraction and drawn from the earlier colonial settlements of Vermont, Massachusetts, Connecticut, New Jersey, Pennsylvania, and the eastern counties of New York. Among them were many soldiers of the Revolutionary war.

The chief activity of the early settlers was lumbering, and the products of the extensive forests, chiefly pine, which occupied the valleys and the uplands, were rafted down the Susquehanna River and found a market on the coast. In those early days the profit in lumber was such that agriculture held a secondary place and continued to do so until the timber was well exhausted.

Settlement was active until about the year 1825, when the Erie Canal was opened for use, and this outlet to the west led the stream of emigration to the more remote regions conveniently reached by the use of that thoroughfare. The Chenango Canal, extending from the Erie Canal at Utica to Binghamton, was opened for use in 1837 and promoted settlement in this county. It was about this time that agriculture began to be actively followed and lumbering declined in importance. The development during the next forty years was rapid and regular and was aided by the extension to Binghamton of the Erie Railroad in 1849, and of others a few years later. Cereals, hay, and potatoes were the leading crops, and later tobacco became important. In 1890, 84,100 pounds of tobacco were produced in the county, mostly in the large river valleys. After 1890 the production of tobacco declined rapidly, and during the progress of the survey only one small field was encountered. Since 1880 there has been a decrease in the area of other cultivated crops, particularly on lands outside of the main valleys, with a corresponding increase in the area of pasture. This is shown by a comparison of the following statistics, covering decennial years since 1860, as reported by the United States Census.

Acreage and production of the leading crops and the number of cattle kept in Broome County, N. Y., 1860 to 1900, inclusive.

Year.	Corn.		Wheat.		Oats.		Hay.	
	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Tons.
1860	.....	149,329	.....	67,498	.....	540,233	.....	58,072
1870	.....	202,095	.....	63,203	.....	623,661	.....	101,955
1880	9,673	281,955	6,116	77,335	22,485	728,242	92,963	100,534
1890	3,928	109,543	1,326	19,579	21,941	604,938	106,628	119,057
1900	4,895	125,860	962	15,980	20,341	559,420	97,323	91,101

Year.	Buckwheat.		Potatoes.		Tobacco.		Live stock.	
							Milch cows.	Other cattle.
	Acres.	Bushels.	Acres.	Bushels.	Acres.	Pounds.	Number.	Number.
1860	.....	116,915	.....	192,813	.....	11,000	14,313	9,230
1870	.....	136,085	.....	450,028	.....	25,642	24,649	13,001
1880	8,804	126,910	5,086	469,316	53	67,510	29,398	16,632
1890	7,259	116,279	6,204	298,418	77	84,100	28,411	10,128
1900	6,102	76,530	7,248	658,892	3	3,000	34,320	21,183

These figures show several changes in the agricultural conditions of the county. There has been a remarkable decrease in the production of grain crops since 1880. While there is a decrease in grain production, there has been an increase of 20 per cent in the number of cattle kept and an increase in dairy products. At the same time the manufacture of dairy products has been transferred from the farm to the central factory.

The decrease in the yield of crops must be attributed to the lack of proper methods of soil management. In considering these conclusions as far as yield per acre is concerned, the fact that the differences may be partly due to difference in the seasons must be kept in mind.

A beet-sugar factory was formerly located on the railroad 3 miles east of Binghamton, and was operated from 1898 until 1903, when it was discontinued and the machinery sold. It had a capacity of 500 tons of beets per day. It was unsuccessful, because the farmers adjacent to the factory could not be induced to grow enough beets to give the factory a full season's run. Beets were shipped in for a distance of 100 miles, but the freight rates prevented this practice from being profitable. It was shown that beets of good quality and giving a fair yield could be produced on the Wabash loam, Dunkirk silt loam, and, with a less degree of success, on the coarser textured soils of the region.

CLIMATE.

The salient characteristics of the climate are shown by the following table of temperature and precipitation, taken from the records of the U. S. Weather Bureau stations at Binghamton and Oxford. The lat-

ter town is near the center of Chenango County, in the valley of the Chenango River, some 20 or 30 miles northeast of the area surveyed:

Normal monthly and annual temperature and precipitation.

Month.	Binghamton.		Oxford.		Month.	Binghamton.		Oxford.	
	Temperature.	Precipitation.	Temperature.	Precipitation.		Temperature.	Precipitation.	Temperature.	Precipitation.
	°F.	In.	°F.	In.		°F.	In.	°F.	In.
January	23.4	2.23	22.5	2.83	August	67.6	3.88	65.7	4.17
February	23.5	2.72	22.9	2.59	September	61.5	3.00	58.7	3.55
March	32.8	3.13	31.3	2.83	October	49.7	3.03	46.9	3.44
April	45.5	1.97	43.9	2.93	November	38.2	2.31	35.9	2.84
May	56.8	3.16	55.5	3.95	December	27.6	2.72	27.8	2.74
June	65.9	3.48	64.2	4.24					
July	69.8	3.12	68.3	4.28	Year	46.9	34.75	45.3	40.39

The temperature as shown by these records is 1.6 higher and the rainfall is 5.64 inches less at Binghamton than at Oxford. The former city has an elevation of 850 feet, which is about 150 feet less than that at Oxford. Since both records have been taken in rather deep river valleys it is probable that they show somewhat warmer average temperatures and somewhat less precipitation than prevail on the rolling country outside of the valley, where the elevation is 1,000 feet greater.

The mean annual temperature is 46° F. and the precipitation is about 36 inches. About half of this falls in the five growing months from May to September, inclusive, and the distribution in these months is, as a rule, very uniform. In winter the weather conditions are fairly constant, with a considerable fall of snow.

The average length of the growing season at Binghamton is one hundred and fifty-three days. The latest and earliest killing frosts are May 2 and October 2, respectively. The dates of the first and last killing frosts at Binghamton and Oxford for the years 1897 to 1904, inclusive, are given in the following table. It will be seen that the length of the growing season at Oxford is on the average seventeen days shorter than at Binghamton.

Dates of first and last killing frosts.

Year.	Binghamton.		Oxford.	
	Last in spring.	First in fall.	Last in spring.	First in fall.
1897	May 22	Sept. 28	.....	Sept. 28
1898	Apr. 13	Oct. 17	May 9	Oct. 17
1899	Apr. 17	Sept. 16	May 16	Sept. 15
1900	May 11	Sept. 19	May 11	Sept. 19
1901	.....	.....	May 14	Sept. 20
1902	May 15	Oct. 10	May 21	Sept. 6
1903	May 2	Oct. 22	May 6	Sept. 30
1904	Apr. 22	Sept. 23	Apr. 23	Sept. 22
Average	May 2	Oct. 2	May 10	Sept. 23

PHYSIOGRAPHY AND GEOLOGY.

