Series 1932, No. 13 Published February 1937

UNITED STATES DEPARTMENT OF AGRICULTURE

Soil Survey

of

Augusta County, Virginia

By

R. C. JURNEY, in Charge, and R. E. DEVEREUX
United States Department of Agriculture

and

G. W. PATTESON and EDWARD SHULKCUM
Virginia Agricultural Experiment Station

Bureau of Chemistry and Soils

In cooperation with the
Virginia Agricultural Experiment Station

For sale by the Superintendent of Documents, Washington, D. C. - - - - - - - - - Price 40 cents

BUREAU OF CHEMISTRY AND SOILS

HENRY G. KNIGHT, *Chief*
W. W. SKINNER, *Assistant Chief*
FRANK L. TEUTON, *Editor in Chief*

SOIL SURVEY

CHARLES E. KELLOGG, *in Charge*
W. E. HEARN, *Inspector, District 8*
J. W. McKERICHER, *in Charge Map Drafting*

COOPERATION

VIRGINIA AGRICULTURAL EXPERIMENT STATION

A. W. DRINKARD, JR., *Director*
T. B. HUTCHESON, *Head, Department of Agronomy*
G. W. PATTESON, *in Charge Soil Survey*

CONTENTS

SOIL SURVEY OF AUGUSTA COUNTY, VIRGINIA

By R. C. JURNEY, in Charge, and R. E. DEVEREUX, United States Department of Agriculture, and G. W. PATTESON and EDWARD SHULKCUM, Virginia Agricultural Experiment Station

COUNTY SURVEYED

Augusta County is in the northwestern part of Virginia (fig. 1). The northwestern boundary forms the Virginia-West Virginia State line for a distance of about 7 miles. Staunton, located near the center of the county, is about 90 miles from Roanoke, Va., and about 150 miles from Washington, D. C. The outline of the county is roughly square, and the dimensions about 32 by 34 miles. The northern and southern boundaries are formed by straight lines, and the eastern and western sides follow the crests of mountain ridges. Augusta County is the second largest in Virginia and has an area of 995 square miles, or 636,800 acres.

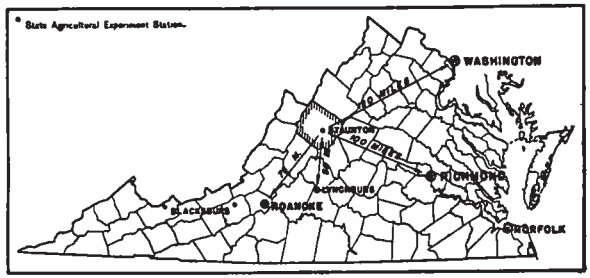

FIGURE 1.—Sketch map showing location of Augusta County, Va.

The general relief is that of a broad smooth valley flanked on the east and west by high mountains which rise abruptly above the level of the valley. The Blue Ridge borders the eastern side of the valley. Little North Mountain and Great North Mountain border the western side, and beyond these are Walker and Shenandoah Mountains. Narrow valleys lie between Little North and Great North Mountains and between Great North and Shenandoah Mountains. These small valleys are almost parallel to the larger valley.

The main valley, a part of the famous valley of Virginia, extends entirely across the county in a northeast-southwest direction and varies in width from about 20 miles along the northern county line to about 12 miles along the southern boundary. This valley has an elevation ranging from 1,200 to 1,800 feet above sea level. Elevations at several places are as follows:[1] Mount Sidney, 1,258 feet; Staunton, 1,480; Swoope, 1,650; Greenville, 1,547; Spottswood, 1,510; Fisherville, 1,321; Crimora, 1,239; Waynesboro, 1,407; Stuarts Draft, 1,385; and Loftin, 1,782. Craigsville, located in one of the smaller valleys in the western part of the county has an elevation of

[1] GANNETT, H. A DICTIONARY OF ALTITUDES IN THE UNITED STATES. U. S. Geol. Survey Bull. 274, Ed. 4, 1,072 pp. 1906.

59889—37——1

1,515 feet. The general slope of the valley, indicated by the drainage, is northeastward, although the southwestern part slopes southward.

The relief of the valley ranges from gently rolling to steep and hilly, but there are some comparatively smooth areas. The more rolling or steep surface features are near the headwaters of streams and in many places along the slopes. Throughout the valley are many high ridges and knolls, with sharp crests and steep slopes. Smoother country lies in the vicinity of Spottswood and Stuarts Draft, east and north of Fisherville, north of Waynesboro, near Trinity Church, Mount Horeb School, Weyers Cave, and in the southwestern part near Middlebrook and Swoope. The terraces and bottoms are nearly level and are the smoothest lands in the county.

The mountains of the Blue Ridge range in width from about 3 miles in the northeastern corner to about 7 miles in the southern part of the county. Elevations in the northeastern part range from 2,100 to 3,100 feet above sea level.[2] Altitudes for the other mountains are not available, but the general elevation is probably about the same. The mountains are characterized by narrow and somewhat winding ridge crests, with a few small smooth areas near passes and at places where the crest widens into spurs or knobs. The slopes are steep, broken, or rough, with a few smoother areas here and there.

