

# SOIL SURVEY OF THE LOCKHAVEN AREA, PENNSYLVANIA.

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## LOCATION AND BOUNDARIES OF THE AREA.

Clinton County is situated in the north central part of Pennsylvania, Only the southern part of the county is of agricultural importance, and the area surveyed (278 square miles in extent) covers approximately the southern third of the county. The northern boundary of the Lockhaven area is the Allegheny Mountain escarpment, which crosses Clinton County in a northeast and southwest direction. On the east Lycoming County forms the boundary, while on the south

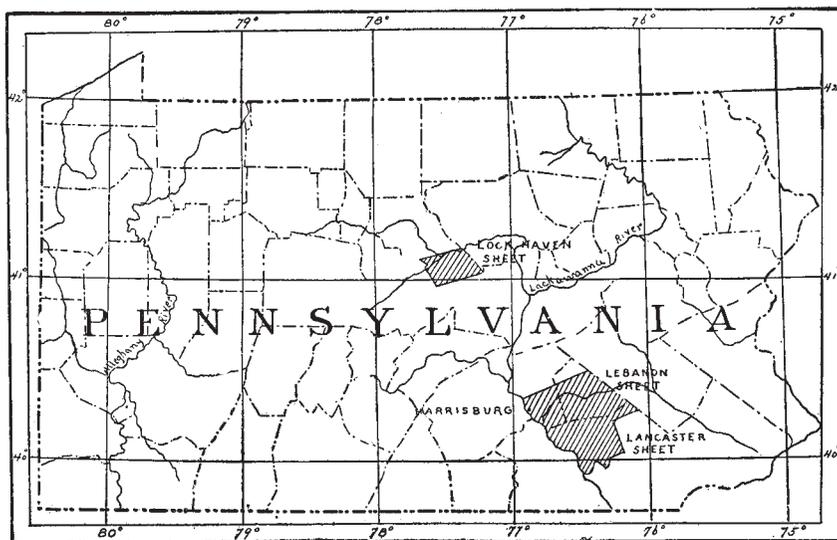


FIG. 4.—Sketch map showing location of the Lockhaven area, Pennsylvania.

and west lies Center County. The area is crossed by parallel  $47^{\circ}$  north latitude and by meridian  $77^{\circ} 90'$  west longitude. The west branch of the Susquehanna River flows through the northeastern quarter of the area. Lockhaven, situated on the Susquehanna River, is the principal town in the area, and has a population of about 7,000. Branches of the Pennsylvania and New York Central railroads run through the northern part of the area in an east and west direction.

## HISTORY OF SETTLEMENT AND AGRICULTURAL DEVELOPMENT.

The country embraced by the boundaries of Clinton County was included in the historic grant of land made to William Penn by the British Crown in 1681. Though settled half a century later than the southern and New England colonies, the eastern section of Pennsylvania made rapid progress and soon became one of the most prosperous of the colonies. The development of the present area of Clinton County, lying on the extreme western frontier of the settlement, was, however, very slow. It was not until 1769 that the first settlement within the limits of the county was made, near the present town of Lockhaven. The fertile valley of the Susquehanna was the natural highway for western migration, the old-fashioned "keel boat" forming the chief means of transportation. The settlers along the river were mostly Dutch, English Quakers, and Germans, with some Scotch-Irish and Swedes. The sturdy character of these settlers assured this section a substantial agricultural development. The exposed position of the settlements caused them to suffer occasionally from Indian outbreaks.

The present county of Clinton was organized in 1839. The West Branch Canal had been completed in 1834 and had given a great impetus to the development of the region, the towboat replacing the clumsy "keel boat." The West Branch timber boom built at Lockhaven in 1849 was the next important public improvement, and in 1859 the Philadelphia and Erie Railroad was completed. The population of the county in 1870 was 23,000 and in 1900 it was 29,000, so that the population has not increased very largely in late years.

Agriculture has been practiced from the time of the earliest settlement, but the hilly character of the country has always confined it to rather limited areas. Corn, wheat, tobacco, potatoes, and hay were grown from the first along the Susquehanna River and its tributaries and in the fertile limestone valleys, and are still the staple crops of the region.

