

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF CHEMISTRY AND SOILS
In Cooperation with the New York State College of Agriculture

SOIL SURVEY
OF
COLUMBIA COUNTY, NEW YORK

BY

H. G. LEWIS, U. S. Department of Agriculture, in Charge,
and D. F. KINSMAN, New York State
College of Agriculture



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COUNTY SURVEYED

Columbia County is in the southeastern part of New York. The southern boundary is about 100 miles north of New York City. The county is bounded on the west by Hudson River and on the east by the State of Massachusetts. It is roughly rectangular, its east-west dimension being approximately 20 miles and its north-south dimension 36 miles. It comprises 638 square miles, or 408,320 acres.

The base map used in this survey includes all or parts of the Copake, Catskill, Millbrook, Sheffield, Pittsfield, Berlin, Kinderhook, and Coxsackie topographic quadrangle sheets of the United States Geological Survey.

Physiographically, Columbia County consists of the western part of the Taconic Mountains and the eastern part of the Hudson lowland, a northern extension of the Great Appalachian Valley. The Hudson lowland is an uneven or moderately hilly lowland. The unevenness is due in part to dissection by Hudson River and its tributaries and in part to the varying resistance to erosion of the underlying rocks, though a minor factor is the varying thickness and method of accumulation of the glacial deposits scattered over this area. The shales and slates of the underlying rocks are comparatively resistant, and the limestone beds are less so. Harlem Valley, in the southeastern part of the county, owes its existence to the comparatively rapid erosion of the underlying limestone.

Hudson River lies at sea level. A few areas of tidal marsh and some made land are the only first-bottom lands along the river. The bluff between the level of the river and the Hudson lowland which lies to the eastward is comparatively steep and broken and in many places is very abrupt.

Harlem Valley ranges from $1\frac{1}{2}$ to more than 5 miles in width and extends from North Hillsdale in a southerly direction through Copake to Boston Corners and to Ancram on the southwest, where the valley narrows down. The elevations range from 500 to 800 feet above sea level. The lower-lying lands are smooth, gently sloping, or undulating, and the upper slopes are gradual or gentle, though some steep slopes occur in places. The valley gives way on both sides to steep and mountainous lands.

The higher-lying lands between Hudson River on the west and Harlem Valley on the east are gently rolling, rolling, or steep and

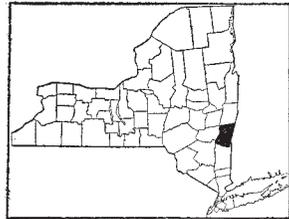


FIGURE 48.—Sketch map showing location of Columbia County, N. Y.

broken in places. The smaller valleys and lower slopes are more gently rolling or undulating. This strip of rolling or hilly land extends through the towns of Livingston, Gallatinville, Copake, Hillsdale, Claverack, Austerlitz, Canaan, New Lebanon, Chatham, and Ghent. Along the main drainage courses the surface is more gently rolling, sloping, or nearly level. The surface of the uplands between the streams is generally steep and broken.

The elevation of the higher-lying divides of the hill section ranges from 400 to 600 feet along the western edge to 800 to 1,000 feet in the central part. The slopes are more gradual in the central part and steeper and rougher on the higher-lying areas. The crests of most of the ridges are comparatively sharp, though some are more gentle and some areas are comparatively broad and smooth.

The Taconic Mountains are along the eastern border of the county, the New York-Massachusetts State line being located near the crest of the range. These mountains include the roughest land and highest points in the county and have a maximum elevation of nearly 2,000 feet above sea level.

Columbia County was organized from a part of Albany County in 1786. The first settlements were made in the northern part of the county, near Claverack Landing and Kinderhook. The first was made by the Dutch Government, and Dutch families later settled in various parts of the county. The first permanent settlement was made about 1655 near Claverack Landing. In the eastern part of the county the first settlements were made about 1750 by families from Connecticut. A large part of the southern portion of the county was included in the patent of Livingston Manor. In 1710 a large settlement of German Palatines was made in the present town of Germantown, along Hudson River. In 1760, emigrants from Massachusetts and Connecticut formed a settlement in the northeastern part of the county, in the town of New Lebanon.

According to the United States census, the population of the county in 1920 was 38,930, of which 24,475, or 62.9 per cent, were classed as rural. The density of the rural population, exclusive of villages having a population of 2,500 or more, is 38 persons to the square mile. The population of the county in 1880 was 47,928, of which 36,584, were classed as rural. In 1900 the population was 43,211, of which 33,683 were classed as rural.

Hudson, the county seat, is located on Hudson River, about halfway between the northern and southern boundaries. The city is a manufacturing center. It had a population of 11,745 in 1920. Chatham, in the northern part of the county, has a population of 2,710 and is a railroad center and factory town. Clermont, Livingston, and Germantown, small settlements in Hudson Valley in the southern part of the county, serve as trading points for the fruit and general farming belt. Stottville, Stuyvesant Falls, Kinderhook, Valatie, North Chatham, Stockport, and Niverville, settlements in the northern part of Hudson Valley, serve as trading centers. Copake, Ancram, Hillsdale, and Copake Falls are settlements in Harlem Valley. There are several settlements along Kinderhook Creek and Wyomanock Creek in the northern part of the county. Philmont, Ghent, and Claverack are in the west-central part of the county. Philmont and Ghent might be called in the central part, as they are not over 2 miles nearer the Hudson River than the Massachusetts line.

The density of the rural population varies with the character of the country. Hudson and Harlem Valleys and other smooth areas near railroads are well settled. The hill lands or more mountainous areas are thinly populated, as much of the land is unsuited to farming. The mountainous country and the sections around the lakes are used for summer homes and camps during the summer months.

With the exception of the higher hill lands and the more mountainous areas, the county is well supplied with railroads. The New York Central Railroad, the Boston & Albany Railroad and a branch of that line, the Rutland Railroad, the Harlem Division of the New York Central Railroad, and a line of the Central New England Railway traverse the county. The Albany & Hudson Electric Railroad connects Hudson with Albany. Boats on the Hudson River serve as carriers of freight for the western part of the county. A very large volume of freight is handled by motor trucks, both to Albany and New York City, as well as to the east into Massachusetts. The populated rural sections are reached by rural free delivery of mail and by telephone. The rural sections are well supplied with schools, and grade and high schools are maintained by the cities and villages.

The manufacturing centers in the county serve as local markets for much of the farm products. The dairy products, mainly milk, and fruits are shipped mainly to New York.

CLIMATE

Columbia County has a temperate climate with marked seasonal extremes of heat and cold and with regional variations in temperature and precipitation from the hill section, or more mountainous eastern part of the county, to the valley lands along Hudson River. The precipitation of the mountainous section is slightly higher than that of the valley lands, and the variations of temperature are greater.

The winters are rather long and severe. The average depth of snowfall at Chatham is 54.6 inches. The summers are pleasant but usually are short. July and August are usually the hottest months, but short periods of intense heat may occur at any time between the middle of June and the middle of September. Periods of intense cold may occur during the winter months, but they are usually of short duration.

The average date of the last killing frost at Chatham is May 9 and of the first is October 4, giving an average frost-free season of 147 days. The latest spring frost recorded was on May 27, and the earliest in the fall was on September 11. The frost-free period is slightly longer along the Hudson River Valley than at Chatham and slightly shorter in the mountainous sections of the eastern part of the county. Cool, wet spells in the spring or fall shorten the growing season.

As a rule the precipitation is fairly well distributed throughout the year, and crops seldom suffer for lack of moisture during the growing season. At Chatham the mean precipitation for the summer months is 11.78 inches and for the winter months is 7.60 inches.

Table 1, compiled from the records of the Weather Bureau station at Chatham, is fairly representative of conditions in the central part of the county. The hill section, or more mountainous area in the eastern part of the county, usually has more snowfall and colder weather than this station.

TABLE 1.—Normal monthly, seasonal, and annual temperature and precipitation at Chatham

[Elevation, 470 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1908)	Total amount for the wettest year (1903)	Snow, average depth
	° F.	° F.	° F.	Inches	Inches	Inches	Inches
December	26.4	64	-20	2.74	1.56	2.60	10.2
January	23.2	65	-18	2.37	2.29	1.67	11.0
February	22.0	57	-24	2.49	2.76	2.61	14.1
Winter	23.9	65	-24	7.60	6.61	6.88	35.3
March	33.9	81	-9	3.09	2.04	3.51	12.8
April	45.9	90	16	3.66	1.82	2.05	3.0
May	57.3	96	24	3.11	3.77	1.25	Trace.
Spring	45.7	96	-9	9.86	7.63	6.81	15.8
June	65.2	99	34	4.08	3.10	10.86	0
July	71.3	103	42	3.77	2.87	8.15	0
August	68.5	100	38	3.93	2.57	7.30	0
Summer	68.3	103	34	11.78	8.54	26.31	0
September	61.9	95	20	3.49	.81	1.72	0
October	51.5	86	20	3.36	2.25	6.87	Trace.
November	38.0	71	8	2.28	.66	2.45	3.5
Fall	50.5	95	8	9.13	3.72	11.04	3.5
Year	47.1	103	-24	38.37	26.50	51.04	54.6

AGRICULTURE

All of the land in Columbia County was originally forested. The early settlers cleared small patches of land to grow corn and wheat. The agricultural development was rather rapid, and to-day agriculture is well organized and highly developed. Fruit raising and general farming have developed mainly in the western part of the county, and the production of hay and forage crops, in conjunction with dairying, mainly in Harlem Valley and the hill section of the county.

In 1880 there were 3,145 farms in Columbia County, with an average of 130 acres. The succeeding decennial census reports show a steady decrease in the number of farms, and in 1920 there were only 2,580 farms in the county. During this period the average size of the farms remained nearly constant, varying from 130 acres in 1880 to 132 acres in 1920. The acreage of improved land in farms fell about 9 per cent. Values of all forms of farm property have shown steady and substantial increases, the total average value of \$7,132 in 1880 increasing to \$9,601 in 1920.

There has been very little change in the proportion of farms operated by owners, tenants, and managers.

Table 2, compiled from the census reports, gives the acreage and yields of the six principal crops of Columbia County by decades from 1879 to 1919.

TABLE 2.—*Acreage and yield of farm crops in stated years, 1879-1919*

Crop	1879		1889		1899		1909		1919	
	<i>Acres</i>	<i>Bushels</i>	<i>Acres</i>	<i>Bushels</i>	<i>Acres</i>	<i>Bushels</i>	<i>Acres</i>	<i>Bushels</i>	<i>Acres</i>	<i>Bushels</i>
Rye	42,493	468,584	35,012	438,818	28,451	364,080	18,280	230,195	17,153	202,262
Oats	29,070	724,719	25,593	595,777	19,910	465,260	21,369	503,088	16,946	359,949
Corn	22,211	537,196	17,042	357,372	18,477	438,600	17,385	410,576	12,371	404,709
Buckwheat.....	8,624	128,878	4,604	55,710	4,619	69,830	4,456	81,037	3,849	60,066
Potatoes.....	7,481	579,421	4,000	144,141	3,183	230,280	3,144	232,702	2,745	168,539
Hay and forage	90,197	<i>Tons</i> 97,207	100,736	<i>Tons</i> 106,360	99,143	<i>Tons</i> 95,341	179,730	<i>Tons</i> 167,434	167,006	<i>Tons</i> 174,800

The principal sources of farm income in this county are shown in data from the census report of 1920 on the farm products of this county given in Table 3.

TABLE 3.—*Sources of farm income*

Product	Value	Product	Value
	<i>Dollars</i>		<i>Dollars</i>
Cereals	1,570,506	Livestock and products:	
Other grains and seeds	2,591	Animals sold and slaughtered (estimated).....	946,048
Hay and forage	1,867,416	Dairy products, excluding home use	1,543,555
Vegetables	632,923	Poultry and eggs	600,815
Fruits and nuts	2,951,099	Wool, mohair, and goat hair.....	36,143
All other crops.....	711	Total.....	10,151,807

The total value of all farm products in 1919 had increased from \$5,240,949 in 1909. This increase in the value of farm products is largely in fruits and nuts, with considerable increase in the value of dairy products.

According to the 1920 census report, hay and forage crops led in acreage among the various classes of crops. Timothy and clover mixed occupied the greatest acreage, followed by other cultivated grasses, then by timothy alone. The acreage in clover alone was 1,787 acres and in alfalfa 305 acres. Hay crops are produced on all soils in the county, but the silt loam and silty clay loam soils are more productive of these crops than the sandy and coarse sandy soils.

Cereal crops rank second to hay and forage crops in acreage. In 1919, 17,153 acres were planted to rye. The acre yield was less than 12 bushels. The acreage devoted to this crop has been decreasing in the last few years, owing to reduced yields and a lessening demand. In 1919, 16,946 acres were planted to oats and yielded 359,949 bushels, or approximately 21 bushels to the acre. The acreage of this crop has been decreasing in the last few years. In 1919, 12,371 acres were planted to corn and yielded 404,709 bushels, or approximately 31 bushels to the acre. There were 3,849 acres planted to buckwheat in 1919, and a yield of 60,066 bushels, or slightly more than 16 bushels to the acre, was obtained. The acreage of potatoes has been decreasing. In 1919 potatoes yielded approximately 62 bushels to the acre. A few acres are planted to beans, which yield less than 10 bushels to the acre. The acreage of vegetables is comparatively small, although most of the farmers produce enough for home use. Wheat yields about 17 bushels to the acre.

Dairying is carried on in conjunction with general farming in all parts of the county but especially in the western part and in Harlem Valley in the southeastern part. The larger part of the forage crops is fed to dairy animals, and some mixed feeds are shipped into the county. Approximately 75 per cent of the dairy cattle are Holstein-Friesians. Dairy products rank second in the value of agricultural products of the county. Most of the milk is shipped to New York City. There are 2 cheese factories in the county and 11 or more milk stations. Approximately 75 per cent of the milk produced is shipped out as whole milk.

The value of the fruit crop is approximately one-third of the total value of all the agricultural products of the county. The principal commercial fruit-producing sections of the county are in the vicinity of Hudson, Germantown, Claverack, Stuyvesant, and Kinderhook. The climatic conditions along Hudson River and extending back from the river for as much as 6 miles are favorable for fruit growing. Fruit, especially apples, is grown in almost all parts of the county for home use, and there are some commercial orchards in the more favorable locations in the hill section. The acreage of fruit in the county is approximately 21,000 acres.

Apples, the fruit most extensively grown, cover approximately 12,000 acres. The principal varieties are Baldwin, Rhode Island Greening, Wealthy, McIntosh, Ben Davis, Northern Spy, Tompkins King, Hubbardston, Oldenburg (Duchess of Oldenburg), Alexander, and Gravenstein. About 75 per cent of the trees are bearing and are in good condition. The young orchards are planted to corn, berries, and other crops. The largest part of the apple crop is shipped by boat to New York City.