In the western part of the county, Little North, Great North, Walker, and Shenandoah Mountains include a total area of about 350 square miles. This mountainous section is about 9 miles wide in the northern part and about 13 miles in the southwestern part of the county. The highest elevations range from 3,600 to 4,400 feet.[3] The ridges are narrow, the slopes are steep and broken, but in places, particularly near the gaps, some smooth areas obtain. Numerous streams which have their sources near the ridge crests have caused many small valleys and ravines to form down the mountain sides. The small valleys between the main mountains are characterized by smooth to rolling and hilly uplands and level to gently undulating areas along the streams.

A drainage divide extends approximately north and south across the western part of the county, beginning at the headwaters of North River and Calfpasture River and extending by Elliott Knob to McKinley in the main valley and thence passing near Oakland Church and Spottswood to the headwaters of St. Mary River in the Blue Ridge. The principal drainageways on the western side of the divide are Calfpasture River, Little Calfpasture River, Walker Creek, Moffatts Creek, and St. Mary River, and on the eastern side the important streams are North, Middle, and South Rivers. The drainage waters of about three-fourths of the county follow the watersheds of these three rivers. All the rivers have their source within the county, and they are comparatively narrow. Thus far attempts have not been made to develop water power on a large scale, but many streams are used to operate gristmills.

In addition to the main drainageways, creeks, branches, and intermittent drains ramify throughout all parts of the county, and every

[2] Topographic map of the proposed Shenandoah Park, Va. (south half), published by the U. S. Geological Survey in 1934.

[3] UNITED STATES DEPARTMENT OF AGRICULTURE, FOREST SERVICE. Map of the George Washington National Forest, Virginia and West Virginia. 1932.

farm or pasture is connected with one or more of these, thereby assuring good surface drainage in all sections. Streams through pastures furnish an ample and dependable supply of water for cattle in normal times, but during protracted dry weather many of them cease flowing or the water supply is greatly shortened.

Practically all the mountains are covered with forest, but in the valley the tree growth is sparse compared with that of the mountains and is confined to steep slopes, crests of prominent ridges, and in places occurs as fringes along streams. Most of the mountain forest is embraced in the George Washington National Forest which includes forested sections in the Allegheny Mountains and the Blue Ridge.

The mountain forests are mainly a culled timber growth, as most of the original trees have been cut for lumber and other purposes. In the western part of the county these forests consist mainly of white oak and red oak, with some spruce pine, pitch pine, and chestnut; and on the mountains in the eastern part the trees are chiefly scarlet oak, chestnut oak, and white oak, with a few pitch pine, spruce pine, blackjack oak, chestnut, poplar, and hickory. In the valley the predominant trees are white oak and locust. In the mountains, laurel, azalea, and huckleberry are the common undergrowth, and in the valley dogwood and redbud are conspicuous. Bluegrass is the main species of grass in the valley, and in the mountains native wire grass and coarse grasses are predominant.

Augusta County was formed in 1738 and was reduced to its present size in 1791, when some of the original territory was taken to form other counties.[4] The first settlements were made mostly by people of Scotch and Scotch-Irish descent, who settled in the southeastern part. About the same time, natives of Germany settled in the northeastern part. These pioneers farmed land along the streams, but in about 1800 the population began to move westward and settle on the uplands of the valley. The present population consists mainly of descendants of the early settlers, and some people have come in from nearby counties and States. In the valley the population is fairly evenly distributed, but in the mountains it is confined mainly to settlements near the streams and on the lower mountain slopes. A few homes are located near mountain passes. According to the 1930 census, the population is 38,163, and the average density is 38 persons a square mile. This does not include the people in Staunton, the county seat and an independent city.

Staunton is of historical interest as the birthplace of a former president—Woodrow Wilson. It is noted for its educational institutions. Located here are Mary Baldwin College, Stuart Hall, Staunton Military Academy, Dunsmore Business College, Templeton Business College, and the Virginia School for Deaf, Dumb, and Blind. This city is an important trading center for the rural inhabitants of a large part of the valley section. Some manufacturing is carried on, mainly of furniture, clothing, and flour. A State lime-grinding plant and several large limekilns are located nearby.

Waynesboro, the next town in size, has a population of 6,226. It is an important trading place for the eastern section. A rayon plant, silk mill, furniture plant, and foundry are located here, and a large

[4] WADDELL, J. A. ANNALS OF AUGUSTA COUNTY, VIRGINIA, FROM 1726 TO 1871. Ed. 2, rev. and enl., 545 pp., illus. Staunton, Va. 1902.

sand quarry is nearby. This town is the location of Fishburne Military Academy and Fairfax Hall.

A large portland cement plant is at Fordwick. Other important towns, principally trading centers, are Stuarts Draft, Middlebrook, Greenville, Churchville, Mount Sidney, Craigsville, Mount Solon, and Fisherville. Augusta Military Academy is situated near Fort Defiance. Near Ellard is a large clay mine, and at Augusta Springs there is a silk mill.

Two well-known natural wonders are in the county. Grand Caverns are near the county line in the northeastern part and Natural Chimneys, until recently called "Cyclopean Towers", are near Mount Solon.