The topography of the Binghamton area is that of a very much eroded plateau region, into which the streams have cut deep valleys through a long period of time. The Susquehanna River flows diagonally across the area from the vicinity of Lestershire to the southeastern corner. Its valley varies from one-half mile to nearly 2 miles in breadth between the steep walls. At Binghamton this stream is joined by the Chenango River, which nearly bisects the upper half of the area. The highest elevations in the area surveyed lie along the Pennsylvania line, where the hilltops range from 1,700 to 1,860 feet above sea level. The river valleys lie at an altitude of about 840 feet. The hill portion of the Binghamton area is well drained by a large number of small streams, which empty into the Susquehanna River or its tributaries. Along both the Susquehanna River and the Chenango River there are small areas, lying at a slightly higher elevation, subject to occasional overflow. There are found various bottom-land areas, the lower portions of which are sometimes overflowed. Within these valleys there are also extensive stream terraces lying at elevations of 30 to 80 feet above normal stream levels and constituting valuable lands. The low-lying bottom lands are also farmed, although crops are sometimes injured or destroyed by unseasonable inundations.

The consolidated rocks which underlie the soils of the Binghamton area consist of thin-bedded sandstones and shales of the Chemung and Catskill groups. The Catskill is only found in the extreme southern part of the area and on the highest elevations. These underlying rocks, while influencing the soil conditions of the Binghamton area, have not given rise to the soils directly. This region lies near the southern limit reached by the invasion of the great continental glacier which once covered the northern part of the United States. During this glaciation the local rock, both shale and sandstone, was thoroughly ground up at the surface, and this pulverized material was mixed with a considerable amount of earth and stones brought in by the glacial ice from regions farther north. The resulting soil of the upland therefore consists of a small proportion of material of other localities, mingled with a considerable amount of detritus from underlying rock. Scattered throughout this mass of soil material are numerous fragments and chips of the original rock of the region, and this combination of glacial material and of the local material gives rise to the chief upland soil type—the Volusia silt loam.

During the period when the glacial ice was melting, large volumes of water flowed from its surface and front, occupying the main gorges which had existed before glaciation occurred. As a result the clay, silt, sand, and gravel from the glacier and from the upland regions were mingled, reworked, and redistributed as a deep filling in bottoms of the main-stream gorges. Some material had also been dumped within these gorges as a direct deposit from the ice. This morainic

material and the later deposits from the melting glacier give rise to the Dunkirk gravelly loam, the Dunkirk gravelly sandy loam, the Dunkirk fine sandy loam, and the Dunkirk silt loam. Within more recent times the overflow of the streams, as they now exist, has given rise to the deposition of a considerable amount of sediment of the more recent, low-lying bottoms, which constitute the Wabash loam. In the same way the torrential streams which descend from the uplands carry down materials which are deposited where the streams flow out upon the more nearly level surface of the valley floors. This material consists of large and small fragments of shale and sandstone and a considerable amount of finer material. This class of deposition has given rise to the Dunkirk shale loam. Poorly drained areas, both through the stream valleys and in isolated patches on the upland, have given rise to conditions favoring the accumulation of considerable amounts of partially decayed organic matter. These poorly drained areas have been mapped as Swamp and Muck.

The soils of the area have a complex origin, being formed partially from the ground-up country rock and partially from material brought into the region through glacial action. Some portion of this material has further been reworked, both by the glacial streams and by the streams which now exist, into terrace and low-lying soil. The Binghamton area is representative of a considerable section of country in southern and central New York, and the majority of the soil types encountered in this area are found both to the east and west along the southern tier of counties and also in the counties of northern Pennsylvania.

SOILS.

The soils of the area consist of one upland type, covering by far the greater part of the survey, and a number of terrace and valley types, forming the most productive farming lands. The upland soil is the direct result of a feeble glaciation of the higher hill country and is the product of the pulverization of a great variety of rocks of widely differing chemical composition and texture. Distinguishing characteristics of the type are the absence of definite structure and a generally compacted condition of the subsoil. The terrace and valley types usually show distinct stratification.

The following table gives the name and area of each of the types as mapped:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Volusia silt loam	118,976	81.2	Swamp	1,024	0.7
Wabash loam	9,280	6.3	Dunkirk fine sandy loam	832	.6
Dunkirk gravelly sandy loam	5,312	3.6	Muck	128	.1
Dunkirk gravelly loam	4,864	3.4			
Dunkirk silt loam	4,288	2.9	Total	146,560	
Dunkirk shale loam	1,856	1.2			

VOLUSIA SILT LOAM.

The soil of the Volusia silt loam consists of from 4 to 8 inches of a brown, yellow or gray silt loam containing from 10 to 25 per cent of shale fragments ranging in size from less than a quarter of an inch to several inches in diameter. From about 6 to 18 inches there is usually a lighter colored band of material of about the same texture as the soil. The lighter color of this material would seem to be the result of a change in the iron salts. The subsoil is a yellow or mottled heavy silt loam of a very compact structure. In the field it appears of a finer texture than the soil, probably because of a weaker granulation and a higher percentage of moisture under average conditions. It contains a somewhat larger proportion of shale fragments than the soil, the range in size being about the same. In both the soil and subsoil there occur occasional large shale tablets and igneous bowlders. Many of these latter are granite.

This type is by far the most important, in point of extent, in the area. It constitutes 81.2 per cent of the area surveyed, and is the only type which occurs outside of the large valleys of the two main rivers, with the exception of very small bodies of swampy land in a few places and narrow bands of an alluvial loam along some of the small streams. It is divided into three main bodies by the rivers, and the slope of each is in general toward these streams. A considerable isolated body lies between Kattel Creek and the Chenango River. In addition to these main bodies of the type there are a number of smaller isolated areas in the Susquehanna River Valley between Binghamton and Lestershire and immediately north of Kirkwood Center. These have a very much less elevation, as is shown by the map, than the great bulk of the type, just emerging from the deposits that fill the valley to a considerable height. These areas appear to be the crests of a formation which underlie much of the alluvial material, and in fact some of the areas still have a thin covering of from a few to several inches of fine silty and fine sandy loam not unlike the soils which surround them.