In 1919, 224,966 bushels of pears were harvested in the county. The principal varieties are Bartlett and Kieffer, but some Clapp Favorite and Seckel are grown. Approximately 3,600 acres are planted to pears.

More than 1,000 acres were in cherries in 1919, when the yield was 15,925 bushels. Both sweet and sour cherries are grown. The principal varieties of sour cherries grown are English Morello, Montmorency, and Early Richmond, and of sweet varieties are Napoleon and Windsor.

In 1919 approximately 700 acres were devoted to peaches. There were more than 20,000 bearing trees which yielded 14,462 bushels. The principal varieties are Elberta, Early Crawford, Champion, Hale Early, and Greensboro. Peaches are grown most extensively near Hudson and Claverack. Approximately 200 acres of plums and prunes were grown in the county in 1919.

In 1919 approximately 1,300 acres were devoted to grapes, which yielded 3,179,551 pounds. The acreage planted to this crop is gradually increasing. Most of the grapes are Concord, but some Worden and other varieties are grown.

In 1919 approximately 500 acres were devoted to the production of small fruits, including strawberries, dewberries, blackberries, raspberries, and currants.

The livestock of the county consists largely of dairy cattle. Most of the hogs raised are required to supply pork for home consumption. The principal breeds are Duroc-Jersey, Berkshire, and Chester White. The number of sheep in the county has decreased largely from that

of several years ago. The principal breeds are for mutton, the Shropshire predominating.

Poultry and eggs produced in the county in 1919 had a value of \$600,815, according to the 1920 census. There are only a few poultry farms, but poultry raising is a side line on most of the farms. The demand for poultry products is good, and poultry raising could profitably be extended.

Climatic conditions, topography, and location with respect to markets are important factors in the development of the agriculture of the county. The climate along Hudson River is favorable for fruit growing and in this belt most of the fruit for commercial purposes is grown. Harlem Valley is well suited and situated, with reference to markets, for raising hay crops and for dairying. The belt back of the Hudson River Valley is well suited for hay and forage crops, and in this belt dairying with general farming, is carried on. The hill section is not so favorable in soil conditions, climate, and surface relief as the other parts of the county, and farming here is not so well developed.

Much of the hill section and the mountainous areas in the eastern part of the county are forested with oak, pine, and some chestnut. Most of the virgin timber has been cut, and the present stand is second growth. The rougher, more mountainous areas are best suited for forestry.

Crop rotation is commonly practiced by the better farmers. The general crop rotation is corn, oats, hay crops, and clover, or clover and timothy left from two to four years. In the central part of the county and in the vicinity of Chatham the general rotation is corn, rye for two years, and then hay crops. In some localities the rotation is corn, buckwheat, oats, and then hay crops from two to four years.

The use of lime is increasing, and in 1922 approximately 4,500 tons of ground limestone were shipped into the county from Dover Plains and West Stockbridge, Mass. Lime is applied on rye and oats that are to be followed by clover or alfalfa. Some lime is used for pasture improvement in the dairy sections. In Harlem Valley only a little lime is used, as the soils are not so acid as in some of the other parts of the county.

The value of organic matter in the soil is realized, and all available manure is spread on the land and green cover crops are plowed under to increase the humus content. Commercial fertilizers are used in increasing quantities. According to the 1920 census, \$142,738 was spent for fertilizers, or an average of \$101.92 a farm on the 1,400 farms reporting. Fertilizers are used for wheat, corn, rye, and oats, and in orchards.

There is a general recognition of the adaptation of soils to crops. Hay and forage crops are grown on most of the soils. The fruit belt, along Hudson River, includes silty clay soils as well as gravelly and sandy loam soils. The pear trees are planted largely on the heavier-textured soils. The gravelly and sandy loam soils are well suited to vegetables and potatoes. The heavier soils in the western part of the county are well adapted to hay.

As a whole, the farm buildings are kept in good condition and the farmers are prosperous. In the hill section some farms have been abandoned because of unfavorable soil and climate and the remoteness from markets.

In 1919, \$840,529 was spent for feed on 2,210 farms. This was an average expenditure of \$380.32 to the farm. The principal feed bought is mixed feed for dairy cattle.

An average of \$671.69 a farm was spent for farm labor in 1919, according to the 1920 census. Farm labor is rather scarce, and the farmer can hardly compete with the manufacturing centers in wages. Day laborers receive from \$2 to \$3, and monthly wages vary from \$40 to \$75.

The 1920 census reports that in 1919 the average land value was \$24.86 an acre. The values vary widely over the county. The producing orchard lands sell at prices ranging from \$400 to \$500 an acre, and general-farming land in the same localities sells between \$100 and \$200. General-farming land in the Hudson River Valley sells at prices ranging from \$40 to \$100 an acre. Much of the hilly land is held for the timber growth, and the selling price is from \$5 to \$25 an acre. The selling price of the rolling uplands, where general farming in conjunction with dairy farming is carried on, is from \$20 to \$50 an acre. Some of the higher-lying hill lands that are farmed principally to hay sell at prices ranging from \$10 to \$30 an acre. Lands in Harlem Valley, where farming is carried on extensively, vary in price from \$35 to \$75 an acre, depending on the improvements and location.

SOILS

The well-drained soils of Columbia County are predominantly light colored; that is, the dry surface soils in cultivated fields are a shade of light brown or grayish brown. The subsoils are generally brown or yellowish brown and are heavier in texture than the surface soils. The substrata, consisting of the unweathered parent materials, are variable in both chemical and physical composition, ranging from gravel and sand of mixed lithologic composition to heavy, silty clay. The surface soils and subsoils are the products of weathering under a temperate and humid climate and a dense forest vegetation. The rainfall is sufficient to maintain, for much of the year, a downward movement of water which has leached the soil materials of soluble salts, including lime carbonate, to a depth of 2 or more feet, and further leaching is in progress. The accumulation of organic matter, mostly leaf litter and leaf mold, under the forest cover was largely on the soil rather than within it, and to this is due the light color of the surface soils.

The poorly drained mineral soils of the county are generally very dark grayish brown to a depth of 8 or 10 inches and are mottled or dull gray below that depth. Under conditions of poor drainage, organic matter accumulated and was preserved in the soil. Many small, very poorly drained depressions are partly filled with accumulations of organic matter composed of disintegrating plant remains preserved by water from complete decay. On a considerable total acreage of land in the county the drainage conditions are intermediate between well drained and poorly drained. In such areas the soils are intermediate between the dark-colored, poorly drained soils and the lighter-colored, well-drained soils, in the color of the surface soil and subsoil and in the quantity and composition of the organic matter.

The parent materials of the soils of Columbia County are extremely variable, and because of the comparatively shallow weathering their

characteristics are preserved to an important extent in the present soils. They are largely glacial drift, which consists partly of heavy-textured and compact, unsorted till; partly of loose, light-textured, gravelly and sandy till; partly of heavy, silty clay lacustrine deposits; and partly of loose, assorted, water-laid materials. In some areas, however, the parent material, wholly or in part, is residual from hard rock. Most of the glacial drift is composed of slate and shale débris, with some limestone material in Hudson River Valley and Harlem Valley and a little igneous rock material in places. The bedrock is largely shale and slate, and it is from these local rocks that most of the drift has been derived.

Soils may be classified or grouped on the basis of one of many characteristics or on the basis of combinations of characteristics. In the soil survey of Columbia County the soils have been classified into soil types on the basis of properties which could be determined by examination and by simple tests in the field. These properties include such physical characteristics as the arrangement and thickness of the soil layers from the surface downward, texture, color, consistence, and structure, and such chemical characteristics as the presence or absence of lime, organic matter, and acids, and the mineralogical composition of the material so far as can be determined in the field. The soil types have been grouped into soil series on the basis of similarity of all characteristics, except that of texture of the surface or topsoil. The differences in topsoil texture which distinguish the soil types within a soil series are indicated in the soil type name. Soil series are arbitrarily given names derived generally from the topography of the region in which they are first recognized, such as Hoosic, from Hoosic River. Hoosic loam indicates a soil having all the features of the Hoosic soils and a loam surface texture. Hoosic fine sandy loam possesses similar characteristics, except in surface texture, which is fine sandy loam rather than loam. Minor variations within a soil type are designated as phases.

In Columbia County 21 soil series, embracing 36 soil types, 7 phases, and 6 types of miscellaneous materials, including muck, were mapped. For convenience, in briefly describing the soil series, they may be arbitrarily arranged in groups, as indicated below:

1. Soils derived from water-laid materials, lying above stream overflow and containing little or no lime in the parent material. This group includes the soils of the Hoosic, Merrimac, Ghent, Claverack, Hinckley, and Otisville series.

The Hoosic soils are characterized by brown, light-brown, or grayish-brown surface soils underlain by lighter-brown or yellowish-brown material, then by grayish-brown or gray materials consisting almost entirely of slate. The lower part shows stratification or assortment of materials. There is little or no compactness of the soil material. The members of this series mapped are the gravelly loam, with its alluvial-fan phase, gravelly fine sandy loam, coarse sandy loam, loam, and fine sandy loam, with its steep phase.

The soils of the Merrimac series have light-brown or grayish-brown surface soils, yellowish-brown upper subsoil layers, and brownish-gray or gray lower subsoil layers. The substratum consists of stratified rounded gravel and sand, mostly igneous rock material. Merrimac gravelly loam was mapped.

The surface soils of the Ghent soils are typically brownish gray or gray and are underlain by highly mottled gray, yellow, and rust-brown, more compact material. The substratum consists of stratified beds of silt and fine sand. Ghent silty clay loam was mapped.

The Claverack soils have brown or grayish-brown surface soils, yellowish-brown or yellow, friable, fine sandy loam subsoils, and gray, compact impervious clay substrata. Claverack fine sandy loam was mapped in this county.

The surface soils of the Hinckley soils are typically light brown or yellowish brown and are underlain by yellowish-brown or yellow friable material. The lower part of the subsoil is grayish-brown or gray friable material. The substratum consists of stratified beds of sand and gravel and contains little or no lime. There is little or no compactness in the soil material. Hinckley gravelly loam occurs in Columbia County.

The surface soils of members of the Otisville series are brown, light brown, or slightly chocolate brown when moist. The upper subsoil layers are brown or slightly reddish brown, and the lower subsoil layers are lighter brown, grayish brown, or gray in the lower part. The substrata consist of assorted gravel and sand. Lime carbonate may occur on the gravel in the substratum. The surface and subsoil layers are commonly poor in lime. The soil material is friable throughout. Otisville gravelly sandy loam and Otisville gravelly loam were mapped.

2. Soils derived from water-laid materials with some lime present in the parent material. This group includes the soils of the Hudson, Copake, and Groton series.

The surface soils of the Groton soils are typically brown, light brown, or grayish brown when dry. The upper part of the subsoil is lighter brown or brown, and the lower part is grayish brown or gray. The soil material is friable throughout. The substratum consists of stratified deposits of rounded gravel derived partly from limestone. Groton gravelly loam was mapped.

The Hudson soils have light-brown or grayish-brown surface soils and brown or grayish-brown subsoils, in which the gray color becomes more pronounced with depth. The subsoil material is heavy and firm. The substratum or parent material shows the presence of lime. Hudson silty clay loam, with an eroded phase, Hudson fine sandy loam, and Hudson silt loam were mapped in the county.

The Copake soils have brown or light-brown surface soils and lighter-brown or yellowish-brown subsoils which become more gray in the lower part. The soil is very gravelly in the lower part, and the substratum consists of gravel which contains some free lime. These soils occur in close association with the Pittsfield soils in the southeastern part of the county. Copake gravelly loam and Copake fine sandy loam were mapped.

3. Soils derived from deep, unassorted glacial till and containing lime in the parent material. This group includes the members of the Stockbridge and Lyons series.

The surface soils of the Stockbridge soils are brown or light brown, the subsoils are yellowish brown and friable in the upper part and more compact in the lower. The substratum consists of gray or

greenish-gray partly weathered glacial till. Stockbridge loam and Stockbridge stony loam were mapped.

The surface soils of the Lyons soils are typically dark grayish brown or gray when dry. The upper part of the subsoil is grayish brown, brownish gray, or slightly mottled gray, yellow, and rust brown, and is more compact than the surface soil. The lower part of the subsoil is dull-gray or drab mottled compact clay. Lyons silty clay loam was mapped.

4. Soils derived from deep glacial till material, unsorted and containing no lime. This group includes the soils of the Gloucester and Bernardston series.

The surface soils of the Gloucester soils are typically brown or grayish-brown loose friable material, and are underlain by lighter-brown or yellowish-brown loose friable material. The lower part of the subsoil grades from grayish-brown into gray partly weathered glacial till, composed largely of granitic material. There is little or no compaction in the soil. Gloucester stony loam was mapped.

The surface soils of the Bernardston soils are commonly grayish brown, and the subsoils are yellowish brown or grayish and are compact. The parent material consists of dark-gray compact till. The soils are acid in reaction. Bernardston gravelly loam was mapped.

5. Slightly calcareous soils derived from thin glacial till over hard rock. This group includes the soils of the Pittsfield and Cossayuna series.

The surface soils of the Pittsfield soils are typically brown or grayish brown and are underlain by lighter-brown, reddish-brown, or yellowish-brown upper subsoil layers, and by grayish-brown or gray lower subsoil layers. There is slight compaction in the subsoil. The stony loam, gravelly loam, and gravelly loam, shallow phase, members of the Pittsfield series were mapped.

The surface soils of the Cossayuna soils are brown or grayish brown, and the subsoils are friable and grayish brown or yellowish brown. The reaction of the soil layers is variable, but in most places lime is present in the substratum. Cossayuna gravelly loam, with a shallow phase, was mapped.

6. Soils derived from shallow or deep till material, influenced to some extent by the underlying bedrock and containing little or no lime. This group includes the soils of the Dutchess and Mansfield series.

The surface soils of the Dutchess soils are typically light brown, yellowish brown, or grayish brown and are underlain by yellowish-brown or yellow friable material. The lower part of the subsoil is grayish brown or gray. There is little or no compaction in the soil. The loam, gravelly loam, gravelly silt loam, slate loam, shallow phase, and stony loam, with a shallow phase, members of the Dutchess series were mapped in Columbia County.

The surface soils of the Mansfield soils are typically dark grayish brown or nearly black. The upper part of the subsoil is highly mottled gray, yellow, and rust brown, and the lower part is dull gray. The subsoil material is compact and heavy. Mansfield silty clay loam was mapped in this county.

7. First-bottom soils. This group includes the Ondawa, Livingston, Hotaling, and Saco soil series.

The Ondawa soils are characterized by light-brown or grayish-brown surface soils, by lighter-brown or yellowish-brown slightly more compact subsoils, and by gray stratified sand and gravel substrata. The silt loam and loam members of the series were mapped in the county.