Railroad facilities are adequate. The Norfolk & Western Ry. traverses the eastern part, and the Baltimore & Ohio R. R. follows the valley near the center of the county. The Chesapeake & Ohio Ry. crosses near the central part and extends through the southwestern part, and the Chesapeake Western Ry. extends a short distance into the northern part. Practically all agricultural sections are within easy reach of a railroad station.

Hard-surfaced State highways serve the county. The Lee Highway crosses from north to south, and an important highway traverses the county from east to west. County roads, many of them hard surfaced, extend to all the agricultural sections, and nearly every farm has easy access to such a road. The roads are for the most part kept in good or fair condition, and they can be traveled throughout the year. The State assumed maintenance of the county road system on July 1, 1932.

Schools and churches are situated at convenient places throughout the rural sections. Telephone service is available in most places, and rural free delivery of mail reaches nearly all sections.

CLIMATE

The climate of Augusta County is continental, as the county is situated far enough from the ocean that the temperatures are not affected by the tempering influence of that body of water. Considerable variation in seasonal temperatures exists, and a rather wide difference in the winter minimum and the summer maximum temperature obtains.

Although the winter temperature is in general mild enough for growing wheat, winter freezing or spring frost sometimes injures the crop. On account of the alternate freezing and thawing of the ground, oats are sown in the spring. Winter vegetables, such as parsnips, turnips, salsify, cabbage, celery, and kale can be successfully grown. The winter weather is sufficiently mild for outdoor work, except on unusually cold days. On the better lands the grazing season extends from about May 1 to November 15, but on the poorer lands it is shorter. The average length of the frost-free season is 179 days, which is sufficient time for the crops commonly grown to mature.

The mean annual rainfall is 37.68 inches, and the heaviest rainfall is during the summer. The normal rainfall is ample for the needs of the common crops. The rainfall given here is representative of the main valley country, but rainfall in the mountainous sections is

more abundant. Snowfall has been known to occur as early as October and as late as April, but the deepest snows are in January and February. The average annual snowfall is 31 inches.

The driest year on record is 1930, the year of the great drought which extended over several States and cut yields of crops considerably. The precipitation for that year was 16.76 inches. In the following year, in Augusta County, crop yields were abundant, and it is supposed by many farmers that the fertilizer applied to the land in 1930 was not leached from the soil and became available for crops the next year.

Table 1, compiled from records of the Weather Bureau station at Staunton, gives the normal monthly, seasonal, and annual temperature and precipitation. Staunton is 1,480 feet above sea level and is located near the center of the county. The data in this table are fairly representative of climatic conditions throughout the main agricultural section.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Staunton, Augusta County, Va.*

[Elevation, 1,480 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1930)	Total amount for the wettest year (1901)	Snow, average depth
	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*	*Inches*
December	37.3	70	−11	2.54	2.10	6.44	4.8
January	35.7	72	−13	2.73	1.99	2.29	8.0
February	35.9	77	−12	2.55	.98	.32	8.8
Winter	36.3	77	−13	7.82	5.07	9.05	21.6
March	44.5	89	4	3.18	1.62	3.39	5.0
April	53.4	94	19	2.89	1.46	8.42	3.8
May	63.5	95	31	3.50	.91	7.88	.0
Spring	53.8	95	4	9.57	3.99	19.69	8.8
June	70.6	99	37	4.18	3.29	4.97	.0
July	74.4	103	44	4.00	.31	5.39	.0
August	73.0	103	44	3.84	1.38	6.71	.0
Summer	72.7	103	37	12.02	4.98	17.07	.0
September	67.8	100	32	3.13	.67	3.46	.0
October	56.1	92	20	2.93	.64	.51	(1)
November	45.5	78	4	2.21	1.41	1.40	.6
Fall	56.5	100	4	8.27	2.72	5.37	.6
Year	54.8	103	−13	37.68	16.76	51.18	31.0

[1] Trace.

AGRICULTURE [5]

Agriculture in the territory now included in Augusta County began with the first settlements and has continued to be the chief pursuit, although, from time to time, there has been considerable activity in the cutting of timber, mining, and quarrying.

[5] The information in this section is based partly on notes from Annals of Augusta County, Va., notes from Mr. Koiner, the county agent, and excerpts from the Soil Survey of Rockbridge County, Va.

Although the first permanent white settlement close to Augusta County was made by natives of Germany in the vicinity of Port Republic, Rockingham County, near the Augusta County line, in 1726, most of the early settlers were Scotch and Scotch-Irish, and as early as 1740 a great influx of these people moved into the valley. The first white men, however, entered the territory in 1716, in search of a short route to the Great Lakes. At that time this section of the valley was uninhabited by Indians, but a band of Shawnees lived near Winchester, and these Indians made hunting excursions into the territory now occupied by Augusta County. The country between the Blue Ridge and North Mountain was characterized by hills and valleys, and forest trees were less numerous than at present, as their growth was prevented by frequent fires started by hunting parties of Indians. Many acres now covered by growing timber were then covered by mere brushwood. At that time wild animals abounded in this section. Buffaloes roamed the hills and valleys, and other animals common to the area were bears, wolves, panthers, wildcats, deer, foxes, and hares.

