

SOIL SURVEY OF CLEARFIELD COUNTY, PENNSYLVANIA.

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DESCRIPTION OF THE AREA.

Clearfield County is situated a little west of the geographical center of the State of Pennsylvania, about 80 miles northeast of Pittsburgh. It is bounded on the north by Elk and Cameron Counties; on the east by Clinton and Center Counties, being separated from the latter by the West Branch of the Susquehanna River and by Moshannon Creek; on the south by Cambria County; and on the west by Indiana and Jefferson Counties. In outline the county is roughly rectangular. It is one of the largest counties of the State, comprising an area of 1,142 square miles, or 730,880 acres.

The county lies entirely within the Allegheny Plateau region, a physiographic division structurally composed chiefly of shales and sandstones and marked by a steeply rolling to hilly topography, generally the result of severe erosion in past ages.

There is a broad similarity in general topographic features in the different parts of the county. Local variations range from level to rugged, but in general the county is formed of an intricate succession of hills and ridges that give it a steeply rolling to hilly topography. There are no distinct mountain ranges, though many of the watersheds between the principal tributaries of the Susquehanna River rise to elevations of 1,700 to 2,250 feet above sea level.

The area of the county may be divided, according to topography, into three divisions—first, the level to gently rolling areas encountered on the crests of hills and ridges, around the heads of streams, along the lower slopes of many of the small streams, and in the alluvial valleys; second, the steep and rugged areas occurring along

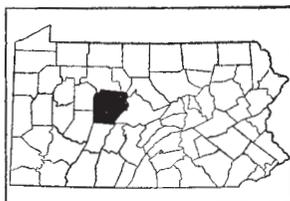


FIG. 5.—Sketch map showing location of the Clearfield County area, Pennsylvania.

all the larger stream courses; and third, the rolling to hilly areas forming the remainder of the county.

The topography is related to the character of the underlying rocks. Extending across the northern third of the county is a high watershed supported by the Pocono and Pottsville formations that consist chiefly of sandstones and conglomerates, the hardest rocks appearing in the county, and the region is consequently hilly to mountainous. It is well dissected by a network of streams flowing through deep, narrow valleys whose slopes are invariably rough, and strewn with large and small boulders and marked in many places with massive rock outcrop. The hills and ridges are fairly well rounded on top, and often broad and fairly level. In general the interstream areas in this watershed have approximately the same level, with usually a few ridges and knobs rising to higher elevations.

The southern and western parts of the county, aggregating probably 60 to 75 per cent of its total extent, are underlain by the softer shales and sandstones of the productive Coal Measures. The region has been reduced to an intricate succession of well-rounded or flat-topped hills and ridges with rather steep but not rugged slopes. Varying quantities of small rock fragments are present on the slopes. The principal drainage lines, however, have cut deep, narrow valleys whose steep walls are well strewn with fragments of sandy shale and sandstone and occasionally marked by exposures of massive sandstone. This condition obtains along the West Branch of the Susquehanna River, and Chest, Anderson, Clearfield, and Moshannon Creeks, and their principal tributaries.

On the crests of the ridges, at the heads of streamlets, and along the lower slopes of many of the small streams, generally, surface features vary from level to gently sloping; also there are small areas, from 50 to 100 acres in extent, promiscuously scattered throughout the county, where the topographic features vary from gently rolling to rolling.

There are no extensive alluvial deposits in the county. Narrow strips are found along many of the streams, but the most important developments occur along Sandy Lick Creek in the northwest, Chest and Clearfield Creeks in the south, Moshannon Creek in the east, and at intervals along the Susquehanna River. These deposits have a flat to undulating topography.

Elevations above sea level range from 850 feet in the northeast to 2,280 feet in the north, with an average of 1,200 to 1,500 feet. The following are some of the towns of higher elevation in the county: Karthaus, 850 feet; Clearfield, 1,089; Curwensville, 1,127; Lumber City, 1,150; Dubois, 1,390; Penfield, 1,280; Luthersburg, 2,060; Burnside, 1,300; Houtzdale, 1,503; and Osceola, 1,471.

The general slope of the county is to the northeast. The region lies almost entirely within the drainage basin of the West Branch of the Susquehanna River, which stream flows across the county in a general northeasterly direction, with numerous tributaries entering along its course both from the north and the south. The northwestern corner of the county is within the Allegheny River drainage, mainly through Sandy Lick Creek. The divide separating these two large drainage basins, marking also a shed between the Atlantic and Gulf waters, follows roughly a crooked line from Troutville through Luthersburg, Rockton, Sabula, and thence northward into Elk County. Near Sabula an arm of this high land extends eastward across the northern part of the county, marking a divide between tributaries of the Susquehanna River, the West Branch of that river on the south, and Sinnamahoning Creek on the north, the headwaters of the latter stream draining the territory around Winterburn, Penfield, and Tyler. The headwaters of the important streams extend to all parts of the county. Natural drainage is well established everywhere, except in narrow marginal strips of alluvial deposits along some of the streams where a marshy condition prevails. Every farm has at least a number of small drainage outlets. The high watershed in the northern part of the county has a strongly established drainage, but is not so well watered as other parts.

The larger streams flow rapidly through narrow valleys cut from fifty to several hundred feet deep below the upland. The process of stream cutting is still going on. Portions of Sandy Lick, Moshannon, and Chest Creeks have reached a stage where alluvial deposits are being laid down over a narrow bottom. Most of the larger streams afford some water power.

Clearfield County was formed from parts of Lycoming and Huntingdon Counties in 1804. It remained annexed to Center County for judicial purposes until 1822, when it was fully organized, with Clearfield as the county seat.

The first permanent settlement was made in the extreme western part of the county in 1785. Only a very scattered settlement took place within the next 25 years, the pioneers locating principally along the Susquehanna River. In the decade beginning in 1805 considerable immigration took place, there being 875 persons in the county in 1810, and subsequently the population steadily increased. The early settlers came largely from the eastern part of the State. They were mainly of Dutch, Scotch-Irish, and German extraction. In later years many immigrants came direct from Europe.

Practically all these earlier settlers engaged in agriculture. Later, the abundance of timber caused the development of extensive lumbering interests and greatly increased the immigration of people ac-

tive in that field of industry, while following the development of the mineral resources, chiefly coal, large numbers of laborers came into the county. At present the population is heterogeneous, the industrial workers being largely of foreign descent, while the rural districts are more largely settled by native-born Americans and descendants of the older families. The county is generally and uniformly settled, with the exception of a rather broad strip across the northern edge, aggregating probably a fourth of the area. Here the lands are high, rough, and stony, depleted of virgin timber, and barren of coal deposits. Here no permanent settlements have been made, but a few camps are scattered throughout the region for use during the hunting season. The population of the county according to the census of 1910 is 93,768. Of this number 71,745, or 76.5 per cent, is rural. The density of population is 62.8 persons per square mile.

Clearfield, the county seat, with a population of 6,851 in 1910, is the oldest borough in the county, and an important business center. Dubois, in the northwestern part of the county, is the largest city, with 12,623 inhabitants. It is a railroad junction, and has important coal mining, lumbering, and other commercial interests. Other places of importance are Curwensville, in the central part of the county, with a population of 2,549; Osceola and Houtzdale, in the southeastern part, with 2,437 and 1,434 inhabitants, respectively; and Ramey, in the southern part, with 1,045 inhabitants. Other towns having a population of 500 to 1,000 are Woodland, Winburne, Grampan, Mahaffey, Westover, Irvona, Coalport, Penfield, Tyler, Hawk Run, Morrisdale, Grassflat, and Munson. In addition to these there are numerous small villages and rural centers.