The surface of the Volusia silt loam is all more or less rolling, and in many places is broken. The topographic features are best understood by reference to the accompanying map. It will be seen from this that the features are those of a high plateau region that has been subjected to excessive erosion. A very complete drainage system was developed before the area was invaded by glacial ice, and the rock formations had been carved into a system of divides of varying height and width, some with narrow and others with broad intervening valleys. The divides generally have moderately to rather steep valley walls, but with few exceptions there are no precipitous slopes. These natural erosion slopes have been modified by the subsequent glacial action that formed a considerable part of the soil material,

and thus are less rugged and abrupt than would otherwise be the case. The divides are sufficiently level to permit most cultural processes to be carried on without serious hindrance, but many of the valley slopes are too steep to permit ready cultivation. The steeper areas are found throughout the type, but are more common in the southern than in the northern part of the area. On the more gentle slopes the soil covering is deep and of the average texture. On the very steep slopes the bed rock is comparatively near the surface, in some places only a few inches or a foot of soil being found. The soil here is more loose and friable, contains more stones than the remainder of the type, and is more uniformly dark colored from the presence of considerable quantities of organic matter. The subsoil is more uniformly yellow and shaly, owing to a greater proportion of purely residual material. These areas are indicated on the map by the stone symbol. They are largely covered with an inferior forest growth, consisting mainly of chestnut, hemlock, oak, and some pine. Where cleared they are used for pasture. On the more level areas of the type the same species of trees are found, but the growth is generally heavier. The native timber consisted of trees of these varieties, and the pine was particularly valuable. At present a relatively small percentage of the type is in timber, and this is all second or third growth.

The Volusia silt loam, as may be inferred from the character of the topography, has a very perfect surface-drainage system. Heavy rains are carried from the surface very rapidly by the many streams. The subdrainage is less perfect, as the dense character of the subsoil hinders greatly the movement of water—a condition often injurious to growing crops in several ways. On level or depressed areas the compact character of the subsoil is even more serious, and swampy conditions are likely to be developed. This is the origin of most of the areas of swampy lands that have been mapped in this type. The moisture that does succeed in penetrating the soil mass on the hills is in some cases led along the surface of the bed rock, appearing in the form of springs or seepage on the steeper slopes where the rock emerges. Springs of this sort are common and their flow is fairly continuous, although the volume fluctuates with the rainfall. The usual depth of wells on this type is from 20 to 30 feet. Artificial underdrainage would in many cases prove beneficial in the wet areas of this soil.

The Volusia silt loam has been derived through the action of glacial ice on a country formed of shaly rocks. The materials composing this soil are varied in character and thrown together without definite arrangement, though they consist very largely of the ground-up product of the local rocks. As is usually the case with glacial soils some foreign material was brought in by the ice, and all the soil materials were probably carried some distance before being deposited in their

present position. The covering of glacial material was undoubtedly thinner on the uplands than in the valleys, and in the higher part of the uplands than elsewhere. Erosion, moreover, has removed more of the glacial débris from such places, hence the soil is more residual in character here than at lower elevations. The soil is also more stony, owing to the nearness of the bed rock. As is indicated by borings, the glacial till varies in thickness from 30 to 50 feet on the divides to only a few inches on the steep slopes and some of the highest elevations. In the large valleys it is doubtless much deeper than 50 feet.

All but a small part of the type is cleared, though only 6 or 8 per cent of it is in cultivated crops. Of these crops potatoes succeed the best and yield from 75 to 125 bushels per acre of tubers of good eating and keeping quality. However, potatoes are a good crop on this soil only by comparison, and the type is not to be regarded as a very desirable soil for their production. Corn is grown to some extent, but does not usually mature and is used for silage. The growth is short. Root crops are not grown extensively, and vegetables only in quantities sufficient to supply home demands. Wheat, very little of which is grown, yields from 12 to 20 bushels per acre. There is a larger production of oats, of which the yield ranges from 25 to 40 bushels. Buckwheat is extensively grown, from 10 to 20 bushels being the range of yield. A small acreage of rye is sown.

Of all the crops grown grass is best suited to the soil and climatic conditions, and a very large proportion of the type is occupied by hay meadows and pastures. As a rule these lands are not carefully seeded, and the stand is often poor and weedy, consequently the yields are low, ranging from one-half ton to 1¼ tons per acre. Timothy is the principal grass, and a considerable acreage of clover is also sown, though it does not succeed well under the natural conditions of the type. It heaves seriously in winter.

Small apple orchards are found about the farmsteads, and the trees make a fair growth. Plums and berries do well, but pears and peaches give indifferent results. On the whole, little attention is given to horticultural crops. The country occupied by this type is primarily a dairy and grazing section, and most of the farmers keep herds of from 5 to 30 cows, either selling the milk to cheese and butter factories or making butter themselves, or, where conveniently situated to railways, shipping milk to local markets and to New York. The important points in the management of this soil are the adoption of suitable crops and the improvement of the tilth by the incorporation of organic matter, for the lack of which the type is often compact and droughty. Grass and root crops are the chief resources of the farmers of this section of the area, and with these the seed should be of good quality and carefully sown on better prepared seed beds. Corn may be used for silage and should be rotated with leguminous crops where

practicable. Combinations of the two make the best silage for dairy stock. This system of farming necessitates the keeping of considerable numbers of live stock, as is now done to some extent. The necessity for a carefully planned rotation can not be emphasized too much, nor can the farmers make a mistake in the use of more green manuring crops. In some areas the land should be underdrained. The depth of plowing should be increased to 8 or 10 inches once in five years, and in addition to organic manures, lime may well be used, say once in four years, and in quantities up to 1,500 pounds per acre.

The following table gives the average results of mechanical analyses of the soil and subsoil of the Volusia silt loam:

Mechanical analyses of Volusia silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
13874, 13878	Soil	4.4	5.3	0.9	1.5	6.1	55.5	26.1
13875, 13879	Subsoil	5.3	7.3	1.6	2.1	4.7	52.2	26.5

DUNKIRK SHALE LOAM.

The soil of the Dunkirk shale loam is a light-brown or yellow silty loam, 6 or 8 inches in depth, containing from 20 to 40 per cent of shale fragments. The subsoil consists of a loose mass of shale fragments varying in size from a fraction of an inch to 1 foot or more in diameter, with the interstices filled with a yellow silty to fine sandy loam. The shale fragments are generally less than 3 inches thick, and interspersed with them occur some limestone and occasional igneous bowlders. All of the rock fragments are much worn and rounded. The proportion of stone in the subsoil is usually 15 or 20 per cent greater than in the soil.

The Dunkirk shale loam occupies only 1,856 acres, or about 1 per cent of the area surveyed. It is found in small detached areas stretching along the foot of steep slopes from the upland, as at North Fenton, Kattelville, and Willowpoint; as a sort of delta formation at the mouths of small streams emerging from the Volusia silt loam, as at Stilson Hollow, in the vicinity of the State Hospital, and at a number of points along the east side of the valley of the Susquehanna, from Binghamton to the Pennsylvania State line; and in the bottoms of small valleys in the main body of the Volusia silt loam, as in the towns of Fenton, Vestal, and Binghamton.

The areas of this type in the large main valleys have the appearance of remnants of terraces and deltas, reaching outward from the walls of the valley and sloping moderately toward the streams. The slope on the side of the stream is as usual quite steep. The areas in the small upland valleys have a nearly level surface and show some terracing.