The fertile alluvial soils on the terraces and bottoms in the eastern part of the county were the first lands to be farmed. The homes were built on the higher bottoms where drainage was good. The early agriculture consisted in the production of wheat, corn, apples, sheep, hogs, and cattle. Kitchen gardens were probably introduced at the time of the Revolutionary War. About the year 1800, agriculture was started on the uplands, and clearing operations continued until about seven-eighths of the valley lands were in farms. The farms were small, and, as access to outside markets was difficult, most of the home supplies, including cloth, were made on the farm. Gristmills were early established at convenient places, and some of these old mills are still in operation.

A railroad was built in the county just prior to the Civil War, and others followed soon after, thereby furnishing outlets for farm products to outside markets.

Home-mixed fertilizer, which was a mixture of dust and superphosphate, was first used during the Civil War. By 1880 fertilizer was used to considerable extent as $82,150 was spent for it in that year.

In the early days, farming implements were crude and included mainly brush harrows and plows with wooden moldboards. Improved farm machinery was introduced about 1880, and by 1895 binders and other improved machinery were in common use. The three factors, railroads, fertilizer, and improved farm machinery, contributed greatly to agricultural expansion after the Civil War.

Although apples were produced in home orchards in the early days, it was not until about 1898 that large commercial orchards were started and by 1910 had reached their maximum development. Success with home orchards, both in quality of fruit and in yields, and also good foreign markets were the main reasons for the expansion of apple growing. The first commercial orchards were set near Staunton, and plantings soon spread to the Fisherville, Waynesboro, and Stuarts Draft sections. At present very few apple trees are being planted, but a small number of commercial peach orchards have been started lately.

Table 2, compiled from the Federal census reports, gives the acreage devoted to the principal crops in the years 1879, 1889, 1899, 1909, 1919, and 1929. A study of this table will show the general trend of agricultural development.

TABLE 2.—*Acreage of the principal crops grown in Augusta County, Va., in stated years*

Crop	1879	1889	1899	1909	1919	1929
	Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Wheat	44,966	52,127	67,179	53,497	69,977	50,899
Corn	31,324	31,125	34,575	38,095	38,213	[1] 27,426
Rye	1,955	1,846	1,444	4,295	3,368	1,714
Oats	8,570	9,184	2,542	4,011	2,009	[2] 2,815
Hay	25,895	40,987	36,673	44,115	41,618	40,802
Coarse forage			321	476	29,276	3,474
		Trees	*Trees*	*Trees*	*Trees*	*Trees*
Apples		203,808	344,276	354,013	554,143	509,354

[1] In addition to corn harvested for grain, that from 3,342 acres was cut for silage, from 104 acres was cut for fodder, and from 73 acres was hogged off.
[2] In addition, oats from 100 acres were cut and fed unthreshed.

According to the 1930 census, 78.8 percent of the farms reported the use of fertilizer in 1929, with a total outlay of $226,281, an average of $108.94 a farm. The fertilizers most commonly used are 16-percent superphosphate and 2–12–2 [6] and 1¼–10–2 grades of complete fertilizers. A few farmers use home-mixed fertilizers, and some use higher grades of complete fertilizers. Superphosphate is used mostly on soil where clover sod has been turned. Stable and barnyard manure are applied to the land in such quantities as are available. Lime is used more extensively than formerly, and ground limestone is the preferred form in which it is applied.

Most of the farm laborers are white, and in general the supply is plentiful. The price paid for day laborers ranges from 75 cents to $1.25, and the price by the month is $20 and board. The help employed on the farms devoted to dairying is paid about the same as the farm laborers, but wages in orchards range from $1 to $1.50 a day, with a somewhat higher price for special workers. In 1929, according to the 1930 census, 65.5 percent of the farms showed an expense for labor totaling $612,344, or $354.77 a farm.

Preliminary figures from the 1935 census of agriculture report a total of 3,835 farms in the county, which is a large increase over the number reported in 1930. Farms in the valley range from 25 to 300 acres in size, but most of those along the mountain sides range from about 15 to about 20 acres.

Good upland farms in the valley are for sale at various prices, depending on their location with respect to markets, good roads, schools, and churches, and on their state of improvement. Bottom lands are usually sold in conection with the uplands. The price of mountain land has a wide range, depending on its suitability for pasture or the value of the growing timber. The average value, including land and buildings, in 1935 was $5,540 a farm.

The 1930 census shows that 78.6 percent of the farms were operated by owners, 16.7 percent by tenants, and 4.7 percent by managers. Tenancy increased by 4.5 percent over that in the year 1880.

[6] Percentages, respectively, of nitrogen, phosphoric acid, and potash.

Under the tenant system, most of the farms are rented on a crop-sharing basis and only a few on a cash basis. The prevailing crop-sharing plan is that the landlord furnishes the land, insurance, taxes, one-half of the fertilizer and seed; and the tenant supplies labor, work animals, and machinery. Under this plan the crops are divided equally. When the landlord furnishes everything except labor, the tenant receives one-third of the crops.