All parts of the county have excellent transportation facilities. The Buffalo, Rochester & Pittsburgh Railway, the Pennsylvania Railroad, the Buffalo & Susquehanna Railway, the New York Central & Hudson River Railroad, and the Pittsburgh & Susquehanna Railway each operate one or more lines in the county. All of these roads have spurs extending to the many coal mines that lie at some distance from their main lines. Besides the steam lines there are two electric railways and several motor bus lines in operation in the county.

The public highways, called township roads, form a network over all parts of the county, except the unsettled regions in the north. They are usually in good condition, particularly during the summer season. The natural shale roads are exceptionally good, but in the regions of sandstone the roads are more generally rough and rocky. The State highways, forming a sparse network of trunk lines, are well constructed and kept in excellent condition. Many miles are of macadam, and the surface is graveled and oiled.

Telephone service and mail delivery routes are established throughout the county. Public schools and churches are conveniently located in every community.

Dubois, Clearfield, Curwensville, Osceola, and Houtzdale are the principal local markets, though some produce is received and sold at all the towns. Philipsburg, in Center County, just across Moshannon Creek, is a local market of considerable importance. Williamsport, Altoona, Harrisburg, and Pittsburgh are convenient outside markets. Very little farm produce is shipped out of the county, as the local demand is greater than the supply.

CLIMATE.

The climate of Clearfield County is comparatively uniform and healthful. The winters are long and cold, being more severe in the higher, barren region of the north than in the lower lying region of the south. In the former region the temperature frequently falls below -20° F. The mean for the winter months is 24.4° F. The summers are very pleasant. Occasionally the temperature reaches 90° or 100° F. during the day in midsummer, but the nights are always cool. The mean summer temperature at Grampian, which may be taken as representative of the southern part of the county, is 68.4° , with an absolute maximum of 100° and an absolute minimum of 34° .

The average annual rainfall is 44.37 inches. This is fairly well distributed throughout the year and is ample for all crops grown in the county. It is heaviest in the summer months, the mean for June, July, and August being 13.12 inches. The snowfall is usually heavy throughout the county.

Below are given the dates of the first killing frosts in the fall from 1909 to 1915, and the last in the spring from 1911 to 1915 at Clearfield as compiled by the Weather Bureau:

Dates of killing frost at Clearfield.

Year.	First in fall.	Last in spring.
1909.....	Sept. 28
1910.....	Oct. 11
1911.....	Oct. 8	May 7
1914.....	Sept. 10	May 17
1915.....	Sept. 29	May 27

These data show a considerable variation in length of growing season. Thus, in the year 1911 the growing season was unusually long—154 days—while in 1914 it lasted but 116 days. It is probable

that the first killing frost in the fall may be expected about the 1st of October and the last in the spring about the middle of May.

The cold winters and the short growing season confine the agriculture of the county to hardy crops and those which mature in a reasonably short time. Late spring frosts frequently injure the peach crop, but apples are grown successfully in all parts of the county. Winter grain crops also are successfully grown. There is some danger from freezing, but a blanket of snow usually affords protection to the crop during the winter months.

The following table gives the normal monthly, seasonal, and annual temperature and precipitation at Grampian, situated in the west-central part of the county:

Normal monthly, seasonal, and annual temperature and precipitation at Grampian.

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1895).	Total amount for the wettest year (1890).
	° F.	° F.	° F.	Inches.	Inches.	Inches.
December.....	26.4	60	-10	3.61	3.48	4.28
January.....	22.9	60	-32	3.56	5.10	4.41
February.....	24.0	60	-24	3.40	.96	5.52
Winter.....	24.4	60	-32	10.57	9.54	14.21
March.....	31.5	81	-14	3.93	1.90	6.32
April.....	44.7	90	14	3.41	3.81	3.39
May.....	57.2	94	23	4.29	2.38	6.87
Spring.....	44.5	94	-14	11.63	8.09	16.58
June.....	66.7	100	34	4.19	2.87	2.74
July.....	70.6	98	39	4.93	2.85	3.37
August.....	67.8	94	34	4.00	3.08	6.41
Summer.....	68.4	100	34	13.12	8.80	12.52
September.....	60.8	90	26	3.20	2.20	5.87
October.....	48.1	82	18	2.79	1.26	6.36
November.....	35.8	72	8	3.06	2.57	1.96
Fall.....	48.2	90	8	9.05	6.03	14.19
Year.....	46.4	100	-32	44.37	32.46	57.50

AGRICULTURE.

The agricultural development of Clearfield County began in the latter part of the eighteenth century, when a few homesteads were located along the Susquehanna River. By 1810 there were nearly a thousand persons in the county, and immigration was steadily in-

creasing. Most of the early settlers were farmers. Corn and rye were the principal crops grown, with wheat, potatoes, flax, hemp, and grasses finding a place as larger areas of land were cleared. Lumbering became an important industry, and sawmills were established, the lumber being rafted down the river to market. The growing population increased the demand for farm produce, and the agricultural development of the region progressed steadily. Wheat, corn, buckwheat, oats, rye, and potatoes were grown, and orchard fruits and maple sirup were produced in small quantities. For a time after the advent of the railroad in 1869 there was a notable decline in the production of farm crops, due to the increased interest in lumbering and coal mining. The following table, compiled from the census reports, shows the relative importance of the principal crops of the county from 1879 to 1909, inclusive:

Acres and production of the principal crops in Clearfield County for the years 1879 to 1909.

Crop.	1879		1889		1899		1909	
	<i>Acres.</i>	<i>Bushels.</i>	<i>Acres.</i>	<i>Bushels.</i>	<i>Acres.</i>	<i>Bushels.</i>	<i>Acres.</i>	<i>Bushels.</i>
Corn.....	14,377	645,199	11,008	363,050	13,802	351,260	11,592	389,915
Oats.....	14,905	352,288	15,066	382,056	15,280	414,040	16,215	337,640
Wheat.....	13,196	141,737	6,142	74,787	7,452	105,720	3,861	57,984
Rye.....	5,685	50,658	5,490	64,145	7,348	87,270	6,229	73,366
Buckwheat.....	6,120	88,038	6,044	81,594	8,826	121,160	10,529	168,450
Potatoes.....	1,802	160,402	2,261	116,311	3,208	334,608	4,496	447,040
Barley.....	75	812	56	955	73	1,230	81	1,489
Hay.....	24,075	<i>Tons.</i> 17,753	43,515	<i>Tons.</i> 53,000	38,281	<i>Tons.</i> 33,799	35,951	<i>Tons.</i> 30,823

At present agriculture is carried on over practically all the county, except the high, hilly region extending across the northern part. Little development has taken place, however, over broad areas in the southern part of the county, in which coal mining and lumbering have been important.

The prevailing agriculture consists of the production of grain, hay, fruits, and vegetables, and the raising of poultry and live stock, chiefly hogs, dairy cattle, and beef cattle. All surplus products are sold at local markets. Corn, oats, buckwheat, rye, and wheat are the principal grain crops, timothy and clover the chief hay crops, and potatoes and other vegetables the important special crops. Barley, beans, alfalfa, coarse forage, grasses, and sweet potatoes are grown to a small extent.