Lumbering has been an industry of the first importance in the history of the county. The original timber was pine and oak, with some chestnut, hemlock, walnut, maple, ash, and hickory. It is estimated that between 1860 and 1880 nearly a hundred million feet of timber were converted each year into lumber in the many sawmills of the county, and that as much more was annually cut into logs and square timber and floated down the river. To the lumbering industry has been due much of the prosperity of the area. At the present time the lumber industry is fast falling off, only small, isolated patches of timber remaining, and a local scarcity seems imminent unless the woodlands are put under forestry management. There is a prosperous wood-pulp factory at Lockhaven which makes use of the smaller sized timber for manufacturing paper.

CLIMATE.

The climate of this area is in all essentials that of the Middle Atlantic States. The summers are not excessively hot, nor the winters very cold, as is shown by the following table of normal monthly and annual temperature as given by the records of the Weather Bureau stations at Lockhaven and State College, the latter in Center County, just outside the area. The rainfall in an average season furnishes abundant moisture for growing crops.

*Normal monthly and annual temperature and precipitation.*

Month.	Lockhaven.		State College.		Month.	Lockhaven.		State College.	
	Temperature.	Precipitation.	Temperature.	Precipitation.		Temperature.	Precipitation.	Temperature.	Precipitation.
	° F.	Inches.	° F.	Inches.		° F.	Inches.	° F.	Inches.
January .....	28.4	3.12	26.6	2.92	August .....	69.9	4.22	68.6	4.05
February .....	28.9	3.23	27.7	2.92	September ..	63.9	3.78	62.6	2.99
March .....	36.5	3.51	28.4	3.10	October .....	51.6	3.76	49.3	3.24
April .....	49.6	3.01	47.8	2.95	November ..	41.6	3.30	39.8	3.11
May .....	61.4	4.13	59.1	4.51	December ...	32.2	3.20	31.6	2.66
June .....	70.2	4.25	67.6	4.47	Year ..	50.5	42.03	48.3	40.81
July .....	71.3	2.52	70.1	3.88					

PHYSIOGRAPHY AND GEOLOGY.

The rocks of southern Clinton County are all sedimentary in character and consist of sandstone, shale, and limestone. Originally laid down in horizontal sheets, they have since been thrown into a series of folds and crumples. The Carboniferous sandstones form the northern boundary of the area, occurring as a steep ridge running in a north-eastern direction. Next to this ridge on the south, and parallel to it, is a slight valleylike depression where the sandstones and sandy shales of the Catskill group come to the surface. Parallel to the Catskill outcrop and next to it on the southeast there outcrops the Chemung, Portage, and Hamilton shales of the Devonian. For a few miles northeast of Beech Creek there is a narrow outcrop of the Oriskany sandstone, which ends, however, about opposite Millhall and is not found elsewhere in the county. The Helderberg limestone, being covered by alluvial deposits of Bald Eagle Creek and the Susquehanna River, is not a factor in soil formation within this area, nor is the Clinton shale outcrop along the slopes of Bald Eagle Mountain, which is mostly covered by the down-sliding masses of sandstones from the upper part of that mountain. Bald Eagle Mountain is composed of a ridge of Medina and Oneida sandstones which here rises from under the Devonian and extends in a series of nearly parallel folds to the southern boundary of the area and into Center County. The folds in the sandstone are nearly parallel to the Allegheny escarpment, and the

most of them have been so deeply cut into as to uncover the underlying Silurian limestone.

Occupying the northern part of the area is the Bald Eagle Valley, here from 4 to 5 miles wide. The southwestern end of this valley is drained by Bald Eagle Creek, which, about midway the length of the valley, flows into the West Branch of the Susquehanna River, which here enters Bald Eagle Valley through a great gap in the Allegheny Plateau and continues down the valley to Lycoming County. This valley is bounded on the south by the Bald Eagle Mountain ridge, which is composed of the upfolded Medina and Oneida sandstones. The next valley on the south is the Nittany Valley, formed in the first upfold of the above-mentioned sandstones, which has been eroded to a floor of underlying limestone. The main drainage of this valley is through Big Fishing Creek, which leaves the valley through a gorge at Millhall and flows into Bald Eagle Creek. Owing to the soluble nature of the limestone floor of this valley, many of the smaller streams sink into underground caverns and gush out at other places as large springs. The caving in of these cavern roofs has in some places caused sinkholes or basinlike depressions.

Nippenose Valley, only a small portion of which lies in Clinton County, is a cut in the same upfold in which the Nittany Valley is formed and is separated from it by an unbreached portion of the sandstone.