According to the 1930 census, land represents 53.6 percent of the total value of farm property, buildings 32.2 percent, implements 5.1 percent, and domestic animals 9.1 percent. Most of the farm homes, particularly in the valley section, are large and are mainly of substantial wooden construction, although many houses are built of brick and a few of limestone. Some of the homes are of colonial architecture and have been in use a long time. Oak groves, lawns, shrubs, and flowers adorn many of the yards. The barns are of substantial construction and are sufficiently large for storage. The bank barn is the prevailing type built. Other outbuildings on many farms include a granary, a corncrib, and a poultry house. The feeding barns on some farms are located some distance from the house, in order to be convenient to pasture and water.

Most of the farms are equipped with modern machinery. A representative outfit includes an 8-foot binder, a mower, a hayrake, a drill, a manure spreader, two disk harrows, two 2-horse plows, a corn planter, two wagons, a 2-horse riding cultivator, and a land roller. Some of the large farms have tractors, tractor equipment, and hay loaders. Threshing machines and hay balers are driven from place to place in the communities to thresh grain and to bale hay and straw. All the farms are fenced, mainly with woven wire or barbed wire, and in a few places wooden rails are used.

Most of the work animals are horses, and the average number on a farm is four. The 1930 census reported 7,931 horses and only 156 mules in the county.

Nearly every farm has a vegetable garden and a home orchard of apple and peach trees. On some farms pears, plums, cherries, and grapes are grown for a home supply of fruit.

According to the 1930 census there were in the county on April 1 of that year, 34,299 cattle, 56,671 sheep, 24,453 swine, 223,779 chickens, and 26,592 other poultry.

Livestock raising is of great importance and is the main source of cash revenue. In 1930, according to the census, the value of domestic animals, dairy products, poultry, and wool was more than $4,000,000 and was about equal to the combined value of the cereal and fruit crops.

At present much attention is given the beef herds and improvement of the dairy herds. Grazing and finishing cattle on grain are carried on extensively, particularly in the eastern part near Waynesboro. The cattle are brought in from Rockbridge and Highland Counties and finished for market, almost entirely with feed produced on the farms. The beef cattle are mainly Hereford, Aberdeen Angus, and Shorthorn. The finished cattle are shipped to markets in Baltimore, Jersey City, and a few to Lancaster, Pa. In addition to grazing and finishing cattle, many dairy and beef cattle are raised on the farms in all sections. Dairying increased from about the

time of the beginning of the World War until the output of dairy products has practically doubled. The dairy cattle are Holstein-Friesians, Jerseys, and Guernseys. Most of the dairying is done in connection with other farming operations, and the farmers keep from three to seven milk cows. There are, however, about 50 extensive dairies in the county. The whole milk is shipped mainly to Washington and Richmond, and local creameries ship much of their products to Philadelphia.

Sheep are raised on about two-thirds of the farms. They include flocks of Shropshire, Hampshire, Southdown, and Dorset breeds. Lambs are sold mainly on the Jersey City market, and wool is sold, through pools and dealers, to manufacturers in the Eastern States and in North Carolina.

Hogs are raised for a home supply of meat and to some extent for market. Hog raising is increasing, and the favorite breeds of hogs are Duroc-Jersey, Poland China, Berkshire, and Hampshire. A large number of hogs are shipped to Baltimore for sale.

Poultry raising is important, and a large number of fowls are raised for market. Chickens are raised on most of the farms; and turkeys, geese, ducks, and guineas are kept on many. In some places chickens of improved breeds, mainly Rhode Island Red, Plymouth Rock, and White Leghorn, are raised. Most of the chickens, turkeys, and eggs are sold on the New York market.

SOILS AND CROPS

Augusta County lies in both the Appalachian Mountain and the limestone valley physiographic provinces, about one-half of the area being mountainous country and the other half valley. Owing to the occurrence of these two provinces of contrasting relief and, to a large extent, of different rock formations, a large number of distinct soils differing in surface soil and subsoil characteristics and also in agricultural use have been formed. Throughout the mountains and in the foothills are large areas of steep, rough, or broken country, and the soil in these places is shallow and nearly everywhere has rock fragments on its surface and in many places embedded in its surface soil and subsoil. Large boulders and rock outcrops are evident in many places. On some of the lower slopes and in a few places on ridges the relief is smooth, and the soil is deep enough for use in agriculture, but throughout most of the mountain section farming is prevented by steepness of slope and stoniness of the land. Most of this section is in forest, and farming is confined almost entirely to the lower slopes of the mountains and to the bottoms. Large areas of this mountain country are in national forests and national parks. Since the beginning of agriculture in this county, very little farming has been attempted in the mountains proper, although in the comparatively narrow intermountain valleys some farming has been carried on for a long time. Because of the more abundant rainfall, crop yields are more dependable in these places than in the main valley.

Agriculture is confined largely to the broad valley section, where the relief is smoother, and the soil has more depth than on the mountains. Most of the valley is underlain by limestone, but there

is a rather large area of comparatively smooth country underlain by shale which is in places calcareous. It is on soils whose formation these rocks have favorably influenced, together with the smooth inherently fertile alluvial soils, that the agricultural worth of the county depends.

The soils in the valley are uniform over rather large areas, although the relief or resistant rock has caused textural differences. On many slopes where streams have cut through the rock formations, stony or shaly soils have developed, and on many of the steeper ridges and knolls much chert gravel or stone is scattered on the surface or embedded in the soil.