The drainage of the Dunkirk shale loam, with little exception, is good. This is due in part to position and in part to the loose, open character of the soil and subsoil. Those parts situated next to the steep slopes from the upland are likely to be poorly drained for a short distance from the base of the slope, owing to seepage from the higher lying lands. The Dunkirk shale loam is associated in origin with the drainage of the region during and since the recession of the ice sheet. It represents the wash of swiftly flowing streams which have deposited alluvial cones when their swift flow has been checked upon descending to level areas. It thus forms low alluvial cones and fans and consists of large and small stones loosely piled together. The interstitial loam is the result of the checking of mud-laden water as it moved through the porous rock mass. This is shown by the relation which the material bears to some of the finer textured types of soil, such, for instance, as the Dunkirk silt loam. Material of the same general texture as the Dunkirk shale loam passes under the Dunkirk silt loam in a number of places, and there is a very regular gradation upward from the shaly mass to the silty material at the surface. This may be observed in the cuts on the State Hospital grounds and at a number of places in the Susquehanna Valley. The high level area near Willowpoint probably represents the discharge of a superglacial stream.

The agricultural value of the Dunkirk shale loam is moderate. The more level bodies produce fair crops of corn, potatoes, and oats. Apples are found to grow well on some parts of the type, and berries also thrive. Grass, oats, and potatoes have in general been found to be the best crops on this soil. Timothy hay yields from 1 to 1½ tons, oats from 30 to 35 bushels, rye about 25 bushels, and potatoes from 75 to 100 bushels per acre. The soil is easily cultivated. It can be much improved by the use of organic manures. Near the city it is valued at $20 to $30 an acre.

The following table gives the average results of mechanical analyses of the soil and subsoil of the Dunkirk shale loam:

Mechanical analyses of Dunkirk shale loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
13856, 13858	Soil	7.5	8.6	2.4	8.1	16.6	35.2	21.4
13857, 13859	Subsoil	11.7	11.5	3.7	9.8	16.0	30.9	16.1

DUNKIRK GRAVELLY SANDY LOAM.

To a depth of about 8 inches the soil of the Dunkirk gravelly sandy loam is a light-brown or yellow sandy and silty loam. Between 8 and 15 inches the material grades into light loose gravel and coarse sand, which becomes more coarse and open and of a grayer color with

increase in depth. Below 2 feet the formation is generally a loose gravelly sandy loam, which extends to a depth of 20 or 30 feet.

The areas of the Dunkirk gravelly sandy loam are distributed along the courses of the Chenango and Susquehanna rivers, the most extensive development occurring along the former and along the Susquehanna below the junction of the two streams. The areas sometimes extend some distance up the smaller lateral valleys. The cities of Binghamton and Lestershire are situated on areas of this type of soil. The most characteristic area is in the vicinity of Lestershire, where there is a shallow sandy soil, which grades into a coarse, loose gravelly, and sandy mass, highly variable in composition and plainly cross-bedded, which reaches to a depth of many feet. Gravel derived from the formation at this place is used for various economic purposes. The surface of this area is somewhat rolling.

The point of land on which the city of Binghamton is situated and the area of this type that extends north to Chenango Bridge constitute a phase of the type which is distinguished by having a yellow silty loam soil, in many places quite free from gravel and extending to a depth of 15 to 20 inches, below which the typical gravelly material is found. The surface is more nearly level than about Lestershire. Most of the Kattel Creek Valley area belongs to this phase. The upper part of the Kattel Creek area and the areas opposite Chenango Forks and in the Page Brook Valley constitute a third phase of the type. The surface here is more uneven and is made up of large lenticular ridges and of irregular kame and kettle areas. The ridges and knolls have a coarse sandy soil with coarse gravel near the surface and with a number of large bowlders distributed throughout the material. The intervening depressions have a dark loamy soil of considerable depth. All of this phase is coarser in texture than the other two phases, and the large bowlders are often so numerous as to be a serious hindrance to cultivation. The last two phases of the Dunkirk gravelly sandy loam approach the Dunkirk gravelly loam in texture, the second more nearly than the third; but they are to be distinguished from it by the much more loose and porous nature of the deep subsoil. The areas of the type along the Susquehanna above Binghamton have rather the character of the second phase.

The Dunkirk gravelly sandy loam is essentially a terrace soil formed from the wash materials carried in the swollen streams during the melting of the glacial ice. The elevation varies from 80 to 100 feet above the level of the present rivers, and the surface from level to irregular and rough. Parts of the original terraces have been cut away by recent erosion and in these places steep slopes have been formed. Such slopes are distinct around Binghamton and in a number of places higher up the Chenango River. In some places large channels cut through these terraces are now occupied by mere threads

of streams, such, for example, as Brandywine Creek and the stream north of Lestershire.

The chief drawback to this type of soil is its excessive drainage. Being too porous to hold sufficient water to carry crops through a protracted period of dry weather, it is best suited to early maturing crops and to crops with root systems that penetrate deep into the soil. Trucking is followed extensively near the larger cities. In seasons of abundant rainfall all crops give good yield. In general, corn does fairly well and gives an average yield of about 40 bushels per acre; potatoes form a profitable crop on the more northern phase, producing from 100 to 150 bushels per acre; oats yield from 35 to 40 bushels; wheat, 15 to 20 bushels, and timothy and clover hay from one-half to 1 ton per acre. Cabbage grows fairly well on the heavier phases and such areas are most uniformly productive for crops in general.

In the matter of adaptation, deep rooting and early maturing crops must always prove the best for this type of soil. Once started alfalfa should grow well on much of the type. Where the surface soil is quite sandy, alfalfa should be protected by a nurse crop the first season to guard against the effects of excessive heat. The use of organic manure is recommended as a means of increasing and maintaining the supply of moisture.

The following table gives the average results of mechanical analyses of the fine earth of the soil and subsoil of this type.:

Mechanical analyses of Dunkirk gravelly sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
13844,13846.....	Soil.....	8.1	19.7	7.9	12.5	15.9	22.1	13.4
13845,13847.....	Subsoil.....	9.7	27.4	13.4	12.9	7.0	15.6	13.7

In order to study the manurial requirements of this soil a sample was collected from a field which has been in cultivation many years. This field has been intensely cultivated and received large applications of manure.

The results obtained indicate that the productiveness of this soil may be increased very largely by the use of cowpeas as green manure; that the application of manure or lime will produce a fair increase; that nitrate of soda will produce a small increase, but that other mineral fertilizers will have little if any effect.

Wheat plants were used as an indicator in these tests, and the results are not held to be applicable to other unrelated crops, nor to fields which have received treatment essentially different from that from which the sample was taken.

DUNKIRK GRAVELLY LOAM.