The sandstone then occupies all of the rest of the area, with the exception of a small upfold in which is cut Sugar Valley, a narrow valley tapering at each end like a canoe. This valley also has a limestone floor and is drained by Big Fishing Creek, which crosses into Nittany Valley through a gorgelike gap. All the streams of this sandstone area flow in gorges cut in the sandstone and are exceedingly steep and rocky.

The valley of Cherry Run, which lies between the Nittany and Sugar valleys, represents the earlier stage of both of the above valleys. Here the sandstones are cut through into the Hudson River shales, which, however, form no soil, being covered by the talus from the sandstone ridges on each side.

The Medina and Oneida sandstones which cover such a large surface of the area vary in hardness from a quartzite to soft sandstone. The hard areas, standing up and, resisting erosion, form the long ridges on each side of the several valleys.

#### SOILS.

The soils of the Lockhaven area may be divided into two classes—those resulting directly from rock disintegration and decomposition, known as residual soils, and those which have been transported by water, known as alluvial soils. The first of these cover the hills and

valley sides, and the other class is found along the more important stream courses.

Of these the residual soils cover the whole area except a narrow strip along Bald Eagle and Pine creeks and the West Branch of the Susquehanna River, where the underlying Helderberg limestone is covered by sediments brought down and deposited by those streams.

The following table gives the extent of each of the several soil types:

*Areas of different soils.*

Soils.	Acres.	Per cent.	Soils.	Acres.	Per cent.
De Kalb stony loam .....	111, 872	62. 8	Norfolk loam .....	3, 648	2. 0
Hagerstown shale loam .....	25, 728	14. 5	Lickdale clay loam .....	1, 984	1. 1
Hagerstown stony loam .....	22, 016	12. 4	Meadow .....	896	. 5
Penn stony loam .....	6, 080	3. 4	Total.....	178, 048	.....
Norfolk silt loam .....	5, 824	3. 3			

DE KALB STONY LOAM.

The De Kalb stony loam covers the largest acreage of any of the soils in this area. The surface where this type occurs is mountainous, and to a large extent is very rough and broken. The roughest areas are unfit for cultivation, and have in the past been covered by forests. Some of this type, however, is easily cultivated, being comparatively free from rocks, while other areas that are under cultivation represent a large expenditure of labor in removing rocks, which have been built into walls or piled in great heaps. On the mountains north of Loganton there are large areas of this type quite free from rocks, but only a small proportion has been cleared for agricultural purposes, the rest being covered with second-growth timber, which has often been burned over by forest fires. There is a phase of this soil occurring at the mouths of gorges in the form of alluvial fans, where in times of heavy flood the soil and rocks have been swept out and deposited. This phase is in no wise different from the rest of the type, except that many of the sandstone bowlders have been rounded by water action. One of the largest of these alluvial fans is found at Youngdale, 4 miles east of Lockhaven. Here McElhatten Creek, coming from its gorgelike cut through the Bald Eagle Ridge in torrential floods, has spread out such a large amount of material that it has caused a northward bend in the Susquehanna River.

The soil of the De Kalb stony loam consists of from 10 to 36 inches of yellow sandy loam, containing from 10 to 60 per cent of sandstone and quartzite fragments, grading into broken masses of sandstone or quartzite. In the mountain gorges bed rock outcrops to a large extent, or the slopes are covered with a talus of great sandstone fragments.

The De Kalb stony loam results from the decay through weathering of the Medina and Oneida sandstones of Silurian age. These, on account of their hardness, resist erosion and stand up as mountain ridges.

This is the poorest agricultural soil of the area, but where well cultivated it produces fair crops of corn and potatoes. The potatoes grown on it surpass in quality those grown in the heavier soils of the valleys, but the yields are small and uncertain. A few fine apple orchards have been set out on the mountain, north of Loganton. This is the great peach soil of western Maryland, and the development of this industry is worthy of consideration. The soil is well drained, and has many springs and streams of clear, soft water.