In 1909, according to the census, there were 11,592 acres planted to corn which produced 389,915 bushels, averaging 33.6 bushels per acre. The crop is consumed almost entirely on the farm. It is grown

usually on sod land, which is broken in the spring after having received a dressing of barnyard manure. A well-prepared seed bed is obtained by harrowing and dragging. Yields range from 45 to 65 bushels per acre on selected areas of the DeKalb gravelly loam and gravelly silt loam and the Holston soil types.

The area in oats in 1909 exceeded that in corn, being 16,215 acres, with an average yield of 20.8 bushels per acre. The crop ordinarily follows corn or wheat. It is harvested in July and fed largely on the farm, the surplus being sold in the local markets. The fields are seldom fertilized.

Buckwheat is next in importance, 10,529 acres being reported in 1909, with an average yield of 16 bushels per acre. The acreage planted varies considerably from year to year, depending on seasonal conditions. This crop is sown early in July and harvested in October. As a rule it is grown on stony and gravelly types of soil. Practically all the crop is consumed locally.

Rye occupied 6,229 acres in 1909, with an average yield of 12 bushels per acre. It is commonly drilled in after buckwheat. Quite often the crop is pastured off. On slopes it is beneficial in retarding any severe erosion. The grain is disposed of in the local markets, principally at distilleries. Rye does well on all the soils of the county, responds readily to any fertilizer treatment, and with proper care could be made a very profitable crop generally.

The area in wheat is relatively small, only 3,861 acres being reported in 1909. The total yield was 57,984 bushels, or 15 bushels per acre. This is about one-half the production reported by the previous census. Winter wheat is grown, and while the yields are low the grain is of good quality. The crop usually follows oats. The fields are prepared in August or September and the seed sowed with a drill in October. An application of about 200 pounds per acre of phosphatic fertilizer is made. Wheat is grown both for home use and as a money crop.

Potatoes are grown in small patches by nearly every farmer for home use, the surplus being sold at the local markets. In 1909, 4,496 acres planted to potatoes gave an average yield of about 100 bushels per acre. The soils of the county are generally well suited to potatoes, and much larger yields could be obtained by using care in selecting seed, applying fertilizers, and employing modern methods of cultivation.

Hay is important both in supplying feed for live stock and as a cash crop. Timothy and clover are the principal hay crops. Alfalfa is successfully grown in a small way on the Dekalb shale loam, gravelly silt loam, and loam. Three cuttings per season are ordinarily obtained, with seasonal yields of 3 to 4 tons per acre. Clover is

usually seeded with timothy in the oats and wheat. It does well for one or two years, after which the timothy predominates. In 1909 a total of 35,024 acres was devoted to cultivated grasses, with a production of 27,560 tons of hay, or an average of nearly 1 ton per acre.

Small acreages of barley, beans, and sweet potatoes are customarily grown. Vegetables are grown on every farm in small patches, both for home use and for sale in the local markets. There are no large truck farms. Blackberries, raspberries, and strawberries are grown in patches and sold locally.

Apples are grown on nearly every farm. No large commercial orchards have been developed, although considerable fruit is sold. The leading varieties of apples are the Northern Spy, Maiden Blush, Rambo, York Imperial, Baldwin, Ben Davis, Winesap, and Rhode Island Greening. Apple culture could be developed in the county on a large commercial scale.¹ The quality of the fruit is usually good, and yields are high. Steps to prevent loss by fungous diseases and insect pests are necessary.

Peaches are uncertain, and little development in the production of this crop has taken place. There are several young commercial orchards in the central part of the county. Pears are not grown extensively, though certain varieties, including the Kieffer, Bartlett, Lincoln, and Clapp Favorite do very well. The trees suffer from blight. Plums, grapes, and cherries do well and are grown by many farmers for home use.

Dairy and beef cattle and hogs are raised on nearly every farm. The dairy animals are usually of pure-bred Jersey or Holstein stock, while the beef cattle are mostly grades. Feeding is practiced only during the winter months. A large number of farmers keep as many cows as they can conveniently care for, and near the principal cities there are a few rather large dairies. The dairy products are sold on the local markets and at near-by mining towns. No milk or butter is shipped from the county.

Hogs are commonly raised in small numbers for home use, although local city markets are partly supplied from the surrounding rural districts. The stock consists mostly of Poland-China, Duroc-Jersey, Berkshire, and Chester White breeds and their crosses. There are only a few small flocks of sheep in the county. There would seem to be an opportunity for the extension of sheep raising on the stony types of soil, which are not largely utilized for the production of crops. Some poultry is raised on nearly every farm.

¹ See Annual Report of the Pennsylvania State College, 1910-11, Fruit Lands and Soil Variety Adaptation, by Wilder.

The following table, compiled from the census reports, gives the number of domestic animals on farms and ranges and the number sold or slaughtered in 1909:

Status of domestic animals, Clearfield County, census 1910.

Animal.	On farms and ranges.	Sold or slaughtered in 1909.
Horses, mules, asses and burros.....	6,053	1,457
Milch cows.....	9,237
Calves.....	2,771	4,274
All other cattle.....	4,874	3,789
Swine.....	9,923	13,498
Sheep and goats.....	4,572	1,837

¹Sold.

The total value of all farm products, according to the 1910 census, was \$2,973,077. Deducting the cost of labor, feed, and fertilizers, amounting to \$481,712, there remains a balance of \$2,491,365 representing subsistence, interest, and profits.

Physiography has an important bearing upon the utilization of the soils. Extensive areas in the northern part of the county, where the soils are high, rather poorly watered, of sandy texture, and largely stony, are untouched. In other sections, chiefly near the larger stream courses, where the land is steeply sloping and badly eroded, little cultivation is attempted. Where clean-cultured crops are grown, surface slope is a vital factor, since erosion is active and leaching is rapid.

There is such general similarity in the character of the soils that little attention is given to soil adaptation. The Dekalb stony silt loam, gravelly silt loam, stony loam, and gravelly loam, the prevailing soil types of the county, are adapted to the same crops and give similar yields. Corn is planted on all the principal upland and bottom-land soils. The shale lands, including loams and silt loams, are preferable for wheat, oats, rye, timothy, and clover. Oats and rye are grown extensively on the Dekalb shale loam. Buckwheat is usually sowed on stony and gravelly soils. Potatoes do well on all the shale soils, the Dekalb shale loam, gravelly silt loam, gravelly loam, and heavy sandy loams. Fruits are grown on all the soils of the county with satisfactory results.

The farms of the county are as a rule fairly well equipped. Farm dwellings are usually well constructed and in good repair, and barns and outhouses are large and well built, often with silos to supply dairy stock. Farm machinery and work stock are of good quality and adequate for all needs. Wagons, plows, cultivators, harrows,

rollers, reapers, binders, and mowers of modern design are in general use.

The systems of cultivation and of crop rotation are broadly uniform over the county. The prevailing practice is to rotate corn, oats, wheat, and grass, in the order named. Variations from this are frequent, however, and potatoes or oats may be planted on the sod land and wheat may follow corn when the season is favorable for an early corn crop. Rye usually follows buckwheat.

Corn is grown usually on sod land that has been plowed in the spring and harrowed and dragged into a mellow seed bed. Manure is customarily applied to the grass lands before breaking. The young corn is cultivated with weeders and cultivators. Replanting of missing hills is usually done by hand.

Oat fields are plowed in the fall or spring, and the crop is drilled in. No fertilizer is used. Better yields and a better quality of grain would result from the addition of phosphoric acid, lime, and organic matter.

Wheat land is plowed and prepared in the fall, and the seed is drilled in. An acreage application of about 200 pounds of commercial fertilizer is generally used.