The Livingston soils are associated with the Ondawa soils, occupying poorly drained depressions in the stream bottoms. The surface soils are very dark colored, and the subsoils are heavy and mottled. Livingston silty clay loam was mapped.

The Hotaling soils consist typically of grayish-brown surface soils underlain by lighter-brown or brownish-gray material, and in turn by gray fine sand. There is little or no compactness in this soil. Hotaling loam was mapped.

The surface soils of the Saco soils are typically brown or grayish brown in color and are underlain by mottled gray, yellow, and rust-brown more compact materials. The substrata consist of stratified sand and rounded gravel. Saco silt loam and Saco silty clay loam were mapped.

8. Soils derived from organic matter. This group includes muck, as mapped in this county.

Muck in this county is commonly more than 3 feet thick. The surface soil is dark brown or nearly black and is well decomposed. The next layer consists of brown or nearly black less well-decomposed material which commonly continues to a depth of several feet.

9. Miscellaneous soils and conditions. This group includes meadow, rough stony land, steep broken land, tidal marsh, and made land. These soils represent topographic conditions rather than definite soil types.

Table 4 gives the names, acreage, and proportionate extent of the soils mapped in Columbia County; the accompanying soil map shows their distribution; and the following pages are devoted to a discussion of them.

TABLE 4.—Acreage and proportionate extent of soils mapped in Columbia County New York

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Hudson silty clay loam.....	16,320	} 5.3	Dutchess stony loam.....	8,808	} 2.3
Eroded phase.....	5,312		Shallow phase.....	728	
Hudson silt loam.....	9,280	2.3	Bernardston gravelly loam.....	7,424	1.8
Hudson fine sandy loam.....	2,112	.5	Gloucester stony loam.....	1,792	.4
Hoosic gravelly loam.....	26,304	} 6.9	Groton gravelly loam.....	3,584	.9
Alluvial-fan phase.....	2,048		Otisville gravelly loam.....	16,256	4.0
Hoosic fine sandy loam.....	1,984	} .6	Otisville gravelly sandy loam.....	960	.2
Steep phase.....	256		Hinckley gravelly loam.....	192	.1
Hoosic gravelly fine sandy loam.....	3,904	1.0	Lyons silty clay loam.....	1,152	.3
Hoosic loam.....	3,284	.8	Ghent silty clay loam.....	384	.1
Hoosic coarse sandy loam.....	5,120	1.2	Mansfield silty clay loam.....	2,752	.7
Claverack fine sandy loam.....	2,304	.6	Ondawa silt loam.....	9,728	2.4
Copake gravelly loam.....	5,056	1.2	Ondawa loam.....	3,520	.9
Copake fine sandy loam.....	256	.1	Livingston silty clay loam.....	2,304	.6
Merrimac gravelly loam.....	768	.2	Saco silt loam.....	1,152	.3
Cossayuna gravelly loam.....	30,016	} 8.8	Saco silty clay loam.....	576	.1
Shallow phase.....	6,400		Hotaling loam.....	320	.1
Pittsfield gravelly loam.....	6,656	} 1.8	Muck.....	3,520	.9
Shallow phase.....	704		Meadow.....	15,808	3.9
Pittsfield stony loam.....	12,864	3.1	Rough stony land.....	56,832	13.9
Stockbridge loam.....	10,240	2.5	Steep broken land.....	1,344	.3
Stockbridge stony loam.....	4,352	1.0	Tidal marsh.....	896	.2
Dutchess gravelly silt loam.....	1,408	.3	Made land.....	192	.1
Dutchess gravelly loam.....	7,232	1.8			
Dutchess loam.....	50,048	12.3	Total.....	408,320	-----
Dutchess slate loam, shallow phase.....	53,888	13.2			

HUDSON SILTY CLAY LOAM

The surface soil of Hudson silty clay loam, to an average depth of 8 inches, is light-brown or yellowish-brown smooth silty clay loam. When dry it has a decidedly grayish-brown color in cultivated fields. The upper part of the subsoil, to a depth varying from 12 to 15 inches, is typically slightly mottled yellow, gray, and rust-brown silty clay loam, which grades into compact, heavy silty clay or clay having a brown or slightly pinkish color streaked with rust brown. In most places near a depth of 3 feet there are some streaks or accretions of light-gray lime material. The subsoil is compact and plastic when wet and is more or less impervious to the movement of the soil water. The gray color of the material commonly increases with depth, and near a depth of 3 feet it is in many places decidedly gray. The mottled or slightly mottled layer immediately below the surface soil, indicating a lack of proper drainage, is very pronounced, especially in the flatter areas. Where the surface is slightly rolling this mottled layer is not well developed and in some places is entirely lacking.

The clay and silt deposits from which this soil was derived vary in thickness from 5 to 50 or more feet. The material was deposited in glacial Lake Albany which covered this part of the county at or near the close of the glacial period. The level of this ancient glacial lake was a few hundred feet above the present level of Hudson River. The surface soil is acid or very acid, and lime is not present above a depth varying from 3 to 5 feet.

This soil occurs in the western part of the county in Hudson River Valley, on broad, plainlike areas. The surface for the most part is smooth or gently sloping, but some areas are flat or nearly level. The more extensive sloping or broken areas were mapped as an eroded phase of this soil. The relief is favorable to intensive cultivation. Surface drainage, for the most part, is fair or good, though some of the flatter areas do not allow the run-off of surface waters. Internal drainage is generally retarded by the compact, impervious subsoil. The soil is fairly retentive of moisture. It is rather hard to manage under cultivation as it can not be plowed when too wet or too dry.

The surface soil of Hudson silty clay loam is poor in organic matter and lime. Some of the areas would be improved by more thorough drainage by tile or open ditches.

Originally all of this soil was forested, but at present 90 per cent or more of it has been cleared and is used for hay and pasture land and for the production of general farm crops and fruit.

Dairying is the most important branch of agriculture on this soil. The leading crops are timothy and clover, but some alfalfa, corn, oats, and other grains are grown. Hay crops do well and yield from 1½ to 2½ tons to the acre. Corn produces from 30 to 50 bushels of grain and from 10 to 15 tons of silage to the acre. Oats do well, yielding from 25 to 40 or more bushels to the acre. The pasture lands furnish good grazing for dairy cattle. Some of this soil along Hudson River and in the vicinity of Germantown is devoted to the production of fruit, and trees do well. More pears are being planted on this soil of late, as it seems well adapted to them.

The current selling price of Hudson silty clay loam varies from \$40 to \$75 an acre and is much more if the land is planted to fruits.

Hudson silty clay loam, eroded phase.—This phase of soil includes the steep, eroded slopes of Hudson silty clay loam. The surface soil

consists of light-brown or grayish-brown silty clay loam or silty clay, ranging in thickness from 2 to 6 inches. The surface soil is not so deep as in the typical soil, as erosion has removed much of the soil material. The material is granular when dry. The upper part of the subsoil is compact, slightly mottled gray, yellow, and rust-brown clay loam or clay. On the steeper slopes this mottled condition rarely occurs, and the surface soil grades into brown, reddish, or slightly pinkish compact, heavy clay loam or plastic clay. Just above a depth of 3 feet the material is commonly brown or grayish brown and contains some lime streaks or accretions. There is little or no stone or gravel in this soil.

This soil is rather extensive in the western part of the county. It occurs along the breaks from the Hudson Valley plain to Hudson River and along the drainage courses coming from the upland. The soil material is similar to that of the typical soil. The land is too steep and broken to be used for farming. At present it is used entirely for pasture lands and for growing small timber.

HUDSON SILT LOAM

The surface soil of Hudson silt loam in cultivated fields is typically light grayish-brown or brownish-gray smooth silt loam to a depth of 7 inches. It contains little or no gravel or stone. The upper part of the subsoil, to a depth varying from 12 to 18 inches, is mottled gray, yellow, and rust-brown silty clay loam or silty clay. The lower part of the subsoil is brownish gray or gray and contains some lime streaks or accretions in the lower part. The substratum is dull-gray plastic compact silty clay or clay.

The soil material of Hudson silt loam, which is similar to that of Hudson silty clay loam, was laid down in waters of glacial Lake Albany. Like Hudson silty clay loam the surface soil is poor in organic matter and lime.

Areas of this soil are gently sloping, undulating, or nearly level. On the more level areas the mottling in the upper part of the subsoil is more pronounced. Drainage, for the most part, is poor. The relief is not sufficient to allow good run-off of surface waters, and the compact, impervious subsoil does not permit good internal drainage.

Hudson silt loam occurs in several areas in the western part of the county in the Hudson River Valley. Most of it is farmed in the same way as the silty clay loam of the same series, with results that are similar. Land values are comparable to those of Hudson silty clay loam.

HUDSON FINE SANDY LOAM

The surface soil of cultivated Hudson fine sandy loam, to a depth of 6 or 8 inches, is light-brown, yellowish-brown, or grayish-brown fine sandy loam. It is loose and friable and is easy to till. Some small shale fragments are present in places, but as a whole the surface soil is free from gravel or stone. The upper part of the subsoil, to a depth of 20 or 25 inches, is yellowish-brown or pale-yellow, loose, friable fine sandy loam or sandy loam. The lower part of the subsoil, to a depth of 3 or more feet, is grayish-brown, brownish-gray, or gray sandy loam or coarse sandy loam, slightly more compact than the material above. The substratum, to a depth of several feet, consists of stratified beds of sand, coarse sand, and rounded gravel.

The soil material consists of deposits of fine sand and some coarser and finer sediments, deposited by water. It is poor in organic matter and contains little or no lime carbonate.

This soil occurs in a few areas in the southern part of the Hudson River Valley near Livingston and in the extreme southwestern corner of the county. It comprises a total area of only a few square miles. The surface is comparatively smooth or nearly level, with some slight undulations characteristic of terraces, outwash plains, and outer edges of the old lake plain. Drainage is good, and much of the surface water is absorbed by the soil.

Approximately 90 per cent of this soil is under cultivation. It is used for fruit, mainly apples and peaches, and some corn, potatoes, oats, hay, and rye are grown. The yields are fair or good. Potatoes do exceptionally well.

Land values vary from \$25 to \$75 or more an acre.

HOOSIC GRAVELLY LOAM

The surface soil of dry Hoosic gravelly loam, to an average depth of 7 inches, is brown, light brown, or grayish brown in cultivated fields. Locally the surface soil is slightly reddish brown when moist. The texture is typically loam or gritty loam, and the soil contains variable quantities of rounded gravel and stone. The subsoil, to a depth of 20 or 25 inches, is yellowish-brown or brown gravelly loam, generally friable and loose, though locally the material is slightly compacted. The soil is browner when moist and more yellowish when dry. The gravel content is generally high, but there is only slight assortment of the material. The lower part of the subsoil, to a depth of 3 or more feet, is typically yellowish brown grading into grayish brown, and the lower part is decidedly gray. The gray color is pronounced below a depth ranging from 30 to 36 inches, where the material consists of unweathered gravel. The substratum consists of stratified deposits of gravel and sand and extends to a depth of several feet. The gravel deposits range from 5 to 40 or more feet in thickness.

The soil material consists of stratified deposits of small rounded gravel and sand composed largely of slate, shale, quartzite, and sandstone. Limestone may occur at a depth of 5 or more feet below the surface. The soil layers are commonly acid in reaction. Cuts in gravel banks several feet below the surface, however, show lime present, and lime-coated gravel is common.

Hoosic gravelly loam is fairly uniform over the areas mapped in the county, but some slight variations are included on account of their small area. Near Edwards Park and the State line areas of stony loam are included. The stones are large, and the stone content is high. In some included small, narrow, poorly drained areas the subsoil is slightly mottled. Along Kinderhook Creek, southwest of Brainard Station, some of this soil is very stony.

This soil is in general well drained, and much of the surface water is absorbed. It is fairly extensive in the Hudson River Valley and in the western part of the county and is also scattered over the county as bench or terrace lands along the larger streams. It occurs in association with the Hudson soils and in the northwestern part of the county occupies the elongated ridges or bars that stood above the

level of glacial Lake Albany. Many of the areas in the northern part of the county represent bars or beach lines of the former lake.

Areas of Hoosic gravelly loam are smooth, nearly level, slightly undulating, or very slightly rolling. The true bench and terrace lands are typically smooth or gently undulating, and some of the bars or ridges of the northern part of the county are gently sloping or slightly rolling. All of the soil is favorable in relief for intensive cultivation.

From 90 to 95 per cent of this soil, which is considered one of the best general-farming soils in the county, is under cultivation at present. The principal crops are corn, oats, wheat, rye for forage and for paper making, hay crops of timothy and clover, pasturage, and fruit. The principal fruit is apples, but some peaches, cherries, pears, and berries are grown. Where climatic conditions are favorable, this soil is well adapted to fruit raising. The general farm crops produce good yields. Potatoes yield from 50 to more than 100 bushels to the acre. The general farming carried on is centered around dairy farming, and the crops grown are used largely for forage.

Land values vary from \$50 to \$100 for general-farming soils and from \$300 to \$500 for producing orchards.

Hoosic gravelly loam, alluvial-fan phase.—The surface soil of this soil is typically gravelly loam, light brown, brown, or grayish brown when dry. The gravel may be slightly rounded, but more generally is sub-angular slate and shale fragments. The upper part of the subsoil, to a depth of 18 or 20 inches, is brown or yellowish-brown friable gravelly loam. The lower part of the subsoil grades from yellowish brown through grayish brown and becomes gray at a depth of about 30 inches. There is little or no compaction in the soil or soil materials at any depth.

This soil occupies gently sloping terraces or recent alluvial fans where streams from the uplands have built up fans in the valley floors. The soil-forming material is composed almost exclusively of shale and slate fragments, very poorly assorted and stratified. It is acid or very acid throughout.

The surface of this soil is gently sloping or undulating. The soil is not extensive and occurs only in the valley areas of the hill section of the county.

Most of this land is under cultivation, and the general type of farming is the same as on the typical soil. Very little fruit is grown, as the climatic conditions are not favorable. The yields of the general farm crops are about the same as on the typical soil, and the farming carried on is centered around forage crops grown in conjunction with dairying.

HOOSIC FINE SANDY LOAM

The surface soil of Hoosic fine sandy loam, to a depth of 8 or 10 inches, is light-brown or grayish-brown loose, friable fine sandy loam. The upper part of the subsoil, to a depth of 25 or 30 inches, is yellowish-brown or brownish-yellow slightly more compact fine sandy loam. When moist the color is in places reddish brown. Near a depth of 3 feet the material grades in color from reddish brown with streaks of rust brown and grayish brown to gray. The lower part of the subsoil is slightly compact in places but is friable and crumbly when it is bored out. There is little or no stone or gravel in the soil.

Hoosic fine sandy loam is fairly uniform in the county. It occurs principally in the northwestern part near Stuyvesant and along Hudson River. The subsurface layer of yellowish-brown or yellow sandy

loam is used for molder's sand. The land is farmed after this layer is removed.