The soil of the Dunkirk gravelly loam to a depth of 8 to 12 inches is composed of a dark silty and sandy loam mingled with from 15 to 30 per cent of well-rounded gravel and pebbles ranging in size from small particles up to gravel 6 inches in diameter. The subsoil is a dark-yellow or brown gravelly loam, somewhat sandy in places, with the gravel generally increasing in quantity with increase in depth. The quantity of gravel varies in different places from 15 to 60 per cent. All of it is rounded, and a great variety of rocks is present. Shale and limestone, however, are the most common.

The Dunkirk gravelly loam is closely associated with the Dunkirk gravelly sandy loam. It is a valley type, and is found in both the large river valleys and in the small upland valleys. In the latter it forms either the bottom adjacent to the stream or low terraces but a short distance removed from it. The material here is a mass of gravelly wash with silty and sandy loam filling in the interstices between the stone and forming a thin surface covering over them.

In the large river valleys the areas are generally more extensive and occur as lateral terraces or remnants of terraces. These areas range in elevation from 20 to about 100 feet above the river, and therefore correspond very closely in general position with the Dunkirk gravelly sandy loam. This part of the type must be regarded as having been formed at the same time and under the same general conditions as the other gravelly type, and is distinguished from it mainly by the much more loamy character of the soil and its consequent higher crop values. It grades into the Dunkirk gravelly sandy loam in many places, so that parts of the two types are very similar in character. The typical materials, however, are easily distinguished. In the Chenango Valley above Binghamton the soil varies from the type in having a silt loam soil containing very little gravel and ranging in depth from 10 to 20 inches over a large part of the area. The upper part of the soil has a characteristic dark color which changes to yellow with depth. It is essentially an overlapping of material of the Dunkirk silt loam on the gravelly formation. Below the silt the proportion of gravel gradually increases.

The topographic features of the Dunkirk gravelly loam consist of flat-topped terraces sometimes varied by low, rounded ridges and knolls, with moderate slopes near the edge of the terrace where erosion has been active. Along the river this type is frequently set off from the Wabash loam by a nearly vertical slope with a change in elevation of from 10 to 50 feet.

With very few unimportant exceptions the drainage is good. This is assured by the deep porous subsoil which permits the easy passage of water. The upland areas are likely to be flooded in times of high water, but practically none of the type in the main valley suffers in

this way. The origin of the Dunkirk gravelly loam has been touched upon in the discussion of its distribution. It was formed from deposits left by swiftly flowing streams and may be divided into two phases on the basis of the time of formation. The upland areas and some of the low-lying bodies in the large valleys are of recent origin, while the remainder of the type is probably older and represents the deposits from glacial floods. The process of formation in the two cases has been essentially the same, and the resulting material is of nearly the same character and crop value.

Chief among the crops is corn, which yields on an average 35 to 45 bushels per acre, with larger yields in specially favorable seasons and under the best cultural methods. Potatoes do fairly well, and yield from 100 to 200 bushels. The more silty areas give fairly good yields of cabbage and tomatoes. Adjacent to the large cities the soil is used for trucking, and in seasons of ample rainfall gives good results. Small fruits, peas, beans, and other truck crops are grown. Cucumbers, squashes, and pumpkins are also satisfactory crops. For celery the type is not so well adapted. Hay crops in general are poor. Timothy and clover are short lived. While no alfalfa was seen, it is believed that on a large part of the type the conditions are very favorable for its growth, more favorable in fact than on any other type in the area surveyed. Manures and fertilizers have marked beneficial effects, and in all cases the results are best in moist seasons.

The following table gives the average results of mechanical analyses of the fine earth of this soil.

Mechanical analyses of Dunkirk gravelly loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
13870, 13872.....	Soil.....	2.5	4.4	2.4	21.1	25.0	29.6	14.5
13871, 13873.....	Subsoil.....	6.0	10.8	3.0	18.4	21.5	27.4	12.6

For the purpose of ascertaining to what extent this soil would respond to treatments with manure and various chemical fertilizers, a large sample was taken at a point about 1½ miles north of Port Dickinson. The field from which the sample was taken had been in cultivation for over fifty years, during which time no mineral fertilizers had been used, and only medium applications of stable manure made. Notwithstanding the long period of cultivation and the fact that no fertilizers had been used, this field was in excellent condition and producing corn at the rate of 50 to 80 bushels per acre, potatoes at the rate of 200 bushels per acre, and hay at the rate of 1½ to 2 tons per acre.

The results obtained on this soil by the wire-basket test indicate that a small increase in productiveness may be obtained by the use of

stable manure. Mineral fertilizers consisting of sulphate of potash, acid phosphate, nitrate of soda, and lime failed to produce any appreciable increase in the growth of plants, whether these ingredients were used separately or in combination. Wheat plants were used in this test, and to what extent the results are applicable to other crops and to fields which have received different treatments is a subject for further investigation.

DUNKIRK FINE SANDY LOAM.

The soil of the Dunkirk fine sandy loam is a brown or yellow fine sandy loam, about 8 inches in depth, and of rather silty character. It contains from 3 to 15 per cent of shale fragments and gravel. Below 8 inches the material is a yellow or dark-gray fine sandy loam, which becomes coarser in texture with depth, and is of medium grade at 36 inches below the surface. The subsoil material is usually underlain by a more gravelly stratum, except where it joins with the areas of Volusia silt loam, in which case it rests on the glacial till.

The Dunkirk fine sandy loam is found entirely in the valley of the Susquehanna River, and the main areas lie west of Binghamton. Other small areas occur southeast of the State Hospital. It has a medium elevation, occupying a terrace between the level of the Wabash loam and the gravelly loam types, and is generally associated with the Dunkirk gravelly sandy loam.

The surface has a gentle slope and the drainage is good, the chief deficiency from an agricultural viewpoint being the insufficient supply of moisture even in moderately moist seasons.

The material composing the Dunkirk fine sandy loam is an alluvial deposit, probably laid down at the same time as the gravelly loam types into which it grades. It represents deposition from much slower currents than gave rise to the coarser textured soils.

The Dunkirk fine sandy loam is of little agricultural importance for the reason that much of it lies within city limits. It is really the best early truck soil in the area, and is used for this purpose south of Lestershire. Corn, potatoes, cabbage, turnips, onions, and hay give from low to medium yields. The potatoes are of fine quality. Asparagus and lettuce do well. The crop-producing power is much increased by a generous use of organic manures and careful cultivation.

The following table gives the average results of mechanical analyses of this type of soil:

Mechanical analyses of Dunkirk fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
13860, 13862.....	Soil.....	1.5	5.3	4.1	26.1	25.1	26.3	11.3
13861, 13863.....	Subsoil.....	1.9	7.0	5.4	31.0	24.0	20.2	10.1

DUNKIRK SILT LOAM.

The Dunkirk silt loam consists of a brown or dark-gray silty loam 8 inches deep, underlain by a yellow silt loam. The soil is generally loose and friable, and the lower part of the profile is more dense and clayey. There are generally some shale fragments and gravel, ranging from 2 to 15 per cent, scattered through the soil and subsoil. Examination of a number of cuts shows that the silt is generally underlain by a shaly or gravelly material at a depth of from 2½ to 5 feet. In some of the areas lying in the western part of the survey the proportion of fine sand becomes more noticeable.