The following table gives mechanical analyses of typical samples of fine earth of this soil:

*Mechanical analyses of De Kalb stony loam.*

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
8635	Near Millhall .....	Yellow sandy loam, 0 to 8 inches.	1.17	3.50	6.70	8.74	25.80	22.62	20.96	11.78
8639	Near Youngdale....	Sandy loam, 0 to 10 inches.	1.23	3.70	6.42	7.08	22.52	20.52	24.14	15.40
8636	Subsoil of 8635.....	Yellow sandy loam, 8 to 16 inches.	.25	5.20	7.72	9.86	28.64	21.14	18.80	7.40
8640	Subsoil of 8639.....	Sandy loam, 10 to 14 inches.	.47	4.20	7.62	10.12	28.32	20.44	19.76	9.40

HAGERSTOWN SHALE LOAM.

The Hagerstown shale loam extends along the north side of the Bald Eagle Valley in a strip from 2 to 3 miles wide. The surface of the country over which this type is found is very hilly, the fields lying at an angle of from 10° to 40°. These hills run in a series of broken ridges parallel to the Allegheny escarpment, representing outcropping ledges of shales of varying hardness. At least one-third of this type is not under cultivation, but most of it can be farmed.

This soil results from the weathering of the Chemung, Portage, and Hamilton shales of Devonian age. These shales are frequently interbedded with thin arenaceous layers, fragments of which are found through the soil and on its surface.

The soil consists of a gray to yellow silty loam 10 to 12 inches deep, containing from 10 to 60 per cent of shale fragments. The subsoil

consists of a heavy yellow clay loam full of fragments of shale, grading at varying depths into broken shale. The soil when dry is light and powdery, but when wet it becomes heavy and sticky. The steepness of the fields on this type insures good drainage, and the shale fragments prevent its becoming as heavy when wet as it otherwise would be.

The Hagerstown shale loam is a fair general-purpose soil, under good cultivation producing medium crops of corn, wheat, and potatoes, as well as tobacco. It also furnishes some of the best pasturage of the area and grows good crops of hay.

The following table gives mechanical analyses of typical samples of fine earth of this soil:

*Mechanical analyses of Hagerstown shale loam.*

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
				P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
8552	3 miles NE. of Beechcreek.	Gray fine loam, 0 to 10 inches.	3.96	7.82	5.62	1.82	2.52	5.82	51.46	25.06
8554	4 miles W. of Lockhaven.	Yellow loam, 0 to 8 inches.	2.22	11.50	7.52	2.32	3.32	3.84	41.38	30.06
8553	Subsoil of 8552.....	Yellow clay loam, 10 to 36 inches.	.92	9.00	8.84	3.00	3.70	4.60	40.58	30.64
8555	Subsoil of 8554.....	Yellow clay loam, 8 to 36 inches.	.52	7.68	8.20	3.40	4.10	3.50	35.94	36.68

HAGERSTOWN STONY LOAM.

The Hagerstown stony loam occurs in the three elongated valleys of the area which are cut through the Medina and Oneida sandstones. These are the Nittany, Nippenose, and Sugar valleys, of which the Nittany Valley contains the largest and most typical area of this soil. These valley bottoms are rolling in character, and have numerous depressions or sinkholes, due to the falling down of the roofs of limestone caverns, of which there are undoubtedly many still existing. The soil is well drained.

The soil consists of from 8 to 10 inches of brown to grayish-yellow loam or silty loam, which bakes very hard when dry and is quite sticky when wet. The subsoil to a depth of 36 inches consists of a yellowish-red clay loam or clay, very stiff and tough, which when brought to the surface by the plow bakes into hard lumps. Both soil and subsoil contain many fragments of flint and chert.

The Hagerstown stony loam is derived from the weathering of Lower Silurian limestone, which in these valleys has been brought near the

surface by upfolding and erosion. Throughout the valleys outcrops of this limestone are numerous, and there are frequent remains of limekilns, once quite common, but now mostly abandoned.

On the Hagerstown stony loam occur some of the best farms of the area, and all of them have an air of prosperity. The barns are large and well built, and the buildings and fences are in good repair. Fully 80 per cent of the area occupied by this type is under cultivation; only here and there are small patches left in forest.

The Hagerstown stony loam is well adapted to wheat, corn, rye, grass, and especially clover. Other general crops do well, but the above-mentioned crops seem especially to thrive on this type. Thus far no tobacco has been grown on the Hagerstown stony loam, although it seems probable the soil is adapted to the Pennsylvania type of this crop.

Although the Hagerstown stony loam is a soil derived from limestone and is full of limestone fragments, it is greatly benefited by a liberal application of burnt lime, large quantities of which are used. The use of lime lightens the soil and makes it easier to work and less liable to bake and clod.