Timothy is usually seeded with wheat in the fall or with clover in both wheat and oats. The mixture of timothy and clover gives an excellent hay crop for a year or two, when the clover dies out. The grass lands are allowed to continue as long as satisfactory yields of hay are produced.

According to the census of 1910, with 1,871 farms reporting, the total expenditure for fertilizers amounted to \$84,113, or \$45 per farm. It is the general practice to supplement the barnyard manure with acreage applications of about 200 pounds of commercial fertilizer. Various clovers are also grown in part for the purpose of increasing the fertility of the soil. Considerable quantities of agricultural lime are applied, with beneficial results. Lime is almost indispensable in obtaining a good stand of clover and alfalfa. There are no lime kilns of large capacity in the county, but lime can be bought in adjacent counties to the east.

On account of the higher wages paid in the mining, lumbering, and other industries, there is a scarcity of farm labor. Farm wages usually range from \$20 to \$30 a month, or from \$1 to \$2 a day for shorter periods.

In 1910, according to the census, there were 3,642 farms in the county, aggregating 271,094 acres, or 37.1 per cent of the total land area. Of this, 59.5 per cent, or 44.3 acres per farm, was classed as improved land. The average size of the farms was 74.4 acres. Individual holdings range in size from 25 to over 1,000 acres.

The 1910 census reported 88.4 per cent of the farms operated by owners, practically the same proportion that had prevailed for several decades. Land is usually rented on shares, the owner receiving from one-third to two-thirds of all crops, depending upon the proportion of the materials supplied by him.

Land values range from \$5 to \$100 an acre, mineral rights, location, and improvements being dominating factors. According to the last census the average assessed value for the county is \$22.01 per acre. Farms of ordinary quality sell at \$10 to \$35 an acre, the better class of shale soils at \$30 to \$60, and the less desirable hilly areas at \$5 to \$20.

SOILS.

Clearfield County lies wholly within and near the eastern border of the broad physiographic division of the State of Pennsylvania known as the Allegheny Plateau. The escarpment, or front, locally called the Allegheny Mountains, crosses Center County, adjoining Clearfield on the east, in a northeast and southwest direction.

The plateau in this section presents horizons of a variety of indurated rocks of Carboniferous age, from which the upland soils have weathered. The principal formations include the Pocono sandstones, Pottsville sandstones and conglomerates, and the Allegheny and the Conemaugh shales and sandstones, known also as the Coal Measures.

The exposure of the Pocono formation is a rather coarse gray sandstone, which, with the more extensive Pottsville rocks of coarse gray sandstone and conglomerate, forms a broad band across the northern part of the county, probably forming a third of its total area. These rocks also appear along the slopes of the deeper stream valleys in the central and eastern parts of the county, particularly along the West Branch of the Susquehanna River and Anderson and Clearfield Creeks. The resistance of these rocks to weathering has given rise to a very rough and rugged topography, varying from hilly to mountainous. Rock fragments varying in size from a few inches in diameter to huge boulders are scattered over the surface and mixed with the soil. The stream slopes are usually steep and very rough with boulders and rock outcrop.

The shale and softer sandstone formations of the "barren" and "productive" Coal Measures occupy the southern two-thirds of the county. These formations consist of arenaceous and argillaceous shales, shaly sandstones, and sandstones, interstratified at times with massive sandstone, thin beds of coal, and fire clay, but there is no regularity in the sequence of the strata that comprise them. These rocks are not so resistant as those in the northern part of the county,

and the topography is rolling to hilly, with the hills and ridges well rounded or flat topped.

The soils of the county are included in two broad general groups, based on manner of formation—the residual soils of the uplands, derived in situ from the weathering of rock formations, and the alluvial soils of the stream bottoms, formed of materials transported by the streams and deposited on flood plains during periods of overflow.

The residual or upland soils are grouped in two series, the Dekalb and the Lickdale, with a third broad separation designated as Rough stony land.

The Dekalb series occupies over 95 per cent of the area of the county. It is derived from all the geological formations exposed in the county and occupies varied topographic positions. The surface soils are gray, light brown, or grayish yellow, and the subsoils are yellow, with occasional gray, yellow, and brown or gray and yellow mottling in areas occurring on lower slopes or in gently sloping, low-lying positions where drainage is not thoroughly established. The soil material is frequently 3 feet or more deep on lower slopes and over the more level areas, but generally bedrock is encountered within the 3-foot section. Eight types and a number of type phases of the Dekalb series have been recognized and mapped in this county, of which the stony loam, stony sandy loam, stony silt loam, gravelly silt loam, and gravelly loam are the most extensive. The other types are the gravelly sandy loam, shale loam, and silt loam.

The Lickdale series is represented in Clearfield County by one type, the silty clay loam. This consists of a light-gray to pale-yellow silt loam to silty clay loam, underlain by a mottled yellow and gray or yellow, gray, and brown, heavy, plastic clay.

The alluvial soils are encountered in very narrow strips at intervals along some of the principal stream courses. Most of the valleys are very narrow, with steeply sloping walls, and the possibilities for alluvial deposits are very limited. Three series were recognized in the classification of the alluvial soils; the Pope, Atkins, and Holston, with a few small areas of Meadow indicated by conventional symbols.

The Pope series is characterized by brown surface soils and yellowish-brown to brownish-yellow subsoils. Two types are mapped in Clearfield County, the silt loam, and loam.

The Atkins series, here represented by a single type, the silty clay loam, includes soils with dark-gray to mottled gray and pale-yellow surface soils, underlain by compact, plastic clay subsoils, mottled gray, drab, yellow, and brown.

The types included in the Holston series have light brownish yellow to gray soils and yellow to reddish-yellow subsoils. The series

is developed on terraces lying above overflow. The series is represented in Clearfield County by one type, the Holston loam.

Rough stony land includes all areas that are too rough and stony for agriculture.

The soils of the county are exceptionally uniform in general character, but the various types have individual peculiarities that, without doubt, should be taken into consideration in farming them. Surface slope and rock content are vitally important features to which careful consideration has been given both in the mapping and in the discussion of the individual types which follows.

The following table gives the names and extent of the different soils mapped in the county:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Dekalb gravelly silt loam.....	193,664	} 29.2	Dekalb silt loam.....	28,416	3.9
Steep phase.....	19,008		Dekalb shale loam.....	23,488	3.2
Dekalb stony loam.....	124,288	} 24.5	Pope loam.....	16,000	2.2
Steep phase.....	54,976		Lickdale silty clay loam.....	5,248	.7
Dekalb stony sandy loam.....	102,272	14.0	Dekalb gravelly sandy loam.....	3,904	.5
Dekalb stony silt loam.....	43,072	} 8.9	Holston loam.....	3,904	.5
Steep phase.....	21,888		Pope silt loam.....	3,136	.4
Dekalb gravelly loam.....	49,984	} 7.0	Atkins silty clay loam.....	2,368	.3
Steep phase.....	960				
Rough stony land.....	34,304	4.7	Total.....	730,880

DEKALB STONY SANDY LOAM.

The surface soil of the Dekalb stony sandy loam consists of a light-gray loamy sand to light sandy loam, 2 or 3 inches deep, passing into a yellowish sandy loam, which extends to an average depth of 6 inches. The subsoil is a yellow, heavy sandy loam to sandy clay loam, with frequently a very noticeable content of silt. Bedrock is encountered at 24 to 40 inches. Varying quantities of sandstone and conglomerate fragments, ranging in size from small chips to huge boulders, are usually present on the surface and through the soil section. In places it is impossible to make borings with the soil auger on account of large proportions of fragmentary rock, which increases in quantity with depth. There are variations in the texture of the soil material. The sand grains range from fine to coarse, and there is occasionally enough silt to be readily discerned. Areas of stony fine sandy loam are frequent, and many small bodies of heavy stony loam are included. In some instances, where the type is derived from coarse sandstone or conglomerate, the entire mass of fine earth is a loose sand, or a loose coarse sand.