Areas of this soil range from smooth and nearly level or gently sloping to rolling. The relief is mostly favorable to intensive cultivation. The soil occurs on benches or terraces, and the soil material was laid down by water during or following the glacial period. It comes mainly from sandstone and shale and does not contain any lime carbonate. The soil is comparatively poor in organic matter. Drainage is largely internal and in many places is excessive, and the soil is inclined to be droughty.

Most of the Hoosic fine sandy loam is under cultivation to general farm crops such as corn, grain, and timothy and clover, and to fruit crops such as apples, peaches, and cherries. The fruits do well. General farm crops do fairly well, but the yields are not so high as on Hoosic gravelly loam.

Hoosic fine sandy loam, steep phase.—This soil is similar to typical Hoosic fine sandy loam, except that the surface soil has been largely removed by erosion. This phase includes the steep and eroded areas of Hoosic fine sandy loam, occurring along the drainage courses where erosion has been very active and has carved out deep stream courses. The land is steep and rough, and none of it can be cultivated. It is used for pasture land and for forestry purposes, to which uses it is best adapted.

This soil is not extensive. It occurs in close association with the fine sandy loam of the series in the northwestern part of the county along the stream courses that break from the upland of the Hudson River Valley to the level of Hudson River.

HOOSIC GRAVELLY FINE SANDY LOAM

The surface soil of Hoosic gravelly fine sandy loam, to an average depth of 8 inches, is brown, light-brown, or grayish-brown gravelly fine sandy loam. Most of the gravel on the surface and in the soil is small and slightly rounded. The gravel content becomes greater with depth and in the substratum is very large. The upper part of the subsoil, to a depth of 20 or 25 inches, is yellowish-brown or yellow gravelly fine sandy loam or sandy loam, coarser than the surface soil material. The lower part of the subsoil is gravelly loam or gravelly coarse sandy loam which grades in color from grayish brown to gray and contains some streaks of yellow and rust brown in places. The substratum consists of stratified beds of sand and gravel. The gravel content of this soil is far less than of Hoosic gravelly loam, and the gravel is much smaller. There is no compaction of the soil material.

The material of this soil is similar to that of the other soils of the Hoosic series. It is poor in organic matter and is acid or very acid throughout.

This soil is inextensive in the county. It is mapped in the vicinity of Claverack and near Blue Store along Livingston Creek in the southwestern part of the county. It occurs as terraces, bench lands, and outwash plains. The land is smooth, gently sloping, or undulating, with some small steep areas along the stream courses. Drainage is largely internal, and as the soil is loose and porous it takes up the surface water rather quickly.

Approximately 90 per cent of this soil is under cultivation to the general farm crops of this section, to fruit, hay, and pasture crops. The crop yields compare favorably with those obtained on the gravelly loam member of the series, though on the whole they are slightly less. In some sections fruit is grown. The soil is well adapted to fruits, potatoes, and vegetables.

Land values vary from \$25 to \$50 an acre for the general-farming soils to much higher prices for the lands used for fruit.

HOOSIC LOAM

The surface soil of Hoosic loam, to an average depth of 7 inches, is brown, light-brown, or grayish-brown loam. It is loose and porous and contains some fine shale and slate gravel in places. The upper part of the subsoil, to a depth of 20 or more inches, is yellowish-brown loose and porous sandy loam or coarse sandy loam. The lower part of the subsoil, to a depth of 3 or more feet, is brownish-gray or gray coarse sandy loam or fine gravelly sandy loam, underlain to a depth of several feet by stratified beds of sand and fine gravel. There is no compaction of the soil material. The quantity of fine gravel present is variable but, as a rule, is not large in the surface soil.

The soil material consists of water-deposited sand and fine gravel. The material is assorted and has been derived largely from slate and shale, together with some sandstone. The soil is acid or very acid throughout and as a rule is poor in organic matter.

This soil occupies a total area of several square miles in the northwestern part of the county along Kinderhook Creek and to the north. It occurs on high terrace or bench lands on both sides of Kinderhook Creek. Areas are nearly level, gently sloping, or gently undulating. Drainage is largely internal, and the soil takes up the surface water very quickly.

Between 85 and 95 per cent of this soil has been cleared and is used for farming. In the Stuyvesant Falls section, as well as near Kinderhook, considerable fruit, mostly apples, peaches, and cherries, is grown, and the yields are usually good. General farm crops such as corn, hay, and grains are grown. Considerable rye has been grown for paper making. Pasture lands are inclined to dry up, and hay crop yields are comparatively light.

The current selling price of this soil varies from \$25 to \$45 an acre, but the fruit lands sell for much higher prices.

HOOSIC COARSE SANDY LOAM

The surface soil of Hoosic coarse sandy loam, to a depth of 8 or 10 inches, is light brown or grayish brown. It is friable and loose and contains sufficient small fine gravel or flakes of shale and slate fragments to give it a very gritty feel. The upper part of the subsoil, to a depth of 20 or 25 inches, is typically yellowish-brown, brownish-yellow, or slightly reddish-brown, loose coarse sandy loam. The lower part of the subsoil grades in color to grayish brown or brownish gray. The substratum consists of stratified beds of sand and gravel, the gravel content becoming greater with depth.

This soil is extensive in the northwestern part of the county, occurring in close association with Hoosic loam. Typical areas are in the region of Kinderhook.

The soil material was laid down under the same conditions as that giving rise to the sandy loam member of the series. The soil occupies terraces, bench lands, and outwash plains. The surface is smooth, gently sloping, or slightly undulating. Drainage is largely internal and is good or excessive. The soil is inclined to be droughty. It is poor in organic matter and deficient in lime.

Practically all of this soil has been cleared and is used for the production of general farm crops and fruit. In the vicinity of Kinderhook much of it is planted to fruit, which gives good yields. General farm crops do not produce so well as on Hoosic gravelly loam. Considerable rye is grown on this soil and the straw is used for making paper.

CLAVERACK FINE SANDY LOAM

The cultivated surface soil of Claverack fine sandy loam consists of grayish-brown friable fine sandy loam 8 inches thick. A little gravel may occur on the surface but not to the extent that it definitely characterizes the soil. The subsoil, to a depth of 20 or 24 inches, is yellowish-brown gravelly fine sandy loam or sandy loam, grading down into grayish-brown gravelly sandy loam. The upper part of the subsoil contains sufficient rounded gravel to make it open and loose in structure. The material of the lower part of the subsoil is slightly stratified. The substratum, which commonly occurs below a depth of $2\frac{1}{2}$ feet, consists of heavy, firm, brownish-gray or gray silty clay loam. The material is laminated and is typical of glacial-lake clay deposits.

Claverack fine sandy loam is commonly acid in the surface and upper subsoil layers. The clay substratum may contain lime, but there is no uniformity as to the depth at which it occurs. Free carbonates can usually be detected in cuts 5 or 6 feet deep.

Claverack fine sandy loam occurs in the western part of the county in the vicinity of Claverack. Areas too small to be shown on the map are in the Hudson River Valley. Areas are generally flat. The soil owes its origin to the weathering of deposits of sand and gravel overlying a distinct and separate deposit of smooth clay.

This soil is fairly well drained. In some places where the impervious clay substratum is closer to the surface than is typical, drainage is somewhat deficient. The moisture content is higher throughout the growing season than that of the Hoosic soils.

Claverack fine sandy loam is not an important soil in the county. It does not occur in large units, and as a result does not appear of any consequence on the map. The structural characteristics are so different from those of the associated soils that this soil is distinctive and worthy of separation. Nearly all of it is cleared and farmed intensively. Owing to its water-holding capacity, it is somewhat better adapted to the production of grass and small grains than the Hoosic soils. However, it is utilized in much the same manner as Hoosic gravelly fine sandy loam.

COPAKE GRAVELLY LOAM

The surface soil of Copake gravelly loam, to a depth of 7 inches, is typically brown or light-brown gravelly loam. Small rounded pebbles are scattered over the surface and through the soil. The surface

soil in cultivated fields is grayish brown. The upper part of the subsoil, to a depth of 15 or 18 inches, is lighter-brown or yellowish-brown gravelly loam, slightly heavier than the surface soil. It is underlain to a depth of 25 or 30 inches by light yellowish-brown, yellowish-gray, or gray, slightly coherent gravelly loam. The substratum consists of loose gray round gravel admixed with some sand and finer soil material. Some lime carbonate is commonly present in the substratum.

This soil is uniform as mapped, except that some areas are somewhat stony and in others the surface soil is less gravelly than typical. A few areas of very fine sandy loam were included in mapping.

Copake gravelly loam occurs only in Harlem Valley in the southeastern part of the county. It occupies several square miles, occurring on terraces or outwash plains. The surface is typically smooth or gently sloping, but a few areas are slightly undulating or rolling. Drainage, which is largely internal, is fair or good.

The soil material is derived largely from slate, shale, and limestone. The rounded gravel in the upper part is almost entirely shale, but the lower part contains some limestone. The soil is fairly rich in organic matter and is friable and easy to cultivate.

Practically all of this soil is cleared and under cultivation. The principal crops are corn, oats, wheat, hay, potatoes, and vegetables. The yields are comparatively high, corn yielding from 8 to 12 tons of silage to the acre, wheat from 18 to 20 bushels, oats from 25 to 45 bushels, potatoes from 50 to 100 or more bushels, and hay crops from 1 to 2 or more tons. The principal hay crop is timothy and clover mixed, but some alfalfa is grown. The farming is centered around dairying. The farmers are prosperous, as is shown by the general appearance of the farms. Corn, grain, potatoes, and hay crops are rotated. Little or no lime is used, but some fertilizer is used with most crops.

This soil is prized highly for general farm crops in the southeastern part of the county and sells at prices ranging from \$50 to more than \$100 an acre.

COPAKE FINE SANDY LOAM

The surface soil of Copake fine sandy loam is light-brown, yellowish-brown, or greenish fine sandy loam. The upper part of the subsoil, to a depth of 20 or 25 inches, is yellowish-brown, pale-yellow, or greenish-yellow, friable fine sandy loam having a decidedly smooth or greasy feel. The lower part of the subsoil, to a depth of 3 or more feet, is greenish-yellow or gray fine sandy loam. The parent soil-forming material is derived largely from greenish slate or talcose slate, which imparts the greenish color to the soil. The material contains very little lime carbonate.

This soil occurs in a few small areas near Copake and southeast of Long Pond. It occupies nearly level or slightly undulating terrace or bench lands in Harlem Valley. As a whole it is well drained, but some small spots are inclined to be poorly drained. In general, it is loose and friable throughout.

The larger part of this soil has been cleared and is used for the production of corn and grain and for pasture. Yields are fair or good, comparing favorably with those obtained on the gravelly loam of the series.

MERRIMAC GRAVELLY LOAM

The surface soil of Merrimac gravelly loam, to an average depth of 7 inches, is light-brown or brown, friable, loose gravelly loam. The subsoil, to a depth of 18 or 20 inches, is brownish-yellow or pale-yellow, friable, loose gravelly loam. The substratum is brownish-gray or gray stratified gravel and sand. The soil material consists of stream-laid deposits of gravel and finer materials derived largely from granites, syenites, and other crystalline rocks. It contains little or no lime and is acid or very acid throughout. It is poor in organic matter.

This soil is fairly uniform, as mapped in the county, but locally the material is more sandy and in other places it approaches stony loam. The soil is well oxidized to a depth of 18 or 20 inches, where it rests on unweathered or only slightly weathered stratified gravel and sand. The gravel and stone content increases with depth. The gravel content on the surface varies from 15 to 50 per cent.

Merrimac gravelly loam occurs exclusively in a few areas in the northeastern part of the county on the terrace and bench lands along Kinderhook and Wyomanock Creeks in the vicinity of West Lebanon. It is found in close association with the Hinckley and Gloucester soils on terraces or bench lands several feet above the level of the waters of the streams. It is not subject to overflow. The surface is smooth, nearly level, or slightly undulating, and the land is favorable to intensive cultivation. Drainage is largely internal and is good or excessive.

Approximately 75 per cent of the land has been cleared and is under cultivation. The trees on the forested areas are elm, pine, maple, aspen, and some hickory. The cultivated crops include potatoes, corn, oats, rye, and timothy and clover. Potatoes do well, yielding from 75 to 100 bushels to the acre. Corn, which is largely cut for silage, yields from 5 to 8 tons to the acre. Grain crops are only fair, and hay crops are comparatively light.

COSSAYUNA GRAVELLY LOAM

The cultivated surface soil of Cossayuna gravelly loam, to a depth of 6 inches, is light-brown or grayish-brown friable loam containing a little gravel or a small quantity of rock fragments. The upper part of the subsoil consists of light-brown or yellowish-brown gritty loam, slightly compact and containing numerous small stone fragments. At a depth of 20 inches the subsoil grades into brownish-gray gritty loam with considerable stone intermixed. The lower soil layers are rather difficult to penetrate, owing to the abundance of stone fragments. The gravel and stones on the surface and through the soil consist of a mixture of slate, sandstone, and limestone. The quantity of stone varies according to the locality where the soil is found.

Cossayuna gravelly loam owes its origin to the weathering of glacial débris and the underlying rock. The region in which the soil is mapped is one of very complex rock structure. Slate, sandstone, and limestone, together with some igneous erratics, occur in such complex relationship that it is difficult to determine which rock has the most contributing influence.

The usual field tests indicate that this soil is generally acid in the surface soil. The degree of acidity, however, is not so great as that

of other acid soils in the county. In many places the upper part of the subsoil or the lower soil layers show an alkaline reaction, although failure to obtain free lime in the lower soil layers is not unusual. The soil is well drained. In places the soil material is thin, and the moisture content is a limiting factor in times of drought.

A few areas mapped as Cossayuna gravelly loam are fairly free from stone and gravel. South of North Chatham several areas of loam are included in mapping, owing to their small extent.

Cossayuna gravelly loam occurs almost exclusively in the western part of the county, in that section lying between the high hill country on the east and Hudson River on the west. Areas are distinctive in that they comprise a series of north-south ridges of fairly moderate slope and elevation. These ridges have rock cores of slate, sandstone, or limestone which are covered with a mantle of loose material and soil.

Cossayuna gravelly loam is one of the most important soils in the county. Nearly all of it is cleared and under cultivation. It commonly occurs in small units, owing to the many outcrops of rock. Where surface conditions are favorable for economic farming operations, such crops as corn, wheat, oats, rye, and buckwheat are grown. Mixed timothy and clover is the principal hay crop. Several fields of alfalfa are on this soil, and many apple orchards are scattered over it.

Crop yields as a rule are higher on Cossayuna gravelly loam than on other soils in the county.

The price of land of this type is variable, depending on nearness to markets, on transportation facilities, and on the size of the farm unit.