Agriculture of an evenly balanced type obtains throughout most of the valley country, and it consists of the production of wheat, corn, hay, and, to much less extent, oats, barley, and rye. In addition many cattle, dairy products, sheep, hogs, and poultry are produced. Apples are grown as a special crop in many localities. In forested areas considerable revenue is gained from the sale of lumber, cross ties, and pulpwood. With the exception of the commercial apple orchards, this has been the main system of agriculture followed since the time of the early settlers. Soil conditions and good markets for the products are the reasons for the type of agriculture pursued. The soils are well suited to the crops grown, and most of the farms are so located as to take the best advantage of the soils. The smoother uplands and, when available, the bottom lands are utilized for the production of grain and hay, and the steeper or stony areas are used for pasture.

Native bluegrass thrives well, and extensive pastures are maintained without the aid of fertilizer. In a few localities, however, phosphate and lime are applied. Clover returns excellent yields of hay, and corn yields are high. Large quantities of feed are produced, and many feeder cattle are shipped into the county yearly to be fattened for market. By taking advantage of the good pasture conditions, nearly every farmer has dairy products, beef cattle, sheep, and wool to sell. Much of the land is well suited to apples, and large commercial orchards are maintained in some sections.

The valley soils, owing to good surface-soil texture and good subsoil conditions, respond readily to methods of improvement and are capable of being kept in a high state of productivity. Many soils can be improved by growing and turning under clover or other legumes. Phosphate is lacking in most of the soils, and it is necessary to apply this, in order to get the best results. In the sandy and shaly soils, potash also is needed for good results. The farmers in many sections realize that pastures can be improved by the aid of fertilizer, particularly phosphate and lime.

According to the 1930 census, 53.9 percent of the county is in farms, and the rest is represented by timbered mountain areas largely owned by the Government. Of the percentage of land in farms, 66.6 percent is improved land including crop land and plowable pasture.

Wheat occupies the largest acreage, and in 1930, 50,899 acres were devoted to this crop. The average yield is low, only about 10 bushels to the acre. The crop is produced in all parts of the valley, and the fields range in size from a few acres to 20 or more. Some wheat is sold at local mills or at Covington, Allegheny County. For-

merly much wheat was grown as a cash crop, but in recent years the yields have become smaller, and the crop now is produced for subsistence rather than for sale.

Hay, the next largest crop, includes timothy, timothy and clover mixed, clover alone, and alfalfa, and most of it is timothy and clover mixed. Hay is made in nearly all parts of the valley, mainly on the smoother upland soils, although some is grown on the bottoms. A large part of the crop is fed to cattle on the farms, and some is sold locally or shipped to markets in the South.

Corn ranks next in point of acreage, and the average yield in 1929 was about 33 bushels an acre. Corn also is produced in all parts of the county, but the greater part of the crop is grown on the better valley upland soils and on the bottom lands. Most of the corn is used as feed for the farm livestock, and only a small percentage is sold locally or shipped to outside markets.

Oats are grown on many of the valley farms. They are fed to the work animals, but the local supply of oats is not sufficient for the farmers' needs, and much is shipped in from other points. Barley also is grown on many farms as feed for livestock, and some seed is saved for sowing.

Vegetable gardens are planted on nearly every farm mainly for a home supply, although a small proportion of the vegetables is sold locally. The summer vegetables grown are sweet corn, tomatoes, potatoes, cabbage, snap and lima beans, onions, radishes, lettuce, okra, English peas, beets, sweet peppers, and cucumbers; and the winter vegetables are mainly turnips, cabbage, kale, and celery.

The commercial apple orchards are mainly in the vicinity of Staunton, Fisherville, Waynesboro, and Stuarts Draft. Some of the fruit from these orchards is sold in the Southern States, and much of it is exported to England and France.

Soils are classified according to their characteristics, particularly those characteristics which are important in plant growth or which indicate others that are important. If an excavation is made through a soil, a series of layers or horizons will be observed, which collectively are called, in soil classification, the soil profile. The character of the soil profile, together with more general features, such as drainage, relief, or stoniness, determine how the soil is to be classified. The characteristics and properties of the soil, which are considered in a soil survey, are those that can be determined by examination or by simple tests in the field. In the classifying and mapping of soils, three guiding units are used, namely, the series, the type, and the phase.

The unit of broadest application is the series and, within certain geographical limits, it includes soils having essentially the same color, structure, thickness of the several horizons of the soil profile, and parent material. The soils within a certain series have approximately the same drainage, relief, and condition of parent material. The texture of the upper parts of the soils of a series, including that part commonly plowed, may differ in many series. The series are given geographical names chosen from places near which the soils were first recognized. Hagerstown, Frederick, Berks, and Muskingum are names of soil series which are extensive in the vicinity of Augusta County.

Within the soil series are soil types, isolated according to their texture, or the proportion of sand, silt, and clay composing the surface soil. Thus the class name of the soil texture, such as silt loam, very fine sandy loam, clay loam, silty clay loam, fine sandy loam, and loam, is added to the series name to give the complete name of the soil type. For example, in this county, Frederick silt loam and Frederick very fine sandy loam are types within the Frederick series. Except in texture of the surface soil, these soils have approximately the same general characteristics.