The following table gives mechanical analyses of typical samples of fine earth of this soil:

*Mechanical analyses of Hagerstown stony loam.*

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
8556	1½ miles S. of Cedar Springs.	Brown loam, 0 to 12 inches.	1.93	0.80	3.20	1.92	3.20	15.84	50.30	24.02
8560	1 mile NE. of Lamar.	Brown loam, 0 to 10 inches.	1.73	2.70	4.00	2.10	4.40	7.78	45.82	33.18
8558	2 miles NE. of Salona.	Heavy brown loam, 0 to 8 inches.	.89	1.28	1.86	1.08	2.66	5.38	46.54	40.28
8561	Subsoil of 8560.....	Brown clay, 10 to 36 inches.	1.18	1.70	3.50	2.00	3.70	6.24	51.02	31.84
8557	Subsoil of 8556.....	Clay, 12 to 36 inches.	.53	.80	2.00	.98	3.18	16.30	31.60	44.94
8559	Subsoil of 8558.....	Clay, 8 to 36 inches..	.82	1.96	2.20	.98	2.40	4.10	37.86	50.00

PENN STONY LOAM.

The Penn stony loam occupies the smallest area of the residual soils of the Lockhaven area. It occurs as a narrow belt, from one-eighth to three-fourths of a mile in width, at the foot of the Allegheny escarp-

ment, occupying a hilly upland depression between the outcrops of the Pocono sandstone and the shale members of the Devonian age. Most of the farms in this type are quite hilly and steep, and for this reason are well drained.

The soil consists of a red loam, 8 to 12 inches deep, underlain by a slightly heavier subsoil of the same character. Both soil and subsoil contain from 10 to 40 per cent of fragments of red sandstone and sandy shale.

The Penn stony loam is derived from the red sandstone and sandy shales of the Catskill group, of Devonian age. These sandstones are thin bedded, and the fragments found in the soil are flat and angular. Along the foot of the steep Allegheny escarpment this soil is frequently scattered over with fragments of the Pocono sandstone that have rolled down the steep slopes.

This is an excellent general farming soil, and grows good crops of corn, wheat, oats, rye, and potatoes. Fully 90 per cent of this soil type is under cultivation, little of it being left in forest.

The following table gives mechanical analyses of typical samples of fine earth of this soil:

*Mechanical analyses of Penn stony loam.*

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
				P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
8564	6 miles NE. of Beechcreek.	Red loam, 0 to 12 inches.	2.29	1.80	3.30	1.76	3.70	9.36	50.60	23.80
8562	3 miles N. of Beechcreek.	Brown loam, 0 to 10 inches.	1.74	.80	1.56	.74	2.70	6.70	57.72	29.46
8566	3 miles NW. of Lockhaven.	Red stony loam, 0 to 10 inches.	1.95	3.60	3.04	1.40	4.60	11.96	43.64	31.64
8567	Subsoil of 8566.....	Red stony loam, 10 to 36 inches.	.89	2.98	4.40	2.10	6.24	13.26	40.60	30.30
8565	Subsoil of 8564.....	Red loam, 12 to 36 inches.	.67	3.70	5.50	2.30	4.10	9.12	42.70	32.38
8563	Subsoil of 8562.....	Red loam, 10 to 36 inches.	.70	2.00	3.10	1.80	5.20	9.48	45.08	32.66

NOTE.—The following sample contained more than one-half per cent of calcium carbonate (CaCO<sub>3</sub>): No. 8565, 0.80 per cent.

#### NORFOLK SILT LOAM.

The Norfolk silt loam covers the largest acreage of any of the alluvial soils of the area. It is found entirely in Bald Eagle Valley, along Pine and Bald Eagle creeks and the Susquehanna River. It represents the

deposit of sediments at times of high flood, when the streams overflowed their banks and spread out over the adjacent country. Heretofore it has been distinctly a Coastal Plain type, but as these same sediments help to form the Coastal Plain soils there is good reason to extend the name to cover soils of the same character and material on their way down the larger rivers to the coast.

The Norfolk silt loam consists of from 8 to 10 inches of brown loam containing an occasional scattered pebble or rounded bowlder, underlain by a heavy, brown loam subsoil which exhibits as a local variation thin lenses of sand or sandy loam.