Cossayuna gravelly loam, shallow phase.—The surface soil of Cossayuna gravelly loam, shallow phase, is light-brown or grayish-brown gritty loam about 5 inches thick. The gravel consists of angular slate and sandstone fragments, together with a few stones, mainly sandstone, igneous erratics, and limestone. The subsurface layer consists of brownish-gray gritty loam resting on fragmental slate, sandstone, and limestone. Cossayuna gravelly loam, shallow phase, occurs in close association with typical Cossayuna gravelly loam. It is most extensive in the valley sections of the county, where slate, sandstone, and limestone rocks are intimately mixed.

Areas of this soil are ridgy and are characterized by many exposures of country rock. The soil material is found in rather spotted or irregular areas or on elongated rock ridges. In general, the rock ridges have gentle slopes with a decided north-south trend. The soil owes its origin to the weathering of glacial deposits of slate, sandstone, and limestone material, together with material from the decay of bed-rock in places.

In many places the surface soil is acid in reaction, but the degree of acidity is not so high as in some of the other acid soils in the county. The influence of the calcareous sandstone and limestone interbedded with the slate is indicated by the alkaline reaction frequently obtained. Owing to the shallowness of the soil, it is inclined to be droughty in periods of low rainfall.

This soil is nearly all cleared, and parts of it are cultivated. Crops common to the region are grown satisfactorily wherever sufficiently large areas of cultivable land occur. A considerable part of the soil is utilized for pasture.

PITTSFIELD GRAVELLY LOAM

The cultivated surface soil of Pittsfield gravelly loam, to an average depth of 7 inches, is brown or grayish-brown, friable gravelly loam containing a few scattered stones in places. The upper part of the subsoil, to a depth of 20 or 25 inches, is yellowish-brown, firm but friable smooth loam. The lower part of the subsoil, to a depth of 3 or more feet, is brownish-gray or gray gritty loam, rather compact in places. The gray color is pronounced near a depth of 3 feet. In many places considerable stone is scattered over the surface and through the soil, but this does not interfere with cultivation. Considerable glacial stone and gravel are present in places, but the limestone, which predominates in this soil, occurs locally and the material has not been transported far.

The soil material is glacial till or residuum largely from limestone with some mixture in places of shale, slate, and some igneous rock débris.

Pittsfield gravelly loam is fairly extensive in Columbia County. Some large areas of typical soil are in Harlem Valley in the southeastern part of the county. Others occur in the Hudson River Valley south of Hudson around the base of Becraft Hills, and as isolated areas northeast of Hudson, west of Chatham, and in the vicinity of Malden Bridge. Small areas are scattered over the county.

The surface of this soil is uniformly gently sloping or rolling but in a few areas is steep or broken. Most of the soil is favorable to intensive cultivation. In Harlem Valley the soil occurs on more gentle slopes from the adjacent uplands and on the gently sloping or rolling ridges in the valley. In the Hudson River Valley it occupies the lower, more gentle slopes of the isolated hills and the gently sloping or rolling ridges northeast of Hudson in the north-central part of the county. In a few small very rolling or steep and broken areas, outcrops of the underlying limestone come to the surface, and the relief is more rolling or steep and broken. Drainage is good, except in small included depressions.

In the vicinity of Burden, southeast of Mount Tom, Pittsfield gravelly loam has a decidedly reddish color on the surface, and some areas of dump material from the old iron furnace formerly located near here are included. The red color of the soil and dump material is caused by the iron oxide present.

This soil is commonly neutral or acid in the surface layer and contains little or no free lime carbonate above a depth of 3 feet. It is loose and friable and easy to cultivate. Approximately 80 or 85 per cent of it has been cleared and is used for growing general farm crops. The principal crop is timothy and clover, but some alfalfa, corn, wheat, oats, and buckwheat are grown. Hay crops do well, yielding from 1½ to 2 or more tons to the acre. Corn is commonly cut for silage, yielding from 8 to 10 or more tons to the acre. Wheat yields from 15 to 25 bushels and buckwheat from 20 to 25 bushels to the acre. Corn, when matured, yields from 40 to 70 bushels to the acre. Farming is largely centered around dairying in Harlem Valley.

The current selling price of this soil varies from \$40 to \$75 an acre.

Pittsfield gravelly loam, shallow phase.—The shallow phase of Pittsfield gravelly loam is similar to the typical soil except that at a depth

of 3 feet or less bedrock is present. In places the rock crops out on the surface and interferes with cultivation. Most of the areas of this soil are in the eastern part of the county, in association with Pittsfield gravelly loam. The shallow soil is not so valuable for cultivated crops as the typical, deeper soil, but it is good hay and pasture land.

PITTSFIELD STONY LOAM

The dry, cultivated surface soil of Pittsfield stony loam is light-brown or grayish-brown loam to a depth of 5 or 6 inches. Scattered over the surface and through the soil are large numbers of stones, principally limestone, with some slate, sandstone, and igneous rock. The upper part of the subsoil, to a depth of 15 or 20 inches, is yellowish-brown, slightly more compact yet friable loam containing many stones. The lower part of the subsoil is brownish-gray or greenish-gray partly weathered compact till, composed largely of débris. In many places the underlying limestone occurs within 3 feet of the surface and there are many outcrops of the stone on the surface. Pittsfield stony loam differs from Pittsfield gravelly loam largely in that it carries much more stone in the soil and is shallower above bedrock. The stones in many places have been removed so that the land can be cultivated, but large numbers are still present.

This soil is extensive, occurring in Harlem Valley in the southeastern part of the county and in the Hudson River Valley and elsewhere in close association with Pittsfield gravelly loam. The relief ranges from gently sloping, undulating, and rolling to steep and broken. As a whole, the soil is slightly more rolling and steeper than the gravelly loam member of the series.

Drainage is generally good. Near a depth of 3 feet some lime is present, but the surface soil is neutral or slightly acid.

Most of this soil is under cultivation to crops similar to those grown on Pittsfield gravelly loam, and the yields are about the same. The stonier areas are used largely for pasture land. On account of the presence of the stone, this soil is not so desirable for general farming as Pittsfield gravelly loam. However, where the stones on the surface have been removed, the soil can be cultivated easily, and yields are good.

STOCKBRIDGE LOAM

The surface soil of Stockbridge loam, to an average depth of 7 inches, is light-brown or brown friable loam or silty loam. The color is grayish brown or greenish brown when the soil is dry. The texture is typically gritty loam, and although some stone and subangular gravel are present on the surface and through the soil, the material is not so stony as Stockbridge stony loam. The upper part of the subsoil, to a depth of 12 or 15 inches, is yellowish-brown or yellowish friable or slightly compact loam. It is underlain by yellowish-brown or greenish-yellow compact loam which continues to a depth of 25 inches. The lower part of the subsoil, to a depth of 3 or more feet, is greenish-gray or gray compact loam, silt loam, or silty clay loam. Greenish talcose schist and bluish-gray limestone glacial till material are common near a depth of 3 feet. The till material is generally deep.

The parent material is largely deep till influenced somewhat in places by the shale and slate on upper elevations and by limestone on the lower slopes. Where the shale material predominates the soil is lighter

in color, is more friable, and has a decidedly slick or greasy feel. Where the limestone predominates the material is more compact and browner in color. The till material consists chiefly of an unsorted mixture of limestone and shale débris, with limestone most abundant in the lower part. The till material becomes more compact with depth.

The surface soil is in most places acid, but the subsoil material contains some lime. There is an abundance of lime in the substratum.

Stockbridge loam occurs mainly in the northeastern part of the county in New Lebanon and Canaan Towns. Most of it occupies the lower slopes of the through valleys and of the Taconic Mountains along the State line. The surface is typically undulating or rolling, but a few areas are comparatively steep and broken. Surface drainage is good or excessive, but internal drainage is somewhat retarded by the compact subsoil.

Stockbridge loam is an important soil agriculturally in the northeastern part of the county. Approximately 80 per cent of it has been cleared and is used for pasture or hay land and for cultivated crops. Dairying, with the production of hay crops, is the major farming activity. The forested areas support a growth of hardwoods, mostly oak, beech, ash, and maple. Of the cleared land fully 60 per cent is used for hay crops, principally timothy and clover mixed. The yield of hay crops varies from three-fourths to 1½ tons to the acre. The main crops grown are oats, corn for silage, and some buckwheat. Oats yield from 35 to 50 bushels to the acre, and much of the oat crop is cut and fed to livestock in the bundle. Corn is cut largely for silage, and the yield ranges from 6 to 10 tons to the acre. Buckwheat yields well, producing from 18 to 30 bushels to the acre. Much of this soil supports a good growth of bluegrass and is used for pasture. Some fruit, principally for home use, and some vegetables are grown.

In general this soil is only fairly well supplied with organic matter. All available manure is scattered on the land, and some green cover crops are plowed under.

The current selling price of Stockbridge loam varies from \$25 to \$50 an acre, depending on improvements and nearness to markets. This soil is best adapted to general crops and forage crops, in conjunction with dairy farming. The use of more manure and lime would increase crop yields and fertility.

STOCKBRIDGE STONY LOAM

Stockbridge stony loam is similar to Stockbridge loam, the distinction being that this soil is more stony on the surface and throughout the soil. Scattered over the surface and throughout the soil are rock and subangular materials. In some places it has been necessary to remove the stone before the soil could be cultivated. The till material from which the soil is derived is in most places from 5 to 30 or more feet thick. The deeper till material commonly occurs on the lower slopes and the shallower material on the higher slopes.

This soil occurs in close association with Stockbridge loam in the northeastern part of the county. It occupies the steeper and more rolling parts of the through valleys and is more rolling and steeper than Stockbridge loam. Drainage is generally good or excessive, as run-off is rather rapid. The nature of the subsoil, however, causes

the soil to be rather retentive of moisture. The parent material and the mode of formation of the soil are similar to those of Stockbridge loam. The surface soil is generally acid, but the subsoil or substratum contains some lime carbonate.

Approximately 30 or 35 per cent of this soil is forested with hardwoods, mostly oak, beech, and maple. Most of the virgin timber has been removed. Of the cleared area, pasture and hay lands constitute the largest part. Some corn, oats, and buckwheat are grown with fair success on the less stony and more favorable areas. The pasture lands are largely covered with bluegrass and some wild grasses. Hay crops, principally timothy and clover, yield from one-half to 1 ton to the acre. In some areas the stone content in the soil and on the surface interferes with cultivation.

The current selling price of this soil varies from \$15 to \$40 an acre.

Stockbridge stony loam is best suited for use as pasture land, in conjunction with dairy farming and the production of hay crops. Some of the more stony and steeper areas are best suited to forestry.

DUTCHESS GRAVELLY SILT LOAM

The cultivated soil of Dutchess gravelly silt loam, to a depth of 7 or 8 inches, is light-brown or brown smooth gravelly silt loam. The gravel consists of small subangular slate fragments. The surface of cultivated fields, when dry, has a decidedly grayish-brown or slightly yellowish-brown color. The upper part of the subsoil, to a depth of 20 or 25 inches, is typically yellowish-brown or yellow friable and slightly compact smooth silt loam containing small shale fragments. The lower part of the subsoil grades downward from yellowish-brown through grayish-brown into gray material. This layer is more compact than the one above but is friable and crumbles when crushed. As a whole the subsoil is fairly well oxidized to a depth of 25 or 30 inches. In places the underlying shale or slate rock is present within 3 feet of the surface. The parent material is glacial till which overlies slate or shale and which is composed almost entirely of débris from these rocks.

Dutchess gravelly silt loam is fairly uniform in the county, but the quantity of angular gravel and stone on the surface is somewhat variable. In some places in the Hudson River Valley small areas of Dutchess slate loam, shallow phase, are included with this soil in mapping. Typically the finer soil material is silt loam, but small areas of loam or gritty loam are included.

The surface of this soil is typically gently rolling or undulating, but locally it is very rolling or steep. In some small included depressions the soil is Mansfield silty clay loam, and some small areas of Hudson silty clay are also included.

Between 85 and 90 per cent of this soil has been cleared and is being farmed. It is poor in organic matter and is acid. Drainage is good. The principal crops are hay, corn, oats, buckwheat, and wheat. The yields of all crops are good. A large part of the soil in the Hudson River Valley is planted to fruit trees, mostly apple, peach, pear, and cherry, and to grapevines.

Fertilizers are used, especially on fruit crops and on some of the general farm crops. The soil is well suited to general farm crops and forage crops. The more favorable areas are well suited to fruit

Most of the farmers on this soil are prosperous, as is evidenced by the upkeep and condition of the farms.

The current selling price of this soil varies from \$50 to \$500 an acre. The selling price of the better orchard lands is from \$300 to \$500 an acre and of general-farming lands from \$50 to \$75.

DUTCHESS GRAVELLY LOAM

The cultivated surface soil of Dutchess gravelly loam, to a depth of 6 or 8 inches, is typically yellowish-brown or grayish-brown gravelly loam. The gravel on the surface and throughout the soil consists of small, subangular slate fragments. The surface soil is loose and friable, and the gravel does not interfere with cultivation. The upper part of the subsoil, to a depth of 20 or 25 inches, is yellowish-brown, yellow, or pale-yellow friable, loose gravelly loam or gritty loam. The lower part of the subsoil grades from yellowish brown to grayish brown, becoming grayer near a depth of 3 feet. The material is gravelly loam, slightly compact in places but friable when bored out. The lower substratum consists of unsorted glacial till and in most places extends to a depth of several feet.

This soil is extensive in the vicinity of and northeast of Chatham and in Taghkanic Town. It occurs in the through glacial valleys, where the deposit of glacial till material is much thicker than on the ridges and in the hill section of the county.

Northeast of Chatham this soil has a reddish or pinkish cast, resulting from the influence of red sandstone material. In some areas in Taghkanic Town, the soil below a depth ranging from 3 to 5 feet contains some limestone till material and is calcareous, but as a whole it is acid throughout. The lower substratum in areas where some lime is present is more compact than where the soil is typical.

Areas of this soil are typically gently rolling or undulating. In some areas the land is rolling or kamy and in some it is steep and broken. However, most of the land is favorable for cultivation. Drainage is good or excessive.

Between 80 and 85 per cent of this soil is cleared and under cultivation or is used for pasture land. Farming is centered around dairying, and the crops grown are principally for forage. Timothy and clover do well and yield from 1 to 2 tons to the acre. Oats, wheat, and buckwheat do well. Corn is grown for silage, and the yield is from 6 to 10 tons to the acre. Some areas where climatic conditions are favorable are successfully used for fruit growing.

The current selling price of this soil varies from \$25 to \$75 or more an acre, depending on the improvements and nearness to markets.