The gravelly or shaly material generally underlying the soil often outcrops on the lower slope, forming a narrow strip of gravelly or shaly soil. Since in most cases these are too small to be mapped separately they are included with this type. In the Kattel Creek Valley the material mapped as Dunkirk silt loam rests upon extensive gravel formations at a depth of 4 feet, and the surface soil gradually thins out toward the center of the valley without a marked change in the level until the gravel comes almost to the surface. The shaly strips along the borders of the areas of this soil type are of common occurrence in the Susquehanna Valley.

The Dunkirk silt loam forms second terraces in the large valleys at the foot of slopes covered by the Volusia silt loam. The elevation seldom exceeds 1,000 feet, this contour usually marking the upper limit of the type. Its elevation above the river level is therefore from 20 to 100 feet. It is distributed in rather elongated areas along the borders of the valleys of the Susquehanna and Chenango rivers, the greater extent in the former southeast of Binghamton. An area of some size occurs across the river from Chenango Forks.

In general the slope of the surface is from the upland Volusia silt loam toward the gravel and loam types along the river. The slope is not steep, the gradients ranging from 1 to 5 per cent, so that cultivation is in most cases easy. The drainage is not always good. Where the silty material is deepest the surface is generally more nearly level and there is a tendency for the water to collect. Some of the areas have a decidedly clayey subsoil, and this further retards subdrainage. In most instances this condition may be remedied by artificial drainage.

The Dunkirk silt loam is of alluvial origin, and seems to have been formed at the close of the glacial period through the deposition from slow-moving water of the finer grades of material. At that time the central part of the valleys was probably in most cases occupied by a mass of ice, which during the later periods, when the volume of water had diminished, deflected the drainage to the sides, and the materials were there deposited in the same way as additions are being made to the Wabash loam at the present time. The lighter color of the Dun-

kirk silt loam and the lower organic matter content may be attributed to the much longer period of oxidation and decay to which it has been subjected.

The Dunkirk silt loam is probably the leading trucking soil of the area, excelling the Wabash loam, which is nearly as valuable a soil for truck, mainly because of its better drainage. It is naturally a less productive soil than the Wabash loam, but on some of the well-managed truck farms, where manure and fertilizer are generously applied and cultivation is thorough, corn yields from 75 to 100 bushels; potatoes, 300 bushels; cabbage heavily, with 95 per cent of good marketable heads, and carrots, turnips, and beets in proportion. Tomatoes give yields of 600 to 700 bushels per acre, and asparagus is fairly productive. The celery grown compares favorably with the best produced in the area, whether grown on the Wabash loam or the Muck soils of this region, and in some respects is superior, since it is less damaged by rust. Under the best conditions onions yield from 500 to 700 bushels per acre.

On these intensively cultivated truck farms from 2 to 3 tons of hay is secured per acre, but these yields are far from being the average on the type. Probably the average yields on the type as a whole would be less than half as great. The higher figures show what may be obtained by the best cultural methods, and demonstrate among other things the efficiency of heavy applications of manures and painstaking cultivation. Nearly all the manure used on the truck farms is brought from the city and well fermented before use.

In addition to the crops mentioned, the berry fruits and apples give good results. Alfalfa was growing in two places on the type and apparently doing well. Good yields of sugar beets of high sugar content have been produced on this type of soil, but the crop is not grown at present.

The following table gives the average results of mechanical analyses of the soil and subsoil of the Dunkirk silt loam:

Mechanical analyses of Dunkirk silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
13850, 13854.....	Soil.....	0.4	2.2	1.1	7.1	19.5	50.9	18.7
13851, 13855.....	Subsoil.....	.5	2.3	1.6	8.9	21.2	49.5	15.1

WABASH LOAM.

The Wabash loam consists of a dark-brown or black loam to silty loam from 10 to 18 inches in depth, underlain by a dark-yellow fine loam, extending to a depth of several feet. The texture of the soil varies somewhat, owing to the presence of more fine sand in parts

lying next to the streams and of finer grained and heavier materials along the bluffs and away from the streams.

The Wabash loam is a river and stream bottom type and is distributed throughout the survey. The most extensive areas lie along the rivers, but narrow strips occur on many of the smaller streams. The type is characteristically developed in the valley of the Susquehanna, west of Binghamton, and in the Chenango Valley as far north as Chenango Bridge. In the area southeast of the State Hospital the soil is composed of lighter colored material, is slightly heavier in texture, and has a greater elevation above the river than in the parts just mentioned. Opposite Langdon, in the town of Kirkwood, the material has the texture of a clay loam and is mottled or gray in color.

In general the surface is only slightly elevated above the mean water level of the streams—the range in elevation being from 3 to 30 feet—and is nearly flat. Some of the lower parts are scarcely above the water level, and a large proportion of the type is subject to overflow during periods of high water. The light-colored phase, already described, is not subject to overflow.

Because of its low position the Wabash loam is subject to poor drainage conditions, often making it unsuited for deep-rooted crops, while with other crops injury occasionally results from inundations. In most parts of the areas tile drains would be effective in correcting this condition, and particularly valuable in hastening the drying of the soil after floods. By reason of its more open texture and greater elevation that part of the type next to the stream is generally the better drained. Several islands in the channel of the river are sufficiently above water level to permit cultivation, and in some instances are farmed.

The Wabash loam represents the most recent alluvial deposits of the streams along which it occurs. It is well adapted to the production of corn, and under good management and with ample applications of manure and fertilizer it yields from 75 to 100 bushels per acre. The average yield is probably about 40 bushels per acre. The typical dark-colored soil is the most productive, although its moist, cool nature requires a longer season for the maturity of crops than is the case on the gravelly and sandy types, and crops maturing in the fall are therefore more likely to be injured by frosts. The yield per acre of oats is 40 bushels, of timothy and clover hay from 1½ to 3 tons, of onions from 500 to 800 bushels, and of carrots sometimes as high as 1,000 bushels. Cabbage and tomatoes give good returns, and celery and asparagus are grown with fair success. Early potatoes produce better than late potatoes, and yields of 300 bushels per acre are sometimes secured. One hundred bushels is probably not far from the average yield on the type as a whole. In the vicinity of Binghamton the Wabash loam is extensively used for the production of truck crops,

and for this purpose commands a price of $150 to $250 an acre. More remote parts are valued at trom $50 to $100 an acre.

The only field of tobacco (Connecticut seed leaf) grown in the area in the season of 1905 was on this type of soil. It would yield about 1,600 pounds per acre. The tobacco, which was formerly grown more extensively, is of fair quality and grades largely as binder. The present output is used in the manufacture of cigars at Binghamton. Sugar beets were formerly grown extensively on this soil and with good results, both as regards the yield and the quality of the product. Their production has been discontinued because of the removal of the factory.