Phases of soil types are recognized in soil classification and in soil mapping, in order to separate from the type a soil which differs from it in some minor characteristic that may have especial practical significance. Differences in relief or stoniness are frequently indicated on the soil map as phases of a soil type, for instance, Frederick silt loam, hilly phase, or Muskingum fine sandy loam, stony phase. These features may not fundamentally change the character of the soil, but they may be of great importance in land use.

For the soil scientists or others who may desire more detailed descriptions of the soil profiles and a more thorough exposition of the factors involved in the soil-forming processes in this county, a section on these subjects, entitled "Soils and Their Interpretation", has been written for this report.

A definite relationship exists between the various soil types and the agriculture of the county, and, in order to show this relationship, the soils are placed in two broad groups as follows: Agricultural soils and forest soils.

In the following pages the soils of Augusta County are described in detail, and their agricultural relationships are discussed; their distribution is shown on the accompanying soil map; and their acreage and proportionate extent are given in table 3.

TABLE 3.—*Acreage and proportionate extent of the soils mapped in Augusta County, Va.*

Type of soil	Acres	Per-cent	Type of soil	Acres	Per-cent
Frederick silt loam	93,248	14.6	Muskingum stony fine sandy loam, steep phase	141,440	22.2
Frederick silt loam, gravelly phase	15,040	2.4	Muskingum fine sandy loam	6,592	1.0
Frederick silt loam, stony phase	1,664	.3	Muskingum fine sandy loam, stony phase	36,864	5.8
Frederick very fine sandy loam	17,344	2.7	Muskingum shaly silt loam	29,248	4.6
Hagerstown silt loam	38,336	6.0	Berks shaly silt loam	16,448	2.6
Hagerstown clay loam	2,880	.5	Hartsells shaly silt loam	5,824	.9
Elk loam	4,928	.8	Porters stony loam	7,040	1.1
Berks silt loam	27,904	4.4	Porters stony loam, steep phase	6,656	1.0
Allen fine sandy loam	5,824	.9	Jefferson stony fine sandy loam	44,288	6.9
Jefferson fine sandy loam	11,648	1.8	Allen stony fine sandy loam	2,880	.5
Holston loam	3,968	.6	Hagerstown stony clay loam, steep phase	768	.1
Holston fine sandy loam	2,240	.4	Clarksville gravelly silt loam	12,608	2.0
Holston fine sandy loam, stony phase	1,088	.2	Clarksville stony silt loam	6,912	1.1
Pope fine sandy loam	3,840	.6	Pope stony fine sandy loam	3,904	.6
Pope loam	6,144	1.0	Pope stony fine sandy loam, colluvial phase	12,160	1.9
Hagerstown stony clay loam	17,216	2.7	Rock outcrop	1,152	.2
Frederick silt loam, hilly phase	2,752	.4			
Westmoreland silt loam	22,912	3.6	Total	636,800	
Colbert silty clay loam, dark-colored phase	2,304	.4			
Muskingum silt loam	7,360	1.1			
Huntington silt loam	13,376	2.1			

AGRICULTURAL SOILS

The agricultural soils are divided into three subgroups, based on soil characteristics and agriculture. The first includes the farming soils developed over limestone. These soils have light-brown or brown surface soils and reddish-brown, brown, or brownish-yellow friable and comparatively thick subsoils. The second subgroup comprises the farming soils developed over shale and sandstone. These soils are in general light colored in the surface soil and have light-brown, yellow, or brownish-yellow friable subsoils which nearly everywhere are not so thick as the subsoils of soils of the first subgroup. A third subgroup includes pasture soils, or those soils which at present are used largely for grazing, and in addition other soils which, if cleared of forest, would probably be better suited to pasture than to crops, mainly on account of their texture or steepness of slope.

SOILS UNDERLAIN BY LIMESTONE

The soils of this subgroup include Frederick silt loam, with a gravelly phase and a stony phase, Frederick very fine sandy loam, Hagerstown silt loam, Hagerstown clay loam, and Elk loam. The Frederick soils lie mainly in the eastern and northern parts of the valley and the Hagerstown soils in the southwestern part. Frederick silt loam is the most extensive soil, and Hagerstown silt loam ranks next. Elk loam is a soil of alluvial origin, and it occupies positions along some of the streams. This soil is developed from material derived from both limestone and shale.

The soils of this subgroup occupy about one-half of the valley part of the county, and, because of their favorable qualities, practically dominate the agriculture. Most of the wheat, hay, corn, oats, barley, and rye, and a large proportion of the apples are produced on these soils.

The surface features of the uplands range from undulating, gently rolling, and rolling to moderately steep, and of the bottoms from almost level to gently undulating. Surface drainage is everywhere good, but on some of the steeper slopes heavy rains have caused eroded places. Drainage through the subsoil is, in most places, good. The subsoils are mainly silty clay and under normal conditions are friable, but they become somewhat hard and brittle when dry. The textures of the surface soils are, for the most part, fine, and for this reason the soils cannot be plowed so soon after rains as the light sandy soils. The soils of this subgroup are slightly acid and, with the exception of Elk loam, are low in organic matter. Owing to the heavy texture of the subsoils, the soils hold a large amount of moisture, and when plowed deep much rainfall is absorbed. On account of the fine texture of the surface soils, these soils warm up later in the spring than do the sandy soils. The soils of this subgroup respond well to fertilizer, stable manure, or green manure, as the rather heavy subsoil prevents these amendments from being leached rapidly from the soil.