DUTCHESS LOAM

The surface soil of Dutchess loam is similar to that of Dutchess gravelly loam, with the exception that gravel is not so abundant. However, some gravel and stone, principally fragments of slate or shale, are present. The finer soil material is typically gritty loam but in places is smooth loam or silt loam. The upper part of the subsoil is typically yellowish brown or yellow friable loam, and the lower part grades from yellowish brown through grayish brown to decidedly gray near a depth of 3 feet and consists of rather compact but friable gritty loam. The underlying slate and shale rock is usually

close to the surface. The parent material is similar to that of the stony loam and slate loam members of the Dutchess series. The soil is acid and is low in organic matter.

This soil occurs on the gently sloping or slightly rolling uplands of the hill section in the eastern part of the county. To the north and northeast of Chatham, and near East Chatham, the soil is influenced by the red sandstone and shale and is slightly reddish brown or pinkish. In such places the subsoil is heavier and more compact than typical.

Most of this soil has been cleared and is used for general farm crops, such as hay, corn, oats, and grain, and for dairy farming. Crop yields are fair or good.

The current selling price of this soil varies from \$25 to \$50 an acre.

DUTCHESS SLATE LOAM, SHALLOW PHASE

The cultivated surface soil of Dutchess slate loam, shallow phase, is typically light-brown or yellowish-brown smooth loam or slaty loam in which the slate fragments are abundant on the surface and throughout the soil. In some places the surface soil is more brown, and in dry cultivated fields it has a decidedly grayish or grayish-brown cast. The surface soil is comparatively shallow, as compared to that of some of the other Dutchess soils, as a rule being from 3 to 5 inches thick. Some slightly rounded stone and gravel occur on the surface and in the surface soil, but generally the stone and gravel content is local, mainly from the underlying slate and shale. The upper part of the subsoil, to a depth of 12 or 15 inches, is typically light-brown, yellowish-brown, or pale-yellow friable, porous loam or gritty loam having a high content of subangular slate fragments and stone. There is little or no compaction in this material. The yellowish-brown or pale-yellow friable loam grades into grayish-brown or gray slightly more compact loam or slate loam. The small slate fragments are very abundant in this part of the soil. The gray color becomes more pronounced with depth, and although the material becomes more compact it is friable and crumbly when bored out with the soil auger. The quantity of shale or slate fragments on the surface and in the surface soil is variable.

In the eastern part of the county, where the underlying rock is more talcose slate or schist, the lower part of the subsoil has a decidedly greenish cast and a more slick or greasy feel, owing largely to the presence of the rock material. The slate fragments scattered on the surface and through the soil vary from small, platy pieces to large, irregular stones. Typically the material near a depth of 3 feet is residual from slate bedrock.

This soil is extensive in Columbia County. It occurs most extensively in the hill section or the more mountainous regions of the eastern part of the county. Some isolated areas are in the Hudson River Valley, but these are small ridges or outcrops of the underlying slate rock. In general, drainage is good or excessive, and the soil is poor in organic matter.

Areas of this soil range from gently sloping or undulating to rolling, steep, and broken. The steeper and more rolling areas are timbered and are used for pasture land. The forest growth consists of oak, beech, birch, spruce, and pine.

Between 40 and 50 per cent of this soil has been cleared and is used for pasture land or hay land. Corn is grown for silage, and oats, buckwheat, and rye do well. Potatoes also do well. Farming is centered around dairying and the production of forage crops. The livestock is principally dairy cattle.

Little or no attention is given to crop rotation, and no lime is used. Land values vary from \$3 to \$25 an acre. In the hill section land values are usually low. This soil is best suited for the production of forage crops in conjunction with dairying. Much of it can best be used for grazing land for cattle and sheep, and the steeper and more broken parts should be used for forestry.

DUTCHESS STONY LOAM

The cultivated surface soil of Dutchess stony loam, to an average depth of 7 inches, is brown or grayish-brown stony loam. The stone and gravel content is variable, ranging from low to high. The finer-textured material is typically loose, friable, gritty loam. The upper part of the subsoil, to a depth of 20 or 25 inches, is typically brown or grayish brown when dry and has in places a reddish-brown color when wet. The subsoil material is compact in place, though it is friable when crushed. The texture is typically loam. The lower part of the subsoil, to a depth of more than 3 feet, is hard, compact stony loam or clay loam, in places somewhat gritty. The subsoil is fairly well oxidized to a depth of 20 or 25 inches. The substratum consists of gray, weathered glacial till derived mainly from sandstone and shale with an admixture of igneous rock. The shale and sandstone are in places reddish in color and impart the reddish hue to the glacial till. Over most of the soil the till material is fairly deep, and in only a few places is the underlying rock present within 3 feet of the surface.

Dutchess stony loam in Columbia County includes a considerable area of soil which has a reddish hue when moist. In a number of very small areas this reddish color becomes prominent. The soil in such areas can not be considered Dutchess stony loam, and had the areas been larger or more numerous they would have been mapped as a distinct soil type. Such reddish-colored soils may be found in Rensselaer County in sufficient total area to warrant the recognition of a soil series differentiated from the Dutchess soils, largely on the basis of color.

Southwest of Brainard Station the underlying reddish shale and sandstone come to or near the surface. The soil material is more compact and heavier in texture than typical. Other areas included in this soil on the steeper slopes south of Brainard Station are more stony than is typical, being very stony or bowldery loam. Little or none of this very stony land can be plowed. It is used for pasture or supports a scant growth of timber. In many places the stones are removed before the soil can be cultivated with ease.

Dutchess stony loam occurs only in the northeastern part of the county, principally in the towns of Chatham, New Lebanon, and Canaan. Areas are gently rolling or rolling. In some places the slopes are very steep and in others they are long and gradual. The elevation ranges from 600 to more than 1,000 feet above sea level. Surface drainage is generally good or excessive. Run-off of surface

water is rather rapid, owing to the slope. Internal drainage is good but is somewhat retarded by the compact subsoil.

This soil is deficient in lime and is poor or very deficient in organic matter. Originally all of it was forested with pine, elm, and maple, but at present 80 or 85 per cent has been cleared and is used for pasture or for the production of cultivated crops. The principal crops are timothy and clover, corn, oats, and rye. The yields of hay vary from three-fourths ton to 1½ tons to the acre. Corn for silage yields from 5 to 8 tons to the acre. Oats yield from 25 to 35 bushels. Farming is centered around dairying, and the crops grown are chiefly for forage.

The current selling price of this soil varies from \$10 to \$35 an acre, as it is not prized highly as a general farming soil.

Dutchess stony loam, shallow phase.—The surface soil of Dutchess stony loam, shallow phase, to a depth of 6 or 7 inches, is light brown or yellowish brown and when dry is decidedly grayish brown in cultivated fields. The surface soil is typically smooth loam or silt loam. Scattered over the surface and throughout the soil are numerous slightly rounded stones and slate and shale fragments. The upper part of the subsoil, to a depth varying from 15 to 18 inches, is yellowish-brown or pale-yellow friable loam containing considerable stone and numerous slate fragments. The lower part of the subsoil, to a depth of 25 or 30 or more inches, grades from yellowish brown to grayish brown, becoming more gray near a depth of 3 feet. The material is slightly compact, but it is friable and crumbly when it is bored out. The lower part is decidedly gray and consists of partly weathered till material, with some residual material from slate. Outcrops of slate occur on the surface.

This soil occurs in the hill section of the county, mostly along or near the Massachusetts State line. The surface is generally hilly with steep slopes. The steeper and rougher areas are used largely for forestry and for pasture land. The soil is poor in organic matter and is acid throughout. Drainage is good or excessive.

Very little of this soil is used for cultivated crops. Its value is very low.

BERNARDSTON GRAVELLY LOAM

The cultivated surface soil of Bernardston gravelly loam, when dry, is light-brown or yellowish-brown, friable gravelly loam about 7 inches thick. The gravel consists mainly of small slate fragments. Some sandstone and igneous erratics are also found on the surface. The upper part of the subsoil, to a depth of 24 inches, is yellowish-brown or grayish-brown, compact gritty loam. Considerable coarse slate sandstone and igneous rock are scattered through the soil. The lower part of the subsoil is brownish-gray compact, gritty loam mottled slightly with gray and brown. The substratum consists of grayish-brown or nearly gray compact glacial till. The till is not compact to the extent of being impervious to the movement of soil water. Considerable gravel and coarse rock material, typical of glacial till, is found in the subsoil and substratum. The abundance of slate, sandstone, and igneous material makes the subsoil and substratum rather difficult to penetrate, although when the soil material is disturbed it appears to be friable.

This soil owes its origin to the weathering of deep deposits of glacial till. The effectiveness of the glacial ice as a transporting agency in

the larger valleys resulted in large deposits of unassorted glacial till being left along the sides of the valleys.

Bernardston gravelly loam is generally acid throughout. The substratum seldom carries lime and from the composition of the rocks making up the body of the unweathered till from which the soil is derived, it is questionable if the soil ever carried any appreciable quantities of lime. The degree of acidity in Bernardston gravelly loam, however, does not appear to be so great as in the Dutchess soils occurring at higher elevations.

This soil occurs mainly in the eastern and southeastern parts of the county, in the larger valleys. The surface is generally sloping. In places the slope is rather steep, but as a rule the relief is favorable to cultivation. The soil is well drained, owing to its favorable slope. The internal drainage is not deficient, although some seepage water may collect at the point of contact between the substratum and the bedrock.

Bernardston gravelly loam is not an extensive soil in the county. Owing to its favorable situation on the lower slopes in the larger valleys, most of it is farmed intensively. In conjunction with other valley soils, it comprises some of the best farm land in the county. Where the slope is too steep for satisfactory tillage operations, the soil is used for pasture land. It is well adapted to grasses. Farming is centered around dairying, and the crops grown are principally for forage.

GLOUCESTER STONY LOAM

The cultivated surface soil of Gloucester stony loam, to a depth of 6 or 8 inches, is brown or grayish-brown loam containing considerable slightly rounded stone and gravel and in places some large bowlders. The upper part of the subsoil, to a depth of 18 or 20 inches, is brownish-yellow or yellow friable loam containing some stone and gravel. The lower part of the subsoil is grayish yellow, grading into gray near a depth of 3 feet, and consists of partly weathered, unassorted, coarse-textured glacial till material with imbedded stone and gravel. The lower part is slightly coherent in places but is friable and crumbly when it is bored out. The soil material is well weathered and oxidized to a depth ranging from 18 to 25 inches.

The parent soil material is largely deep unassorted till, derived mainly from granite, syenite, and other crystalline rocks. The stony till material contained little or no lime, and the soil is acid. In some places the presence of large bowlders makes the soil unfit for farming. Most of the surface stones have been hauled off farmed areas.

A few poorly drained areas of Whitman stony loam have been included with this soil in mapping. The surface soil in such areas is dark grayish-brown stony loam; the upper part of the subsoil is mottled gray, yellow, and rust-brown heavier loam or silty clay loam, more compact than the surface soil; and the soil near a depth of 3 feet is gray or drab unweathered stony till.

Gloucester stony loam is of small total extent in this county, being mapped only in the northeastern part along the slopes on both sides of Kinderhook Creek. The surface, in general, varies from gently sloping or rolling to steep and broken in a few places. Most of the steeper areas are more stony, and large bowlders are common. In the narrow area west of West Lebanon many bowlders are scattered over the lower-lying slopes. Drainage is good.

Approximately 60 or 65 per cent of this soil is farmed or used for pasture land. The principal crops are hay, corn, grass, and potatoes, and some oats are grown. Crop yields are fair or good.

The current selling price of this soil ranges from \$15 to \$35 an acre.

GROTON GRAVELLY LOAM

The cultivated surface soil of Groton gravelly loam, to a depth of 6 or 8 inches, is typically light-brown, brown, or grayish-brown gravelly loam. The gravel consists of comparatively small rounded pebbles, derived largely from limestone. In a few places the soil is more sandy. The upper part of the subsoil, to a depth of 15 or 20 inches, is light-brown, yellowish-brown, or slightly reddish-brown, friable, loose gravelly loam which is underlain, to a depth of more than 3 feet, by grayish-brown or gray gravelly loam. The lower part of the subsoil is grayer and consists of stratified rounded gravel and sand. The rounded gravel is scattered over the surface and throughout the soil but does not interfere with cultivation.

The parent soil material is largely waterworn gravel of mixed lithologic composition. Lime is abundant near a depth of 3 feet. The upper part of the soil is neutral or slightly acid. The soil is loose and porous, and any lime that was present has been leached out.

This soil is not extensive in this county. It occurs in Harlem Valley in association with the Pittsfield and Copake soils. It is most extensive in the towns of Ancram, Copake, and Hillsdale. Areas are irregular or knobby, with comparatively steep slopes. The steeper slopes are not suited to cultivation and are usually in pasture.

Originally all of this soil was forested, but at present most of the tree growth has been removed, and 80 or 85 per cent of the soil is farmed or used for pasture land. The principal crops are corn, timothy and clover and alfalfa hay, oats, and potatoes. Corn is usually cut for silage, and the yields range from 6 to 10 tons to the acre. Oats yield from 20 to 30 bushels to the acre, potatoes from 60 to 100 bushels, and hay crops from $1\frac{1}{2}$ to 2 or more tons.

This soil is only fairly rich in organic matter. The use of all available manures and the practice of plowing under some green cover crops would prove beneficial. The water-holding capacity of the soil is fair or good, and crops seldom suffer from drought.

The current selling price of this soil varies from \$25 to \$50 an acre.

OTISVILLE GRAVELLY LOAM

The surface soil of Otisville gravelly loam, to an average depth of 7 inches, is brown or light-brown gravelly loam. The finer soil material is typically loam or gritty loam. Rounded gravel is scattered over the surface and through the soil. The dry surface soil has a grayish-brown cast in cultivated fields. In some places the surface soil is reddish or chocolate colored. The upper part of the subsoil, to a depth of 20 or 25 inches, is yellowish-brown gravelly loam in which the gravel content increases with depth. The yellowish-brown color is more pronounced when the soil is dry. The lower part of the subsoil, to a depth of 36 or more inches, is grayish-brown, brownish-gray, or gray gravelly loam in which the gray color becomes more pronounced with depth. There is little or no compactness in the soil. The substratum, to a depth of several feet, consists of stratified gravel and sand.

At a depth ranging from 5 to 10 feet below the surface in many places there is considerable lime in the form of a coating on the gravel. This soil is fairly uniform in color and texture, but the material in some small areas is more nearly gravelly sandy loam than gravelly loam.

The soil material consists of stratified deposits of gravel and sand, in many places extending to a depth of 20 or more feet. The gravel is all rounded and is commonly from 1 to 3 inches in diameter. It consists largely of shale, slate, and crystalline rock material, with some limestone. The limestone gravel occurs only in the substratum. Little or no lime is present in the soil. Drainage, both on the surface and internally, is good, and some parts of the soil are inclined to be droughty. The organic-matter content is comparatively low in places but is fair as a whole.