This type is very extensively developed in the northern part of the county, where it occupies broad areas over the high interstream ridges composed of the Pottsville sandstone and conglomerate. Geologically the type is weathered from the Pocono and Pottsville formations, consisting principally of gray sandstones and conglomerates. The surface features include broad ridges, or stream divides, indented by numerous small drainage ways with gentle to moderately steep slopes. The larger streams have cut deep valleys whose sides are very steep or rocky. The natural drainage is good. The open, porous character of the soil permits a ready absorption of normal rainfall, and there is a minimum of surface erosion. The ready movement of soil water makes the high-lying areas quite droughty.

The Dekalb stony sandy loam originally supported a valuable stand of chestnut, oak, hemlock, and pine, but most of the merchantable timber has been removed. Large areas have been burned over and now support a brushy tree growth and an undergrowth of huckleberry, fern, and bracken. The State board of forestry controls extensive bodies of this type, on which is located a large State game preserve.

The high elevation, short growing season, dryness of the soil in summer, and large content of stones unfit the type for agricultural use. With the exception of a few hunting lodges and summer camps, it is unsettled. Only a few small areas associated with the loam and silt loam are cultivated. These are used for general farming.

DEKALB STONY LOAM.

The Dekalb stony loam consists of a gray to yellowish-brown loam, 5 to 8 inches deep, underlain by a yellow, friable clay loam which extends to a depth of 20 to 30 inches, where broken bedrock is encountered. The surface few inches of soil is often light gray, owing to a lack of organic matter. The fine earth varies in texture from a light loam to a silt loam, and there are some included areas where it is a sandy loam. The forested condition makes it difficult to establish definite boundaries between the stony soils in all cases. There are always present varying quantities of large and small fragments of arenaceous shale and sandstone, usually sufficient to interfere seriously with cultivation. In many places the stone content is so large as to make it impossible to penetrate below 18 inches with a soil auger. Over a few areas the stones consist of large, scattered boulders not numerous enough to unfit the land for cultivation.

This soil type is very extensive, occurring throughout all parts of the county except the northern part, where the Pottsville rocks give rise to sandy soils. It usually occurs in rather large bodies occupying steep to moderately steep slopes, with some gently sloping areas

along drainage ways. Naturally drainage is in general good, and on the steeper slopes excessive. In some low-lying positions at the base of slopes where seepage water collects the drainage is poor.

Only a small proportion of the type is used for farming, most of it being cut-over timber land now supporting a young growth, consisting mainly of chestnut, oak, hemlock, hickory, pine, and beech. Some areas are covered with a valuable stand of timber. The cultivated areas are farmed in connection with larger areas of other types. Fair to good yields are obtained. Owing to the large percentage of loose stones in both the soil and subsoil, much of this type should be kept permanently in forest or used for pasture.

The price of land of this type ranges from \$5 to \$40 an acre, depending upon location, quality of standing timber, or improvements.

Dekalb stony loam, steep phase.—The steep phase of the Dekalb stony loam includes areas associated with the main type having an average slope of between 40 and 100 per cent. It represents a soil condition rather than a textural classification. The soil material varies from a sandy loam to a silt loam, and there is usually a large content of rock fragments with an occasional outcrop of massive sandstone.

This phase occurs along the principal streams of the county and in other scattered areas. It is valued chiefly for its forest growth, consisting of chestnut, oak, hemlock, hickory, pine, and beech, with a characteristic undergrowth of mountain laurel, rhododendron, and fern. Most of the salable timber has been removed, but there is a good stand of young trees. There is slight possibility of any agricultural use being made of this phase.

DEKALB STONY SILT LOAM.

The Dekalb stony silt loam consists of a gray to brownish-gray, mellow silt loam, 5 to 8 inches deep, underlain by a pale-yellowish, heavy silt loam which gradually changes into a yellow silty clay loam to silty clay. Where drainage is not thoroughly established or the soil is in a wet or moist condition from an accumulation of seepage water the subsoil is usually mottled with yellow or drab. Large quantities of sandstone and sandy shale fragments occur on the surface and throughout the soil section, sufficient in many places to prevent boring with a soil auger below 18 to 24 inches. These fragments range in size from small shale chips to large sandstone boulders, the bulk of them being from 6 to 10 inches in diameter. Bedrock is encountered at a shallow depth. Before the type can be successfully cultivated it is necessary to remove the larger stones.

The Dekalb stony silt loam is one of the more extensive soil types. It is confined mainly to the southern two-thirds of the county. The

topography is gently rolling to hilly, and the natural drainage good. The steeper slopes where cleared are subject to rather active erosion.

The greater part of the type is uncleared, and some small areas have a valuable stand of timber, but most of the type has been cut over and now supports a young growth of native trees consisting chiefly of chestnut, hemlock, oak, pine, and beech.

This type has practically the same crop adaptations and the same productiveness as the gravelly silt loam. It is utilized more extensively for grazing than for general farming, as grass does well even when the stones are not removed. Corn, buckwheat, oats, rye, timothy, and clover do well, but are grown to only a small extent.

When the stones are removed this type is essentially the same as the gravelly silt loam and can be improved by the same methods as are suggested for the latter type. It should be given a good dressing of lime every six or eight years. The soil is well suited to fruits, and there are many good locations for orchards. The more steeply sloping and hilly areas should be left in forest.

Dekalb stony silt loam, steep phase.—The steep phase of the Dekalb stony silt loam is of little agricultural value. It affords some grazing, and a few areas are probably suitable for orchard sites, but most of it is too steep for cultivation. There is usually a large content of rock fragments ranging in size from small gravel to large stones and boulders. The soil material is similar to that of the main type.

DEKALB SHALE LOAM.

The Dekalb shale loam consists of a grayish-brown to light-brown, shaly silt loam, 6 to 8 inches deep, usually underlain by a pale-yellowish, heavy silt loam to silty clay loam which becomes heavier with depth. The broken and partly disintegrated shale rock is encountered at depths ranging from 12 to 36 inches. Small, thin fragments of fine-textured shale are very abundant on the surface and throughout the soil section, being sufficiently numerous in the subsoil to make it rather open and loose. In many places on the steeper slopes, where the type is shallower than usual, the entire soil section consists of a light-brown silt loam carrying large quantities of small shale fragments, and broken bedrock is encountered at 12 to 18 inches. Fragments of arenaceous shale and shaly sandstone are often present, though not in large quantities.

The most desirable areas of this type are those in which the soil material is derived from dark-colored argillaceous shale, as on the ridge between the Susquehanna River and Clearfield Creek, where some excellent farms are located. In the vicinity of Houtzdale and Burnside, where the material is derived more largely from arenaceous

shale, the type is less desirable for farming. Here it is often confused with the gravelly silt loam type.

The Dekalb shale loam is not very extensive, although there are many small bodies scattered over the southern part of the county. The principal areas occur in the vicinity of Dubois, Burnside, Berwindale, and Clearfield. The topography ranges from gently sloping to hilly, and the drainage is good. Some of the more sloping areas are excessively drained and subject to erosion.