This is one of the soils of the area on which the best tobacco is grown. It is also used for general crops, such as corn, wheat, potatoes, and grass. The Norfolk silt loam is all under cultivation and the best farms of Bald Eagle Valley are on this type.

The following table gives mechanical analyses of typical samples of this soil:

*Mechanical analyses of Norfolk silt loam.*

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
8570	Lockhaven .....	Brown loam, 0 to 10 inches.	2.02	Tr.	1.10	1.38	10.30	28.02	41.86	17.40
8568	Flemington .....	Brown loam, 0 to 10 inches.	1.99	0.00	.48	.56	4.88	37.68	37.88	17.78
8572	$\frac{1}{2}$ mile SE. of Oak Grove.	Brown loam, 0 to 10 inches.	2.46	.28	1.32	1.12	3.72	12.66	53.58	27.28
8571	Subsoil of 8570 .....	Heavy brown loam, 10 to 36 inches.	.64	.00	.78	1.60	10.96	25.56	38.44	22.70
8573	Subsoil of 8572 .....	Brown loam, 10 to 36 inches.	.46	.30	1.48	4.12	16.08	15.88	33.94	27.62
8569	Subsoil of 8568 .....	Heavy brown loam, 10 to 36 inches.	1.00	Tr.	.40	.70	5.14	20.86	43.10	29.50

NORFOLK LOAM.

The Norfolk loam occurs in narrow bands along the main stream courses in the Bald Eagle Valley. It represents deposits of river sediments where the current is swiftest and is subject to annual variation due to washing, which sometimes completely removes the soil from areas several acres in extent and deposits it in other places. In several instances this flood washing has been so serious as to cause property holders to ask for abatement of taxes, claiming a serious reduction in the value of their lands.

The soil of the Norfolk loam consists of a yellow to brown fine sandy loam 12 to 14 inches in depth, gradually becoming heavier in lower depths, but often underlain by sandy strata. Both the soil and subsoil contain scattered pebbles and rounded bowlders of sandstone from the adjacent hills.

This is the most valuable tobacco soil of the area, producing the crops of finest quality and heaviest yield. It also produces corn and potatoes, but is not as valuable for wheat and grass as the heavier types.

The following table gives mechanical analyses of typical samples of this soil:

*Mechanical analyses of Norfolk loam.*

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
8576	1 mile E. of Lockhaven.	Fine sandy loam, 0 to 10 inches.	1.98	0.00	0.48	1.08	26.00	40.96	19.90	11.16
8574	Near Charlton.....	Brown fine sandy loam, 0 to 10 inches.	1.86	.20	.46	.94	35.84	32.86	18.36	11.26
8578	2 miles SE. of Oak Grove.	Brown fine sandy loam, 0 to 12 inches.	2.99	.00	.74	.56	12.02	35.94	31.66	18.24
8575	Subsoil of 8574.....	Brown fine sandy loam, 10 to 36 inches.	1.73	.00	.32	.44	16.24	33.24	30.60	19.04
8577	Subsoil of 8576.....	Brown fine sandy loam, 10 to 36 inches.	1.55	.00	.16	.68	15.88	35.08	28.28	19.70
8579	Subsoil of 8578.....	Fine sandy loam, 12 to 36 inches.	1.61	.00	.38	.46	6.26	25.76	37.18	29.96

LICKDALE CLAY LOAM.

The Lickdale clay loam covers the smallest acreage of any soil type of the area, aggregating about 3 square miles. One of these is at the western end of the area, near Beechcreek, and another is at the eastern end, near Oak Grove. It exists also along the border of the hills next to the Hagerstown shale loam, and is derived largely from wash from that type.

The soil consists of from 8 to 10 inches of silty gray clay loam, underlain by a subsoil of mottled yellow and gray clay. Both soil and subsoil contain varying percentages of sandstone and shale fragments. It is a poorly drained soil and hard to cultivate unless artificially drained. It is best suited to pasturage, but when drained and under proper methods of cultivation will yield fair crops of wheat and corn.