Otisville gravelly loam is extensive, occurring principally in association with Hoosic gravelly loam in Hudson Valley and in other valleys. It is extensive along Livingston Creek in the southeastern part of the county, along the eastern edge of Hudson Valley adjacent to areas of the Dutchess soils, and along the valleys to the south of Philmont, near Hollowville and West Taghkanic, to the northeast of Chatham, and elsewhere on the lower slopes in the hill section of the county.

The relief is typically knobby, with intervening smoother slopes and undulating areas. Some of the soil is too steep and rough for cultivation.

Approximately 60 or 70 per cent of this soil has been cleared and is used for pasture land or for cultivated crops. Some pine, elm, and maple grow in places. The soil is loose and friable and easy to till. The principal cultivated crops are corn, oats, rye, and timothy and clover mixed. Corn yields from 30 to 50 bushels of grain or 6 or 8 tons of silage to the acre. Grain crops do well. Hay yields vary from 1 to 2 tons to the acre. The steeper slopes are well suited for use as pasture land.

The current selling price of this soil varies from \$20 to \$50 an acre.

OTISVILLE GRAVELLY SANDY LOAM

The surface soil of Otisville gravelly sandy loam, to an average depth of 6 inches, is light-brown, brown, or grayish-brown gravelly sandy loam. Most of the gravel present is small, and the gravel content is not so high as in Otisville gravelly loam. In some areas little or no gravel is present on the surface or in the subsoil. The upper part of the subsoil, to a depth of 25 or 30 inches, is yellowish-brown gravelly sandy loam or fine sandy loam. The lower part of the subsoil, to a depth of more than 36 inches, is brownish-gray or gray gravelly sandy loam and is underlain by stratified beds of sand and fine gravel which continue to a depth of several feet. The soil is generally well oxidized to a depth of more than 25 inches. In some small included areas the material is fine sandy loam, but as a whole it is gravelly sandy loam.

The soil material consists of stratified gravel and sand derived principally from shale, sandstone, and crystalline rock. It contains little or no lime.

Otisville gravelly sandy loam is not so extensive as Otisville gravelly loam. The principal areas are southwest of Bell Pond in the Hudson River Valley.

The relief is typically rolling or knobby, but some areas are comparatively smooth, with gentle slopes. Some of the slopes are very steep. In general, drainage is good or excessive. The soil is loose and porous and is not very retentive of moisture. The organic-matter content is low.

Approximately 90 per cent of this soil is used for pasture land or for the production of corn, oats, wheat, or timothy and clover hay. Crop yields are generally not so good as on Otisville gravelly loam.

This soil is in need of organic matter, and applications of manures and the turning under of green cover crops would improve it. Pastures are fair or good but tend to dry up during the drier part of the summer months.

The current selling price of this soil varies from \$25 to \$40 an acre.

HINCKLEY GRAVELLY LOAM

The surface soil of Hinckley gravelly loam, to a depth of 6 or 7 inches, is light-brown or yellowish-brown friable gravelly loam. The gravel content is comparatively high on the surface and through the soil. The upper part of the subsoil, to a depth of 10 or 12 inches, is yellowish-brown, yellow, or ocher-yellow friable, loose gravelly loam and is underlain by yellowish-brown or yellow loose, friable gravelly loam which extends to a depth of 20 or 25 inches. The lower part of the subsoil or the substratum, to a depth of 30 or 36 inches, is brownish-gray or gray gravelly loam or gravelly sandy loam. The underlying substratum, to a depth of several feet, consists of stratified beds of sand and gravel. The gravel content is comparatively high throughout the soil, and the soil is well oxidized to a depth of 20 or 25 inches. The gravelstones are small and rounded by water action. The material is not compacted. The soil materials consist of stratified deposits of gravel, mainly of slate, shale, granite, and other crystalline rock materials. The soil is acid throughout. It is poor in organic matter.

This soil is uniform throughout its occurrence in this county. It is not extensive. It occurs in the northeastern part of the county along Kinderhook and Wyomanock Creeks, as small areas in association with the Gloucester and Merrimac soils.

This soil occupies rolling or knobby areas having comparatively steep slopes. It also occurs on eroded faces of the high stratified bench or terrace lands. Drainage is good or excessive. The soil is not retentive of moisture, owing to the looseness and porosity of the surface soil and subsoil.

Approximately 50 per cent of the Hinckley gravelly loam has been cleared and is used for crops or for pasture lands. Some areas support a growth of pine, aspen, birch, maple, cherry, and elm. The forested areas are mostly on the steeper slopes and are unfit for cultivated crops. The main crops grown are buckwheat, oats, corn, hay, and pasturage. When cut for silage, corn yields from 3 to 6 tons to the acre. Oats and buckwheat yields are light. Hay crops do fairly well during the seasons of high rainfall but dry up during the drier seasons. Pastures are only fair.

LYONS SILTY CLAY LOAM

The dry surface soil of Lyons silty clay loam, to an average depth of 7 inches, is dark grayish-brown, dark-gray, or gray heavy loam or silty clay loam. In some small areas the color of the surface soil is

more nearly black, owing to the presence of partly decomposed organic matter. As a whole, the texture is silty clay loam. A few stones and boulders are scattered over the surface. The upper part of the subsoil, to a depth of 18 or 20 inches, is prevailingly grayish brown, brownish gray, or slightly mottled gray, yellow, and rust brown, with, in places, a greenish hue. The material is silty clay loam or silty clay. The lower part of the subsoil, to a depth of more than 3 feet, is gray or drab silty clay, mottled with some rust brown, and in the lower part gray or drab partly weathered till material derived largely from limestone.

This soil is poorly drained, as a whole, and remains in a wet or moist condition much of the time. It is not extensive in the county but occurs in many small depressions in association with the Pittsfield soils in Harlem Valley and in Hudson Valley.

The surface is smooth, nearly level, or almost flat. Surface drainage is poor or deficient, and internal drainage is retarded by the heavy subsoil.

Little or none of this soil is used for cultivated crops. The larger part of it is used for pasture land, for which it is best suited in its present condition. The parent material is similar to that of the Pittsfield soils. The lower part of the subsoil consists of partly weathered till and residual material and contains some lime in places. The surface soil is commonly acid.

Some of this soil supports a growth of oak, elm, and maple, and there is considerable smaller brush and willow. Considering the poor drainage, the soil is best suited for use as pasture land. Probably this will continue to be its chief utilization, as the cost of draining would in most places be high.

GHENT SILTY CLAY LOAM

The surface soil of Ghent silty clay loam, to a depth of 6 or 8 inches, is dark brownish-gray silty clay loam. The subsoil, to a depth of 18 or 20 inches, is highly mottled gray, yellow, and rust-brown, slightly compact and heavy silty clay loam or silty clay. The lower part of the subsoil and the substratum, to a depth of more than 3 feet, consists of brown and gray stratified beds of sand, fine sand, and, in some places, thin layers of silt and clay. The lower substratum is gray or drab silty clay, containing rounded gravel.

A small area about $1\frac{1}{2}$ miles north of Old Chatham varies from the typical soil. The surface soil is dark grayish brown, with a reddish or pinkish cast. The upper part of the subsoil is heavy, plastic clay having a decidedly reddish or pinkish cast, and the lower part is gray or drab with some of the reddish cast and with some mottling. This variation occurs in association with upland soils which have a reddish hue. All of the soil is free from stone or gravel.

The total area of this soil in the county is small. The largest areas occur as narrow bands between West Ghent and Mellenville, and a small area is north of Old Chatham.

The surface is typically smooth, gently sloping, or nearly flat. The areas occur as swales or depressions in association with the adjacent upland soils. Drainage is poor, owing to the lack of relief and the imperviousness of the subsoil. The soil material consists of stratified beds of silt, clay, sand, and gravel laid down by water. The soil is acid or very acid throughout. The supply of organic matter is low

or fair. In many places the water table is close to the surface, and the soil remains in a wet or saturated condition much of the time.

Practically all of this soil has been cleared and is used for pasture and hay land. Some corn is grown on the better-drained areas, and the yields are fair or good. In its present condition, the soil is best suited to use as pasture and hay land. Yields of 1 or 1½ tons of hay to the acre are obtained on the better-drained areas.

There are no farms located entirely on this soil, and it is used in conjunction with the better-drained upland soils.

MANSFIELD SILTY CLAY LOAM

The surface soil of Mansfield silty clay loam, to an average depth of 6 inches, is dark grayish-brown or nearly black silty clay loam. The upper part of the subsoil is highly mottled gray, yellow, and rust-brown, more compact and heavier silty clay loam or silty clay. The lower part of the subsoil is gray or drab silty clay or clay containing some stone and angular gravel. The lower part of the subsoil consists of partly weathered till material.

There are no large areas of this soil, but many small areas occur in association with the Dutchess soils throughout the county. Areas occupy depressions or flats where natural drainage is poor. The surface is gently sloping or nearly flat. The soil is acid.

Practically none of this soil is cultivated, as it is too poorly drained for cultivated crops. Some timothy is grown on the better-drained areas. In its present condition, the soil is used for pasture land, to which use it is well adapted.

ONDAWA SILT LOAM

The surface soil of Ondawa silt loam, to a depth of 10 or 12 inches, is brown or light-brown smooth silt loam. The upper part of the subsoil, to a depth ranging from 24 to 30 inches, is lighter-brown or yellowish-brown, slightly more compact loam or silt loam. The lower part of the subsoil, to a depth of more than 36 inches, is grayish-brown or gray fine sandy loam. In some places the lower part of the subsoil is slightly mottled with gray and yellow or rust brown.

This soil occupies narrow strips on the first-bottom lands of the county, and some of it is subject to overflow. Typical areas are well drained. The surface is smooth or gently sloping, with slight undulations of ridges and swales. The soil material consists of alluvium deposited along the streams. The soil shows an acid condition throughout. The organic-matter content is only fair.

Well-drained areas of this soil are utilized for the production of wheat, rye, barley, and potatoes, and for hay and pasture land. Crop yields are good.

The current selling price of this soil ranges from \$50 to \$75 an acre. It is sold with adjacent upland or terrace soils.

ONDAWA LOAM

The surface soil of Ondawa loam, to a depth of 6 or 8 inches, is light-brown or grayish-brown gritty loam or fine sandy loam. The upper part of the subsoil, to a depth of 18 or 20 inches, is yellowish-brown or yellow loam or fine sandy loam. The lower part of the subsoil is

light-brown, grayish-brown, or gray fine sandy loam or fine sand containing rounded gravel. The substratum, to a depth of several feet, consists of gravel and sand. Some gravel is scattered over the surface and throughout the soil but not in sufficient quantities to interfere with cultivation.

The texture of the soil is extremely variable. Near Kinderhook and to the south along Kinderhook Creek the material is smooth loam or silt loam, and near West Lebanon small areas of fine sandy loam are included. In some small patches enough gravel is present to cause the soil to approach gravelly loam. Such variations are included with this soil in mapping, as they are of comparatively small extent.

This soil occurs on the first-bottom lands along Kinderhook Creek and its tributaries in the northern and northeastern parts of the county. The surface is smooth, gently sloping with the stream gradient, or gently undulating. The soil material is alluvium composed of slate, shale, and igneous rock débris. It is acid and loose and friable throughout. Drainage, for the most part, is good.

Between 75 and 80 per cent of this land is under cultivation or is used for pasture land. Most of it has been cleared, but some willow, cottonwood, and birch are along the creeks in places. Small grain, corn, potatoes, and hay are grown with fair yields. Corn is cut for silage. The lower-lying areas are best adapted to use for grazing land. Hay crops, principally timothy, do fairly well. Potatoes yield from 60 to 100 bushels to the acre on the better-drained areas.

LIVINGSTON SILTY CLAY LOAM

Livingston silty clay loam, to a depth of about 10 inches, consists of dark-brown or nearly black silty clay loam. The color of the surface soil varies considerably, depending on the quantity of organic matter and moisture in the soil. Where it is drained and cultivated, the surface soil is gray. The upper part of the subsoil is mottled gray, yellow, and rust-brown compact silty clay. It becomes less mottled with depth, until at a depth of about 24 inches, gray, compact, impervious clay occurs. This soil is acid throughout.

Livingston silty clay loam occurs exclusively in the southwestern part of the county, in the vicinity of Germantown. The surface is generally flat. The soil occupies depressed areas on the flood plains. Owing to the imperviousness of the subsoil, water stands on the surface for long periods of time.

Livingston silty clay loam is closely associated with Ondawa silt loam. The distinctive features of the former are its compact, impervious subsoil and the poor drainage indicated by the very dark-colored surface soil and mottled subsoil.

This soil is poorly drained, and in its present condition is unfit for cultivation. Hay is cut on some areas.

Livingston silty clay loam is not an important soil. It is not desirable for farming and has a value only for pasture and timber.

SACO SILT LOAM

The surface soil of Saco silt loam, where cultivated, is typically brown or grayish-brown silt loam to an average depth of 8 inches. The gray color is pronounced when the cultivated soil is dry. In uncultivated areas the color of the immediate surface is brown or

dark brown and in some small areas is nearly black. The darker color is common in the less well-drained areas, and in such areas the texture is more nearly silty clay loam than silt loam. The upper part of the subsoil, to a depth of 12 or 15 inches, is mottled gray, yellow, and rust-brown heavy silt loam having a decidedly slick or greasy feel. It is underlain by compact silt loam, mottled gray, yellow, and rust brown or brownish gray to a depth of 25 inches. The lower part of the subsoil, to a depth of more than 3 feet, is more friable, gritty, greenish-gray or gray loam containing small shale or slate fragments. The lower substratum consists of roughly stratified deposits which consist of small shale fragments, sand, and some small stone, and which extend to a depth of several feet. Little or no stone or gravel is on the surface or in the upper part of the soil. Typically the texture is silt loam, but in small included areas it is silty clay loam or fine sandy loam.

Saco silt loam occurs principally in the northeastern part of the county, on first-bottom lands along the streams. Not all areas are subject to overflow. The surface is generally level or gently sloping with the streams, and there are some slight swales, depressions, and undulations. Drainage, for the most part, is fair or good, though in places it is retarded by the compact subsoil. Natural drainage is poor in the swales or depressions.

The soil material consists of wash from the adjacent uplands. The upland soils surrounding this soil are derived principally from glacial-till material consisting largely of slate, shale, and igneous rock débris. The soil is acid or very acid throughout. The organic-matter content is only fair or low.

Approximately 70 or 75 per cent of this soil has been cleared and is used for pasture land or for the production of crops, mainly hay. The forested areas support a growth of elm, willow, and maple. Hay yields from 1 to 2 tons to the acre. A little corn is grown for silage, and the tonnage yield is fair or good. The soil is well suited to use as pasture land. Some areas would be materially improved by more thorough drainage.