The following table gives the average results of the mechanical analyses of the soil and subsoil of the Wabash loam:

Mechanical analyses of Wabash loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
13864, 13866.....	Soil.....	1.2	1.8	1.1	5.1	18.6	50.9	20.8
13865, 13867.....	Subsoil.....	.5	1.1	1.2	5.3	19.7	51.4	20.5

A study was made of this type of soil to determine its responsiveness to different manurial treatments, using the wire-basket method. The sample selected for this purpose was made up from samples taken from a field 1½ miles northwest of Lestershire. This field has been under cultivation for a long time, but no fertilizers except small amounts of stable manure have been used.

From the results obtained it was found that either manure or a complete fertilizer would give a fair increase in productiveness and that nitrate of soda and sulphate of potash combined would give results almost as good. Sulphate of potash and acid phosphate, nitrate of soda and acid phosphate, sulphate of potash alone, and lime alone gave only a very small increase, while cowpeas and nitrate of soda seemed to effect no improvement in the soil conditions.

MUCK.

A half dozen small bodies of Muck are found in the area surveyed. The material to a depth of 15 inches or more consists of a mass of black or very dark brown organic matter which in a moist condition is of a fine pasty consistency. Most of the material is so thoroughly decomposed that the original plant tissues can not be distinguished, and it is therefore in a fair condition for the production of crops.

The areas of true Muck are situated in the valley near Binghamton. In a number of areas mapped as Swamp the soil is of a very dark color, owing to the presence of large quantities of organic matter, but

the accumulations are so shallow and contain such large proportions of inorganic material that the soil can not be properly classed as muck.

The Muck areas owe their origin to deficient drainage conditions, which favor a rank growth of aquatic and kindred plants and the accumulation of their remains in a partially decomposed form. While some attempts have been made to drain these areas, they have not been sufficiently thorough and more drains and outlets are required to put this soil in condition for the production of maximum crops. Without exception the areas of Muck are so situated that drainage is possible at a cost that would be economical.

The present poor drainage condition results in low crop yields, as well as in rather poor quality of the crops grown. Celery, onions, cabbage, potatoes, corn, and hay are the principal crops. Celery is subject to rust. Timothy is a profitable crop, yielding from 1½ to 2½ tons per acre.

SWAMP.

Areas of Swamp occur throughout the survey in small bodies associated with all the other soil types. They represent a condition of deficient drainage rather than a distinct soil difference. All these areas have considerable accumulations of organic matter at the surface, but in general the mineral constituents are like those of the surrounding types. The surface soil is generally a dark or black loam, rich in organic matter, beneath which occurs an impervious loam of varying texture. The cause of deficient drainage varies with the area. In the uplands the areas are depressed below the general level of the surface and receive more or less drainage water from the surrounding land. In the valleys many of the areas occupy abandoned river and stream channels, and while some of them contain water only during periods of rainfall, others are covered with water throughout the year.

None of the areas of Swamp are at present cultivable, and all require drainage if they are to be of any value except for a little summer pasture. Some areas could be drained at a small cost, but most could be reclaimed only at an expense which would hardly prove profitable.

AGRICULTURAL METHODS.

In the large river valleys within 6 or 8 miles of Binghamton the farms are devoted largely to the production of truck crops and small fruits. In the valleys outside of this limit more grain is produced, and on the uplands, where the Volusia silt loam is practically the only type of soil, hay and dairy farming are the principal lines of agriculture.

As a rule the truck farmers follow better and more thorough methods than the general farmers. The soils used in the production of truck crops are usually more easily worked, the area cultivated is smaller,

the profits per acre are larger, and the nearness of the cities enables the farmers to obtain large quantities of stable manure at low cost. All these factors tend to intensive practices and soil improvement.

A great variety of truck crops is produced and find ready sale in the local markets. Frequently two crops are secured from the same land in one season, early spring crops being followed by late fall crops, such as potatoes, cabbage, turnips, and in some cases celery.

The heavy draft on the soil in the production of such rotations, as well as the special requirements of many of the crops, makes necessary the careful cultivation of the soil and the use of large quantities of manures and fertilizers. The land is plowed to a depth of 6 to 9 inches and well pulverized, and where manure is used it is spread on the surface before plowing. Many of the truck growers employ teams regularly in hauling manure from the city, and the quantity applied ranges from 20 to 50 tons per acre. This manure is bought mostly from livery stables and contains a relatively large proportion of straw or other bedding material. A few near the city arrange for the dumping of the street cleanings on their land. The most careful growers ferment the manure in compost heaps before applying it to the land. Experience has shown that the liberal use of manure not only maintains the soil in good physical condition, but also increases its productiveness from year to year. Commercial fertilizers are used by some of the truck growers in quantities ranging from 100 to 1,000 pounds per acre, the maximum quantity only in special cases. Various complete mixtures are used, as well as single constituents. Nitrate of soda is frequently applied in the later stages of development of some crops, and is said to be especially helpful in the production of onions.

Celery is grown most largely on the Dunkirk silt loam, and late potatoes do best on this type; while for tomatoes, cabbage, and small fruits it is regarded as a very satisfactory soil. All of the early crops are planted on this type in preference to the Wabash loam, which is better adapted for onions and cabbage. On the gravelly soils the same crops are grown and much the same methods employed. The use of manure is particularly beneficial, as it increases the power of these soils to retain moisture, droughtiness being their main deficiency.

Onions are grown from the seed and thinned to about 1 dozen plants to the foot. Much hand weeding is required in the culture of this crop. In harvesting all the weeds and rubbish are removed from the land, the tops are clipped, and the roots cut with a shallow running blade attached to plow handles, when the onions may be raked together in windrows. They are generally left on the ground to dry, though a few growers spread them on racks under cover, which is said to give better results. Onions so cured and dried will weigh from 50 to 52 pounds to the bushel.

The truck farms range in size from 10 to 40 acres, and several of them have good-sized greenhouses in which lettuce and cucumbers

are grown in winter. Six crops of lettuce and two of cucumbers may be obtained during the season. Two or three growers are engaged in the production of ginseng roots. These are grown under sheds consisting of frames 8 feet high covered with open lathwork. The Wabash loam and the Dunkirk silt loam are the soils used. The roots mature in seven years from the planting of the seed, and weigh from 6 to 8 ounces each. They are cured by drying and are worth at present $8 a pound.