The following table gives mechanical analyses of typical samples of fine earth of this soil:

*Mechanical analyses of Lickdale clay loam*

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
8641	Near Oak Grove....	Gray silty clay, 0 to 8 inches.	1.54	0.30	1.30	1.70	1.96	10.26	56.66	28.84
8643	Beechcreek .....	Gray silty clay, 0 to 8 inches.	1.32	.30	.90	.60	1.64	9.76	55.64	30.86
8644	Subsoil of 8643.....	Mottled clay, 8 to 36 inches.	.48	Tr.	.30	.10	.76	5.48	42.06	50.80
8642	Subsoil of 8641.....	Gray and yellow clay, 8 to 36 inches.	.37	.40	.60	.40	1.20	7.10	39.12	51.18

#### MEADOW.

There is little Meadow in the area, owing to the fact that the grades are steep enough to furnish a rapid flow to the streams. The small areas of this soil found are in Bald Eagle and Nittany valleys. The Meadow consists of low-lying, poorly drained land along the stream courses and is made up of stream deposits of varying texture. In this area it is used for pasturage.

#### DRAINAGE.

On account of the steepness of the grades of most of the fields of the area the soils are all fairly well drained. The streams have rapid descents and the rainfall finds its way speedily into the main streams. So rapidly does the water rush from the deforested hillsides that the rivers rise rapidly and cause disastrous floods, frequently destroying the growing crops in the Bald Eagle Valley. These floods come at irregular intervals, but are liable to occur during almost any month in the year. The last great flood was in June, 1889, when the water swept the valley of the Susquehanna, destroying crops, buildings, etc., and doing great damage.

The danger from these floods might be materially lessened if an intelligent system of forestry could be established upon the otherwise unproductive lands of the county. These were once covered by magnificent forests, but are now barren, rocky hillsides, with no receptive soil to hold the rainfall.

## AGRICULTURAL CONDITIONS.

As a rule the farmers of the Lockhaven area appear to be fairly prosperous, especially in the Bald Eagle and Nittany valleys. Schools are numerous and dwellings and farm buildings are well kept up. But it is undoubtedly true that with the decline of the lumber industry there has been something of a decrease in prosperity of the farming class. This is shown by the large number of tenant farms and the number of farm mortgages. No exact data are available on this subject, but inquiry indicated that at least 50 per cent of the farms are held by town residents, who rent their lands, and it is undoubtedly true that a large percentage of the freehold farmers have mortgages on their farms. One of the most important factors contributing to this condition is undoubtedly the decline of lumbering, which in its prime furnished a ready local market for farm products.

The farm holdings are as a rule from 150 to 300 acres, a large part of which is usually wood or pasture land. Labor is not easy to obtain, and many of the farmers, obliged to do their own work, are not able to properly cultivate their large holdings.

The crops raised in this section are, with one exception, the general farm crops, wheat, corn, potatoes, and hay, all of which produce good yields. The special crop, which is not of great importance, is tobacco. The tobacco grown in this area is produced almost entirely upon the alluvial soils bordering the main streams in the Bald Eagle Valley. Some is grown upon the Hagerstown shale loam and brings as high prices as that grown in the valley.

The tobacco industry appears to have steadily declined since 1899, when the maximum area of 928 acres was planted. The following table<sup>a</sup> shows that since that year there has been a marked decrease in the acreage planted to this crop:

*Table showing annual acreage of tobacco in the Lockhaven area from 1895 to 1902.*

Year.	Acres.	Year.	Acres.
1895.....	591.0	1899.....	928.0
1896.....	587.0	1900.....	845.5
1897.....	781.0	1901.....	808.5
1898.....	803.0	1902.....	661.0

This gradual decline in acreage is due to a steady fall in price, the result, in part, of increased production in other districts. All the tobacco grown in Clinton County is of the cigar-leaf type, both fillers and wrappers. The Havana seed and Connecticut broad leaf are the

<sup>a</sup> From the Lockhaven Evening Express.

varieties which are most grown and give the best returns. The yield ranges from 1,000 to 2,000 pounds per acre, and the crop sells at an average price of 10 cents a pound.

The soils of the area which are adapted to growing this kind of tobacco are undoubtedly the alluvial types, the residual soils of the upland, with the possible exception of the Penn stony loam, being too heavy to produce the best quality of leaf.

It appears that not enough attention is given to the growing of fruit in this area, especially apples and peaches, which should do well on the hill farms. In the limestone valleys the stock-raising and dairy industries might be made very profitable, the soils being excellent grass producers.

Transportation for farm products of the area is entirely by rail, over branch lines of the Pennsylvania and New York Central railroads and the Central Railroad of Pennsylvania, which taps the Nittany Valley. Sugar Valley's nearest railroad outlet is also by this road, necessitating a 12-mile haul across the mountains.

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