SACO SILTY CLAY LOAM

The surface soil of Saco silty clay loam, where cultivated, is light-brown, grayish-brown, or brownish-gray silty clay loam about 7 inches thick. The upper part of the subsoil, to a depth of 20 or 25 inches, is highly mottled gray, yellow, and rust-brown slightly more compact silty clay loam or silty clay. The lower part of the subsoil, to a depth of more than 3 feet, is gray or bluish-gray plastic silty clay or clay. The bluish color is pronounced near a depth of 3 feet. The lower substratum consists of stratified beds of rounded gravel and of sand.

This soil is not extensive in Columbia County. It occupies first-bottom lands or low terraces in the vicinity of Craryville and in Harlem Valley in the southeastern part of the county. A large part of it is above overflow. The surface is level, gently sloping, or undulating, with some slight depressions and ridges, but it is all favorable to intensive cultivation. Surface drainage, for the most part, is only fair, owing to the lack of relief, and internal drainage is retarded by the compact and impervious subsoil. Some areas would be improved by more thorough drainage.

The soil material consists of stream-laid deposits. The gravel in the substratum is mainly slate and shale. The soil is acid or very acid throughout. The organic-matter content is only fair or low.

The larger part of this soil has been cleared and is used for pasture or for crops of timothy and clover hay. Some corn, buckwheat, and oats are grown. The better-drained areas produce from 6 to 8 tons of silage to the acre, and the grain crops do well. The less well-drained areas are used for pasture, for which use they are well suited. Birch and willow grow along the streams.

With more thorough drainage this soil would be productive of hay, grain, and corn.

HOTALING LOAM

The surface soil of Hotaling loam, where cultivated, is brown or grayish-brown loam 8 or 9 inches thick. The subsoil, to a depth of 25 or 30 inches, is light-brown or grayish-brown fine sandy loam, very fine sandy loam, or loam. The lower part of the subsoil is gray and consists of fine sand and gravel. The soil material is loose and friable throughout.

This soil is not extensive in this county. It occurs only on Hotaling Island and the lower end of Lower Schodack Island, in the Hudson River, at the northwestern corner of the county. It occupies first-bottom lands and is subject to overflow. The surface is smooth, gently sloping, or slightly undulating. The soil material is alluvium deposited by the flood waters of the river. It is commonly acid throughout. The organic-matter content is fairly high.

Some areas of Hotaling loam are forested, mostly with elm, willow, and poplar. Approximately 45 or 50 per cent of the soil is used for growing corn, oats, and timothy and clover hay. Corn does well, and the yields are high except in the wetter seasons. Hay crops do well, producing from 1½ to 2 or more tons to the acre.

MUCK

Muck consists of dark-brown or black well-decomposed organic matter. In Columbia County the deposits are generally more than 3 feet thick and in many areas are 10 or more feet thick. Typically, muck, to a depth ranging from 5 to 15 inches, is dark-brown or nearly black well-decomposed smooth material. This is underlain by lighter-brown silty muck which continues to a depth of more than 3 feet. In places the surface material is dark-brown or nearly black vegetable mold and decaying roots and leaves. The next layer, to a depth of 15 or 20 inches, is dark-brown or black well-decomposed muck, with an admixture of silty material. This is underlain, to a depth of 60 or 80 inches, by greenish-brown or brown fibrous muck beneath which is white marl underlain at a depth ranging from 90 to 95 inches by blue calcareous clay and gravel. The depth to the blue clay or white marl is variable. Locally it is less than 3 feet.

The largest areas of muck mapped in the county are northwest of Niverville, in the northwestern part of the county; in the valley south of New Lebanon; near Queechy Lake, Canaan Four Corners, and Flatbrook; and in Harlem Valley in the southeastern part of the county. Other areas are south of Philmont and elsewhere. Muck occurs in association with several types of mineral soil, occupying small basins or depressions.

Areas of muck are nearly level, flat, or gently sloping in places where the areas occur at or near the heads of drainage courses. Drainage is poor or very poor, and the water table is at or near the surface. In a few areas the water table is a few inches below the surface, but most of the soil remains wet much of the time.

Only a very small part of this soil has been properly drained, cleared, and used for producing crops. It is forested with birch, elm, maple, and willow. On a few areas in Harlem Valley, where drainage is better, some of the muck supports a growth of wild grasses which are cut for hay. The cultivated areas have been drained, and the muck is not so deep as typical. Cultivated areas are used for growing celery, lettuce, and other vegetables.

This soil as a whole is badly in need of drainage, and it would be expensive to properly drain some of the areas. When drained and properly cultivated and fertilized, this soil produces truck crops and potatoes.

Because of its poorly drained condition muck has little or no agricultural value.

MEADOW

Meadow includes the poorly drained, undifferentiated alluvial soils of the stream bottoms and some very poorly drained depressions in the uplands. The material is variable in texture and color. For the most part the surface soil is dark grayish brown, dark gray, or nearly black, and the texture is silty clay or clay. In some areas the material on the surface is dark-brown or black muck or peat an inch or two thick. The upper part of the subsoil is generally highly mottled yellow, gray, and rust brown, and the lower part is commonly gray or drab silty clay loam or silty clay which is compact and impervious in places.

Meadow is rather extensive in this county. It comprises narrow strips along small stream courses where drainage is poor or deficient, swales and depressions in the uplands, and seepy areas at the base of hills or slopes. The surface is in most places flat or nearly level. In many places the cost of adequate drainage would be prohibitive.

The soil consists of alluvial material along the stream courses. In the seepy areas and swales it consists largely of slope wash of fine materials.

Some of the areas of meadow are forested, whereas some of them support a growth of grasses and other moisture-loving plants. The open grass areas are used for pasture and in the present condition they are best suited to that use or to forestry. Little or none of this soil has been drained. In some places the better-drained areas are used for cutting wild grasses for forage, and the yields are fair. If properly drained, this soil would support good grass and produce good yields of hay.

ROUGH STONY LAND

Rough stony land comprises areas where the surface is rough or rugged and stony, rendering the soil mainly nonarable. In places some small and isolated patches of soil might be cultivated. The finer soil material, where there is enough to form a soil mantle over the underlying rock, is variable, but as most of this soil occupies the higher-lying hilly or mountainous lands in the eastern part of the

county, where the rocks are mainly slate and shale, the soil material is similar to that of the Dutchess soils. The surface soils are light brown or yellowish brown, and where there is a subsoil it is yellow, loose, and friable. The rock is near the surface, and outcrops are numerous. In places there is a thin veneer of glacial till material on the surface of the smoother-lying areas. Elsewhere the soil material is residual from the underlying rocks.

Rough stony land is extensive in Columbia County. Most of it occurs in the eastern part of the county, but areas are on some isolated hills and ridges standing above the general level of the valley lands.

In most places there is enough soil present to support a forest growth of oak and chestnut, with some pine. Locally, the land is used for pasture land, but most of it is forested.

This soil has little or no agricultural value except for the forest growth and a little pasturage. Selling prices depend on timber values.

STEEP BROKEN LAND

This class of land really represents a topographic condition rather than a soil type. As mapped it includes a variety of soils of which the outstanding feature is their steep and broken relief. It includes the steep and broken lands along drainage courses in the southwestern part of the county and elsewhere. Along the Hudson River, in the southwestern part of the county, the break from the gently rolling or undulating uplands to the water level of the river is abrupt or rugged in many places, and this class of land includes such areas.

The soil material is variable, though in general it is like that of the Dutchess soils where the material is influenced by the underlying slate and shale, and like that of the Hudson soils, where the material consists of lake-laid deposits.

None of this class of land is cultivated, though some of it is used for pasture. It is best suited to use for forestry and for pasture. Erosion has been and is still very active. To cultivate any of this and would tend to increase erosion.

TIDAL MARSH

Tidal marsh includes areas adjacent to Hudson River on the western edge of the county. These areas are covered by the rise of the tide and are locally known as tidal flats. They remain wet all the time, but most of them are covered by water only during high tide. The mineral soil material consists of silt and clay, with some fine sand. The surface material in many places is partly decomposed organic matter which, in places, extends to a depth greater than 3 feet. Elsewhere the silty material or clay comes to the surface.

The areas occur as narrow strips along Hudson River, around the islands in the river, and at the junctions of the streams flowing into it. These flats support a growth of coarse grass and rushes. In a few places made land, where railroads have been built along the shores of Hudson River, is included.

Tidal marsh has no value for agriculture, and none of the native vegetation is used.

MADE LAND

Made land includes areas that have been filled in and built up by materials that have been dredged from the river or that have been hauled in. In some cases it consists of sand, gravel, cinders, or clay from some of the brick kilns located along the Hudson River. Some areas are fills made by the construction of railroad beds. The areas of made land have no agricultural value and are not extensive in this county.

SUMMARY

Columbia County is in the southeastern part of New York. The southern boundary is about 100 miles north of New York City. The county has an area of 638 square miles, or 408,320 acres.

The surface relief of the county is variable. The relief of the western part ranges from smooth to undulating and slightly rolling and some isolated hills are rougher. The border lands of the hill section of the county are slightly sloping or rolling and include some steep and broken land. The eastern part of the county is generally rolling or steep and in some parts is mountainous. The valleys in the more mountainous areas are gently sloping or rolling. The elevations vary from sea level to more than 2,000 feet above.

Most of the county drains into Hudson River through Livingston Creek, Kinderhook Creek, and Claverack Creek. A small part of the eastern section of the county drains into Housatonic River. Most of the soils are well drained.

The early settlements were along the Hudson River, near Claverack Landing and Kinderhook, and later in Harlem Valley in the southeastern part of the county. The population in 1920, according to the census report, was 38,930, of which 62.9 per cent was classed as rural. The Hudson River and Harlem Valley sections are the most densely populated parts of the county.

The county is well supplied with railroads and improved main roads. Boat service is maintained on Hudson River during the summer.

Columbia County has a temperate climate which is favorable for the production of a variety of crops. The growing season is 147 days at Chatham; is less than this in the more mountainous section of the eastern part of the county; and is longer along Hudson River.

Agriculture has been the leading industry since the first settlement. Within the last few years there has been considerable manufacturing in the towns, and these settlements serve as local markets for farm products.

The present agriculture of the county is centered around dairying and the production of forage crops and some grains, although the fruit industry is becoming increasingly important.

The number of farms in the county has been gradually decreasing since 1879.

The soils of the county vary widely in color, structure, parent soil material, mode of formation, drainage, lime content, and other characteristics.

All of the county was glaciated. The glacial till material is unsorted over much of the area and varies from deep drift to very thin deposits. Where it is thin the soils are derived in part directly from the underlying bedrock. There is a considerable area of lacustrine materials.

In all, 21 soil series, embracing 36 soil types, 7 phases, and 6 miscellaneous types of material, including muck, are mapped in the county.

The soils derived from older water-laid deposits are included in the Hoosic, Merrimac, Ghent, Claverack, Hinckley, Otisville, Hudson, Copake, and Groton series. These soils are variable in texture, ranging from gravelly loams and sandy loams that are loose and porous throughout to silt loams and silty clay loams that are heavy and impervious in the subsoil. The Hudson, Copake, and Groton soils show some lime in the parent material.

The soils derived from deep glacial-till material are slightly calcareous. Such soils are grouped in the Stockbridge and Lyons series. Drainage of the Stockbridge soils is good or fair, and that of the Lyons is poor.

The Gloucester soils are derived from deep, coarse, glacial till that has no lime in the parent material. The Pittsfield and Cossayuna soils are derived from thin, moderately calcareous glacial till. They include some of the better farming lands of the county.

The Dutchess soils are acid. In many places the lower part of the subsoil is residual from the underlying shales and slate rock.

The Mansfield soils occur in poorly drained situations in association with the Dutchess soils. The subsoils are mottled, and the material is more compact and impervious than that of the Dutchess soils.

The organic soils of the county are mapped as muck. Many areas of peat and peaty muck are included. The first-bottom soils occupy nearly level or gently sloping land along stream courses, and the material has been deposited recently by the streams. The texture ranges from sandy loam to silty clay loam. Members of the Ondawa, Hotaling, Saco, and Livingston soil series are first-bottom soils.

The miscellaneous nonarable soils and conditions of the county are included under the heads of meadow, rough stony land, steep broken and, tidal marsh, and made land.



[PUBLIC RESOLUTION—No. 9]

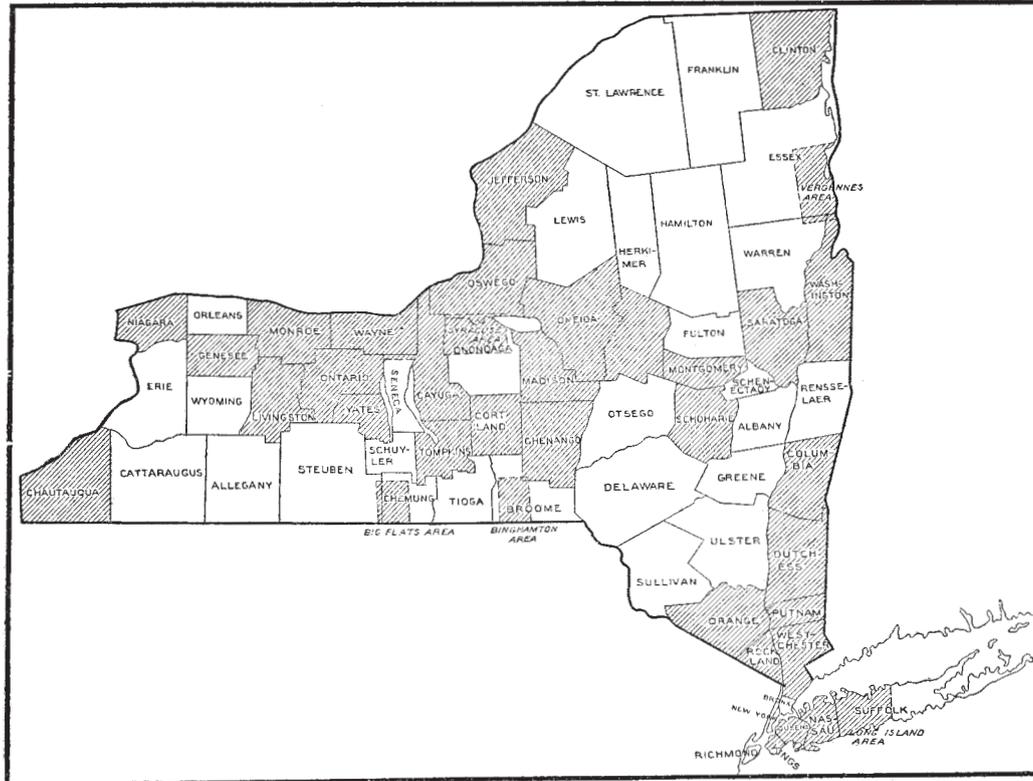
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

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

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

Approved, March 4, 1904.

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



Areas surveyed in New York, shown by shading

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