In upland farms all but about 6 or 8 per cent of the land is kept in grass and used for grazing and for hay. Nearly every farmer keeps a few cows, the usual number ranging from 5 to 15, while in some cases the herds contain as many as 40. The area of cultivated land is limited to the small acreage sowed to corn, almost all cut for silage, a relatively unimportant acreage devoted to potatoes, and the practically negligible extent covered by a small garden grown to supply vegetables for home use. Potatoes do relatively much better than corn. The grass lands are seeded about once in three years with a mixture of timothy and clover, in the proportion of 4 quarts of clover to 8 of timothy per acre, the quantity of clover seed being smaller than usually recommended because of its high price and the fact that on this soil the plant is short lived. Almost all the hay is fed on the farm. A large number of farmers supply milk to cheese and butter factories at convenient points in the county. There is also a considerable number who make butter for sale in Binghamton and adjacent towns. This practice is also followed by those farmers who supply milk for the factories during the summer season and who have some cows that produce during the winter months. The manure produced in the upland sections is carefully preserved and generally applied to the land planted to corn. Very little commercial fertilizer is used, the average expenditure per farm in the whole county being only $7. Plowing is generally to the moderate depth of 4 to 6 inches and tillage operations in general are capable of improvement.

AGRICULTURAL CONDITIONS.

The leading truck growers in the vicinity of Binghamton are making money, though the larger number probably do not clear any considerable amount above their living expenses. In the uplands the farmers are said to be generally quite free from debt, but with net incomes usually less than in the case of the truck growers. Throughout the area the farms are generally well kept and improved with good buildings, the Twelfth Census giving the average value of buildings per farm for the county as $1,107. The average value of farm lands is $18 an acre. In the Volusia silt loam areas the price of land ranges from $8 to $35 and is very much lower than in the valleys. In the valleys from $30 to $150 is the general range, though in special

cases the price has reached $250 for the Wabash loam in exceptionally good condition and advantageously situated with respect to markets. The price of small areas in good cultural condition is generally higher than for larger areas.

The tax rate on farm property is regarded as high. It ranges from $1 to $2 per hundred, and it is said that the land is frequently assessed at more than it would bring at a forced sale. All of the upland farm land has decreased at least half in value within the last twenty-five years, a decline due at least in part to its less productive condition. According to the returns of the last census, which, though given for the county as a whole, apply quite as well to the area surveyed; 95 per cent of the area of the county is in farms, the remaining 5 per cent being nonagricultural lands in cities or held for speculation. Seventy-four per cent of the area in farms is improved.

The average size of farms for the county is 94.6 acres. In the Volusia silt loam regions the farms range from 60 to 250 acres, with an average of about 140 acres. In the valleys, where truck farms are most common, many of the farms contain less than 40 acres, and the general average is less than 94.6 acres.

A little over two-thirds of the farms are operated by the owners. Where valley farms are rented a cash rental is commonly charged, the rate for good trucking land in some cases being as high as $20 to $25 an acre, and probably averaging 10 or 12 per cent on the value of the land. In the upland sections the farms are more often rented on shares, the usual basis being one-half the crop where the tenant pays half the seed bill and the taxes and furnishes the labor, tools, and machinery. In some cases the landlord furnishes the cattle, such as dairy cows, and feed for the work animals, and pays half of the fertilizer bill where fertilizers are used. Where a money rent is given in the uplands the rates range from 85 cents to $1.25 an acre and is commonly $1 an acre. The system of share farming has come into use through the difficulty of securing labor. It is a plan for securing interested labor. How little labor is employed is shown by the fact that the average expenditure per farm for this item is only $57 a year. The work is mostly done by the farmer, with the assistance of his family. Laborers are not generally hired by the month, though the wage for such hands varies from $18 to $25, with board and lodging. Scarcely any labor is hired in the winter months. In the summer season day laborers are to be had at $1.50 and board. Help is easier to secure on the truck farms because of the nearness to the city, and a considerable number of laborers are employed, both by the day and by the month.

The important crops of the area, their relative acreage, and the average production per acre, as shown by the Twelfth Census, are given in the table on the following page.

Principal crops, proportional acreage, and yields of leading crops for Broome County, N. Y.

Crop.	Proportion of farm lands occupied.	Production per acre.[a]	Crop.	Proportion of farm lands occupied.	Production per acre.[a]
	Per cent.	*Bushels.*		*Per cent.*	*Bushels.*
Truck crops	0.22	.....	Forage	1.50	[b]6.43
Wheat	.23	16.6	Potatoes	1.74	91.00
Rye	.34	14.2	Oats	4.80	27.50
Corn	1.17	25.8	Hay	23.4	[b].94
Buckwheat	1.50	12.50			

[a] The average acre value of truck crops is $80. [b] Tons.

This table shows that only 11.5 per cent of the area in farms is occupied by other crops than grass, and that a considerable larger area is occupied by oats than by all other grains. Also that the grain, forage, and root crops cover about one-half as much area as is devoted to the production of hay, and that the two classes of products taken together occupy a little more than one-third of the area in farms. The remaining two-thirds is devoted chiefly to grazing, but includes, of course, the woodland. Eighty-nine per cent of the total area covered by the crops designated in the above table is devoted to crops which are fed on the farm.

Animal products, chiefly dairy products, with some wool and meat, form the principal output of the area. The average value of live stock on the farm is $480 and of dairy products $260. A considerable quantity of milk is shipped to New York City from points on the Erie Railroad, which runs a number of special milk trains that gather milk all along the line through the State, some of it coming from as far north as St. Lawrence County. In regions too remote from the railroad to permit daily shipment the milk is made into butter and cheese. Some butter is made on the farm and sold to regular customers in the local towns, but most of the milk is taken by the factories. Butter factories are situated at Maine, Kirkwood, Glen Aubrey, and Glencastle. The cheese factory at West Windsor made 38,200 pounds of cheese in six months, from May to October, 1904, inclusive, and in the same year the factory at North Fenton made 160,000 pounds in a 200-day run. The cheese factories are said to give slightly better prices for milk than the butter factories.

In and adjacent to the valley the transportation facilities furnished by the two main lines of railroads are very good. The wagon roads in the valleys are generally good, and a number of the more important are macadamized. In the uplands the roads, all of them made of local materials, are kept in good repair, and are fairly satisfactory, and care is exercised in the maintenance of bridges. The roads are, however, very hilly, which makes it necessary to reduce the size of loads, thus greatly increasing the cost of marketing the products of this part of the

area. Aside from this insurmountable drawback the facilities of marketing are good. The local markets show an active demand for the special crops, and there is, moreover, a large demand for all kinds of truck, dairy, and fruit products in the mining regions of Pennsylvania, only a short distance south of the area.

As a whole, the general agricultural conditions in the Binghamton area are better than in some other parts of southern New York, where much the same soil conditions are found. The number of vacant houses is very much less on the Volusia silt loam area than in some other parts of the State where the same type of soil prevails; in fact, very few abandoned farms are to be seen. The rural free delivery of mail has been very generally extended, as has also telephone systems, so that there is much less isolation in the rural districts than formerly.

NRCS Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.