Where the topography is favorable this type is probably as valuable for general farming as any of the upland soils. It forms a part of some of the best farms in the county. About 60 per cent of it is cleared and cultivated. Most of the remainder supports a second growth of chestnut, oak, hickory, hemlock, pine, and maple.

This soil is not especially adapted to corn and wheat, but produces good yields of oats, rye, buckwheat, and potatoes. Alfalfa is grown to a small extent, yielding from 2 to 3 tons per acre per season. Clover does well in places.

The Dekalb shale loam is inclined to be droughty, but can be improved in this respect by careful farming. It is given occasional applications of barnyard manure, hay and grain stubble are frequently plowed under, and a dressing of lime is given at long intervals. Small applications of commercial fertilizer are made for some crops.

The price of land of this type ranges from \$15 to \$30 an acre.

The incorporation of larger quantities of organic matter, both barnyard manure and leguminous crops, would materially benefit this soil. Liberal applications of ground limestone or burnt lime are very desirable for all crops, and especially for clover and alfalfa. Means should be adopted for controlling erosion and preventing the loss of soluble mineral plant foods by leaching.

DEKALB GRAVELLY SANDY LOAM.

The Dekalb gravelly sandy loam consists of a light-gray to slightly brownish light sandy loam, 5 to 9 inches deep, underlain by a yellow sandy clay loam to sandy clay, which extends to a depth of 20 to 36 inches, where partly disintegrated sandstone is encountered. Varying quantities of small sandstone fragments are present on the surface and throughout the soil profile, with a sprinkling of larger fragments several inches in diameter, and in places it is impossible to penetrate below 15 to 20 inches with an auger.

This type is inextensive. It occurs in small, scattered bodies in the northern part of the county, closely associated with the Dekalb stony sandy loam. The largest areas lie in the vicinity of Grassflat and a few miles north of Morrisdale. They usually occupy the crests of broad ridges or gentle slopes having a smooth surface. Both surface drainage and subdrainage are good.

The only areas of this type cultivated lie in the eastern part of the county, south of the Susquehanna River, and these are farmed in conjunction with more extensive soils. The forested areas support a young growth consisting mainly of oak, chestnut, hemlock, and pine. Corn, oats, rye, potatoes, and grass are the principal crops, and fair to good yields are obtained where the soil is properly handled and well fertilized. Orchard fruits and berries also do well. This soil is well suited to truck crops, as it is easily worked, warms up early, and responds readily to fertilizer treatment. It is inclined to be leachy and requires large applications of organic matter, either in the form of barnyard manure or leguminous crops plowed under. Liming the soil has been found beneficial.

DEKALB GRAVELLY LOAM.

The Dekalb gravelly loam, to a depth of 6 to 9 inches, consists of a gray to light-brown or occasionally light yellowish brown loam. The subsoil is a yellow to slightly reddish yellow, heavy loam to silt loam, grading rather abruptly into a clay loam to silty clay loam of similar color, which extends to depths ranging from 20 to 36 inches or more, where bedrock is encountered. The prevailing darker color of the soil in cultivated fields is due to the incorporation of organic matter. From 15 to 50 per cent of the soil mass consists of small, angular fragments of shale and shaly sandstone, with a scant sprinkling of larger fragments of sandstone several inches in diameter. Variations in texture are frequent, the soil ranging from a light loam to a light silt loam. There are also some included areas of Dekalb loam, sandy loam, and silt loam too small to separate on the soil map.

This type is extensively distributed over the uplands in the southern two-thirds of the county. The topography is broadly rolling, with local variations ranging from level to hilly. The hills, knolls, and ridges are well rounded or flat topped, and the sides vary from gently sloping to steep. The soil is naturally well drained. On the steeper slopes the run-off is rapid and erosion is severe.

The Dekalb gravelly loam is one of the most important soils in the county, and a large proportion of it is cultivated. The uncultivated areas consist largely of cut-over timber land supporting a second growth of chestnut, oak, hickory, pine, hemlock, and beech. The heavier-textured areas of the type compare favorably with the Dekalb gravelly silt loam in productiveness. Corn, oats, wheat, buckwheat, grass, and potatoes do well when the soil is properly handled. Many small orchards are located on this soil and the fruit produced is of good quality.

This type is generally cultivated and fertilized in the same way as the Dekalb gravelly silt loam. Manure is applied at intervals and

supplemented by small quantities of commercial fertilizer for certain crops. Lime is used for correcting acidity of the soil, being applied at intervals of 8 to 20 years.

The price of land of this type ranges from \$15 to \$50 an acre, depending on nearness to towns and transportation facilities.

For improving the Dekalb gravelly loam it is recommended that larger quantities of organic matter, in the form of barnyard manure or leguminous crops, be incorporated, and that liberal applications of burnt lime or of ground limestone be made every six to eight years. Cultivations should be frequent so as to promote the absorption of moisture, and means should be adopted for controlling erosion.

Dekalb gravelly loam, steep phase.—The steep phase of the Dekalb gravelly loam includes areas that are so steep as to be of little agricultural value. The soil material is similar to that of the main type. The best use of this phase is for pasture. Contour cultivation should be practiced with strips of sod between the cultivated areas. Fruits might be grown profitably on selected areas.

DEKALB GRAVELLY SILT LOAM.

The Dekalb gravelly silt loam consists of a gray to light-brown, mellow, friable silt loam, about 8 inches deep, underlain by a yellow friable silty clay loam to silty clay, which extends to a depth of 20 to 36 inches, where bedrock is encountered. The surface few inches of soil over uncultivated areas is decidedly gray, while in cultivated fields where organic matter has been supplied it is light brown. The subsoil is quite sticky and plastic when wet, and in places where drainage is not well established it is usually mottled in the lower part. Small, flat, angular fragments of shale and sandy shale and subangular fragments of sandstone are scattered over the surface and embedded in the soil mass, the quantity increasing with depth.

The Dekalb gravelly silt loam as mapped includes a number of variations, as well as many small areas of silt loam, shale loam, and stony silt loam. Where it is typically developed the content of rock fragments constitutes from 10 to 25 per cent of the soil mass. The boundaries between this type and the shale loam and stony silt loam are in many places very indistinct, being arbitrarily drawn on the map.

There are many narrow areas on slopes and around the bases of slopes in which the texture of the soil ranges from a silty clay loam to a silty clay, with a correspondingly heavy subsoil. Such areas resemble the Lickdale soils, but are too small to separate on the map. They are easily identified by a scanty growth of marsh grass, indicating a wet condition. In the southern part of the county, especially in the vicinity of Houtzdale, there are areas in which both soil

and subsoil contain an unusually large proportion of small gravel and bedrock is encountered at a depth of 18 to 20 inches. Here the soil is inclined to be leachy and droughty.

The Dekalb gravelly silt loam is the most extensive soil type in the county. It is developed in all sections of the county, except the northern part, where the Pocono and Pottsville formations occur.

The topography is prevailingly gently rolling to very rolling or hilly, with many small areas that are quite level to undulating. The soil is naturally well drained, and where the slopes are steep it is inclined to be excessive. On the lower slopes there are some areas of deficient drainage.

A very large percentage of this type is under cultivation. Uncleared areas support a forest growth consisting mainly of second-growth chestnut, maple, oak, locust, hemlock, and pine. The principal crops are wheat, oats, corn, rye, buckwheat, timothy, clover, and potatoes. Wheat is extensively grown. Vegetables and fruits, including apples, peaches, strawberries, raspberries, and blackberries, are also grown. A few dairies having from 25 to 75 cows are operated on this type near the larger towns, and many of the farmers keep a few cows. A few hogs and beef cattle and some poultry are raised on nearly every farm.

Corn yields ordinarily 25 to 50 bushels, oats 20 to 40 bushels, rye 10 to 20 bushels, and hay $\frac{3}{4}$ of a ton to $1\frac{1}{2}$ tons per acre. Under the most favorable conditions higher yields are sometimes obtained. The soil is responsive to treatment for its improvement.

A five-year rotation, including corn, wheat, oats, and hay two years, is generally followed on this type. This system is sometimes varied to meet individual needs, and potatoes or oats may be grown on grass land, and oats may follow corn. Rye may also be introduced in the rotation, usually following buckwheat. The preparation of the land for all crops is customarily thorough. Grass lands are given a dressing of stable manure previous to breaking, and an acreage application of about 200 pounds of phosphatic fertilizer is usually made for wheat at the time of planting.

The price of land of this type ranges from \$20 to \$150 an acre, including mineral rights, and from \$25 to \$50 an acre without mineral rights, depending upon location and improvement.

The Dekalb gravelly silt loam could be greatly improved by the more frequent plowing under of leguminous crops. Barnyard manure should be supplemented with phosphoric acid, and lime should be more extensively used. Potatoes, cereals, and hay could be profitably grown on a larger scale than at present. With thorough preparation of the seed bed, inoculation of the soil, and a liberal use of lime, alfalfa could be successfully grown on selected areas.

Dekalb gravelly silt loam, steep phase.—The Dekalb gravelly silt loam, steep phase, differs from the typical soil mainly in topography. It also has a larger content of shale and sandstone fragments. The phase occurs chiefly on the slopes of hills and ridges in areas of small extent, although it includes a few broader bodies consisting of irregular groups of steep-sided hills, knolls, and ridges. Owing to the difficulty of cultivating these steep slopes and their liability to erosion, the phase is of little agricultural value. Some of the less steeply sloping areas are cultivated, however, and produce yields similar to those obtained on the main type. The best use of the areas that can not be profitably cultivated is for the production of hay and for pasture and forest.

DEKALB SILT LOAM.

The Dekalb silt loam consists of a gray to light-brown, mellow silt loam, 5 to 8 inches deep, passing gradually through a pale-yellowish or yellow silty clay loam into a rather stiff and compact, friable, yellow silty clay loam, which extends to depths ranging from 20 to 36 inches or more, where partially decomposed shale is encountered. Usually there is a small quantity of shale and shaly sandstone fragments scattered over the surface and throughout the soil mass. In many of the lower lying, more poorly drained positions the subsoil is mottled with gray in the lower part. There is also a variation occurring in low-lying positions, in which the material consists of a brownish-gray to light-brown, heavy silt loam to silty clay loam overlying yellow silty clay loam, which passes rather abruptly into a mottled yellow and gray silty clay, plastic and sticky when wet, but quite friable when dry or only moist. This variation is often closely associated with the Lickdale clay, which it resembles to some extent.

The Dekalb silt loam occurs in small patches on the crests of flat-topped and well-rounded knolls and ridges, in benchlike positions, around the heads of small streams, at the base of slopes, and along the lower gentle slopes of many of the small streams. The topography ranges from gently rolling to sloping, and the natural drainage is rather poor, except in the higher positions. The compact structure of the subsoil causes seepage water to collect, and the soil remains in a moist condition for long periods.

This type, while not very extensive, is one of the best agricultural soils in the county, and a large proportion of it is under cultivation. The balance is forested, mostly with a second growth, consisting mainly of oak, chestnut, chestnut oak, pine, and hemlock. Cereals, hay, and potatoes are the principal crops, with hay predominating in the lower positions. Corn yields 25 to 50 bushels, oats 20 to 40 bushels, wheat 12 to 30 bushels, rye 10 to 20 bushels, and potatoes

about 100 bushels per acre. Timothy and clover yield about 1 ton of hay per acre. The low-lying areas, where properly drained, are well suited to grass.

The price of land of this type ranges from \$20 to \$100 an acre, depending upon location, improvements, and the value of mineral rights.

The Dekalb silt loam can be readily improved by applying stable manure, and plowing under leguminous crops. Lime is very beneficial in sweetening the soil and is indispensable in growing clover and alfalfa, while phosphoric acid aids materially in growing cereals. Thorough drainage is necessary for satisfactory results with this soil. Artificial drainage can be readily established by placing drains across the upper slopes to intercept seepage water and down the slopes to carry off excess rain water. Owing to the small size of many of the areas, however, it is doubtful if the expense of establishing artificial drainage would be justified.

LICKDALE SILTY CLAY LOAM.

The Lickdale silty clay loam consists of a light-gray to pale-yellow silty clay loam, slightly mottled with brown in many places, and underlain at a depth of about 8 inches by a heavy, plastic silty clay, mottled gray, yellow, and reddish brown. Where there is an unusually large content of organic matter the surface inch or two is very dark gray to almost black in color. The type includes variations ranging from a light loam to a silty clay, but such areas are very small. In the better drained areas the subsoil is less mottled than elsewhere. In places it is yellowish brown in color and very compact, though more friable than usual, and contains considerable dark concretionary material. Occasionally a few large sandstone fragments are encountered on the surface, with usually a sprinkling of small shale chips and small angular sandstone fragments.

The Lickdale silty clay loam is inextensive and occurs in small, scattered areas in the southern two-thirds of the county, at the base of slopes, and around the heads and on the lower slopes of some of the small streams. The topography is flat to gently sloping, and the drainage is invariably poor. The impervious character of the subsoil retards underdrainage.

This type has a low agricultural value, and only a few small patches are under cultivation. The larger portion of it is forested. Some areas have been cleared and are utilized for pasture. The type supports a good growth of native grasses.

The Lickdale silty clay loam in its natural condition remains wet for long periods, and artificial drainage must be effected before it can be used profitably for agriculture. It is also acid and deficient in

organic matter. Probably the most practical use of this soil would be to drain it as thoroughly as possible with open ditches and use it for pasture.

POPE SILT LOAM.

The Pope silt loam consists of a grayish-brown to brownish, heavy silt loam, 4 to 6 inches deep, underlain by a yellowish silty clay loam, usually mottled with gray or gray and brown. The soil varies somewhat in texture, ranging from a loam to a heavy silt loam, and the subsoil from a friable clay loam to a rather plastic silty clay, mottled in the lower part.

This is a first-bottom soil, and its largest development occurs along Sandy Lick Creek, in the northwestern part of the county. The topography is flat, and natural drainage is very poor. The type is for the most part wet and marshy, except in small patches where a more or less efficient system of open ditches has been established. Thorough drainage is difficult to obtain by any artificial means, as the type lies only a few feet above stream level and the water table is usually encountered within 3 feet of the surface.

The Pope silt loam is inextensive and of little agricultural value. Only a few small areas are cultivated, oats and hay being the principal crops. Where cleared the type affords good grazing. This soil is very productive when well drained, and good yields are obtained in dry years.

Before this type can be profitably farmed it is necessary to establish artificial drainage and to incorporate lime to correct acidity. Deep plowing and thorough cultivation are also necessary.

POPE LOAM.

The Pope loam consists of a gray to slightly brownish loam, 6 to 8 inches deep, underlain by a yellowish-brown silty clay loam which is usually mottled in the lower part. There are many variations in this type, and frequently they are so confusing as to render any definite texture classification impracticable. In the subsoil, layers and pockets of sand are often encountered, interbedded with silt loam and silty clay. In many places the subsoil is very plastic and tenacious, resembling that of the Atkins soils, although generally it is decidedly friable.

This type occupies first-bottom positions along many of the streams of the county, being the most extensive of the alluvial soils. The topography is flat to very gently sloping, and the drainage is poor. Much of the type remains wet for long periods. Very little of it is under cultivation, although where properly drained it is very productive. It is an excellent grass soil and affords good pasturage when cleared of brush and trees.

Gravel symbols are used on the soil map to indicate areas of the Pope loam which contain a moderate quantity of rounded and sub-angular gravel and cobbles. Such areas occur mainly along the Susquehanna River above Curwensville. They lie somewhat higher and are better drained than most of the type, and in agricultural value compare favorably with the Holston loam.

In the following table are given the results of mechanical analyses of samples of the soil and subsoil of the Pope loam :

Mechanical analyses of Pope loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
182420.....	Soil (0 to 8 inches)..	0.2	1.2	1.3	13.2	16.8	45.5	21.8
182421.....	Subsoil (8 to 30 inches).	.2	.9	2.1	18.0	17.5	38.7	22.8

ATKINS SILTY CLAY LOAM.

The Atkins silty clay loam consists of a dark-gray to drab silty clay loam, 1 to 3 inches deep, changing to a lighter colored material of similar texture, mottled with yellowish-brown iron stains, which extends to a depth of about 8 inches. The subsoil is a heavy, plastic silty clay, mottled gray, yellow, and brown, the yellow and brown mottling becoming less pronounced with depth. The texture of the material varies in places, and occasionally both soil and subsoil contain some fine sand.

This type is developed in narrow marginal strips along some of the small streams of the county. The largest areas occur near Philipsburg and Hawk Run on Moshannon Creek. The topography is flat and the drainage poor. A very large percentage of the type remains in a wet condition practically all the time, and the water table is usually encountered within 3 feet of the surface. It supports a growth of marsh grass, bullrushes, cat-tails, and brush. A few areas are cleared and utilized as pasture. The higher lying areas, if drained, could be profitably used for crop production.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Atkins silty clay loam :

Mechanical analyses of Atkins silty clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
182401.....	Soil (0 to 9 inches)	0.2	1.2	0.9	5.4	8.5	45.8	38.2
182402.....	Subsoil (9 to 36 inches).	.1	.4	.4	2.2	5.9	51.7	39.4

HOLSTON LOAM.

The Holston loam consists of a yellowish-brown to brown loam 6 to 8 inches deep, underlain by a yellowish to reddish-yellow fine sandy clay, which extends to a depth of 36 inches or more. The texture of this soil varies in places from a heavy fine sandy loam to a light silt loam. In the more elevated areas the soil contains a noticeable quantity of gravel.

This type is encountered only in small bodies at intervals along the Susquehanna River above Clearfield and along Sinnamahoning Creek in the northwestern part of the county. It occupies second-bottom positions ranging in elevation from 12 to 40 feet above stream level, and most of it is beyond the reach of floods, even at times of high water.

The topography is level to gently sloping, and the drainage is generally good. Run-off is not rapid, but both the soil and subsoil are friable and subdrainage is good.

Owing to its small extent, this type is not important agriculturally, although where properly handled it produces excellent yields of grains, grasses, truck crops, and potatoes. It is one of the best corn soils in the county. Much of this type is occupied by towns and manufacturing plants.

ROUGH STONY LAND.

Rough stony land includes areas that are too rough and stony for cultivation. The soil varies widely in texture and color.

A very large proportion of Rough stony land occupies the slopes to the larger streams in the northern part of the county, within the region of the Pocono sandstone and the Pottsville sandstone and conglomerate. These slopes range from 45 to 100 per cent, and are thickly strewn with large sandstone fragments and huge boulders, with frequent outcrops of massive rock. Practically all the type is covered with a second growth of hemlock, oak, chestnut, and pine, with a scattering of other trees. Some areas of Rough stony land could probably be used as pasture. All of it, however, is best used for forestry.

SUMMARY.

Clearfield County is situated near the center of the State of Pennsylvania, about 80 miles northeast of Pittsburgh, and within the Allegheny Plateau region. It has an area of 1,142 square miles, or 730,880 acres.

The topography ranges from rolling to hilly. There are no distinct mountain ranges, but the northern part of the county is high and rather rough and broken. In the southern two-thirds of the

county the hills and ridges are well rounded. Elevations range from 850 to 2,280 feet above sea level, with an average of 1,200 to 1,500 feet.

The county as a whole is well drained, the greater part by the West Branch of the Susquehanna River and its tributaries. The north-western corner is drained by the Allegheny River.

Clearfield County was organized in 1822. In 1910, according to the census, it had a population of 93,768, of which 71,745, or 76.5 per cent, was rural. The population is well distributed, except in the northern part of the county. Many nationalities are represented, particularly in the coal-mining regions.

There are five steam and two electric railroads in the county and all sections have excellent transportation facilities. The public highways are numerous and are kept in good repair. Coal mining and lumbering are important industries.

The climate is uniform and healthful. The winters are cold and the summers cool and pleasant. The mean annual temperature is 46.4° F. and the average annual rainfall 44.37 inches. The rainfall is well distributed throughout the year. There is a range in length of growing season from 116 to 154 days.

Agriculture is carried on throughout the county, except in the high, hilly region extending across the northern part. Corn, oats, wheat, buckwheat, rye, timothy, clover, potatoes, and vegetables are the principal crops. Alfalfa is grown to a small extent. Apples, pears, plums, and cherries are grown by many farmers, mainly for home use. Dairying is carried on in a small way, and some beef cattle, hogs, and sheep are raised on nearly every farm.

The 1910 census reports 3,642 farms in the county, of an average size of 74.4 acres. Of these, 88.4 per cent are operated by owners, 10.6 per cent by tenants, and 1 per cent by managers.

The price of farm land ranges from \$10 to \$50 an acre. The poorest land in the county is valued at only \$5 an acre, while land with mineral rights brings as much as \$150. The census gives the average assessed value of land as \$22.01 an acre.

The soils of Clearfield County are classed in two broad groups; residual or upland, and alluvial or stream-bottom soils. The upland soils are derived in place from shales and sandstones of the Coal Measures and are included in two series, the Dekalb and Lickdale, and one miscellaneous type, Rough stony land.

In the Dekalb series eight types are mapped, covering 95 per cent of the upland area of the county. These are the stony sandy loam, stony loam, stony silt loam, shale loam, gravelly sandy loam, gravelly silt loam, gravelly loam, and silt loam. These soils are quite productive when properly handled and well fertilized. The gravelly sandy loam, gravelly silt loam, gravelly loam, shale loam, and silt loam are

the predominating and most productive types. The stony types are largely in forest.

In the Lickdale series only one type, the silty clay loam, is mapped. This soil is too wet for profitable cultivation and is largely in forest. When cleared it affords good pasturage.

The alluvial soils are not extensively developed, as the streams flow through narrow valleys. The first-bottom soils are included in the Atkins and Pope series and the second-bottom or terrace soils in the Holston series.

The Atkins silty clay loam is wet most of the time, and, with the exception of a few areas that are cleared and utilized as pasture land, has at present no agricultural value. The higher lying areas could be cultivated if properly drained.

The Pope silt loam and loam are strong soils when well drained, but owing to their low, flat position drainage is very difficult.

The Holston loam, the only type mapped in this series, is a strong soil and produces excellent yields of grain, hay, and truck crops.

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