Frederick silt loam.—The 6- to 8-inch surface layer of Frederick silt loam is slightly brownish yellow, light grayish-yellow, or light-brown silt loam. It is underlain by a subsurface layer of yellowish-

red or salmon-colored friable firm silty clay loam which continues to a depth ranging from 12 to 15 inches. The subsoil is brownish-red, light-red, or yellowish-red friable brittle clay which extends to a depth ranging from 34 to 45 inches below the surface and thence passes into dark-red, faintly mottled or streaked with yellow, friable crumbly silty clay material. In many fields red or yellowish-red thin, eroded spots occur in the steeper places. These small areas of thinner soil contain more clay than the surrounding silty soil and have a tendency to clod when plowed too wet. In some places a small quantity of chert particles and a few stones are on the surface but not in sufficient quantities to appreciably change the soil texture or interfere with cultivation. North and east of Fisherville are some areas which are lighter in color in both surface soil and subsoil, and the surface soil is thicker than typical. Such areas are apparently more thoroughly leached of their coloring than the typical areas and are slightly less productive.

This soil has developed in the southern, eastern, central, and northern parts of the valley. It is the most extensive valley soil in the county and has a total area of 145.7 square miles. The individual areas range in size from a few acres to several square miles and large areas are in the southern part of the valley near Spottswood and Greenville, and in the vicinity of Stuarts Draft; in the eastern part, south, east, and northeast of Fisherville, near Hermitage, Trinity Church, and Mount Horeb School, and in the central and northern parts, north of Staunton, in the vicinity of Churchville, near Parnassus and Mount Solon, and southwest of Burketown. Some scattered bodies are in the southwestern part of the valley near Arbor Hill Church and Bethel Church and south of Middlebrook.

As the land is smooth, gently rolling, or rolling, improved machinery can be used on nearly all of it. About 65 percent of this soil is used for crops, 30 percent for pasture, and 5 percent is in timber or wooded pasture. The timber growth is mainly white oak, with some black oak, post oak, locust, and scrub pine.

Wheat, corn, and hay are the principal crops, and oats, barley, and rye are of minor importance. Wheat occupies about 35 percent of the crop acreage and corn and hay about 25 percent each. Wheat yields from 15 to 30 bushels an acre when an application of 200 pounds of 2–10–2 or 2–10–0 fertilizer to the acre is used, or one ranging from 200 to 300 pounds of 2–10–4 or 2–12–4. Approximately the same yields are obtained where the land is limed and 200 pounds an acre of 16-percent superphosphate is applied. Corn produces from 30 to 60 bushels an acre where fertilized with 200 pounds an acre of 1¼–10–2, 2–10–2, 2–10–4, or 2–12–2 grades of fertilizer. Some farmers do not apply commercial fertilizer to corn but apply stable manure to the land or plant the corn following clover or cowpeas, and satisfactory yields are obtained in this way. Acre yields of oats range from 25 to 40 bushels, barley 20 to 35 bushels, and rye 12 to 15 bushels. Some farmers give the same fertilizer treatment to oats and barley as they do to wheat. In general clover or timothy yields about 1 ton of hay an acre, but sometimes clover produces higher yields. The second cutting of clover is saved for seed, and the yields range from 2 to 4 bushels an acre. Mammoth, or sapling,

clover is not used for hay, but it is sown by some farmers for pasture or for seed. The pastures are mainly of native bluegrass and are maintained for the most part without fertilizer, although a few farmers apply lime and 16-percent superphosphate to the sod.

Many farmers on this soil practice rotation of crops. The most common is the following 4-year rotation: Corn, 1 year; wheat, 2 years; and clover or timothy for hay, 1 year. A 5-year rotation used by many consists of corn, 1 year; wheat, 2 years; and clover or timothy for hay, 2 years.

In harvesting corn, most of the crop is cut and shocked in the fields, and on many farms some is used for silage.

Apples are produced to some extent on this soil, particularly in the southeastern part of the valley in the vicinity of Stuarts Draft and Waynesboro, and in favorable seasons yields are good. The trees are fertilized with 4 pounds of 16-percent superphosphate and 3 pounds of nitrate of soda to the tree.

Frederick silt loam, gravelly phase.—The surface layer of Frederick silt loam, gravelly phase, is slightly brownish yellow or grayish-yellow silt loam 6 or 8 inches thick, and the subsurface layer is yellowish-red friable silty clay loam about 4 inches thick. The subsoil, which immediately underlies this layer, is slightly brownish red, yellowish-red, or light-red friable silty clay extending to a depth ranging from 30 to 35 inches. Beneath the subsoil the material is dull-red, mottled or streaked with yellow, friable crumbly silty clay. On the surface and in some places embedded in the surface soil, are many angular chert particles comprising from 15 to 35 percent of the soil mass. Included with the gravel are a few chert pieces large enough to be classed as stones, but they are not sufficiently numerous to indicate a separate phase on the soil map. There are a few chert gravel in the subsoil and the layer beneath the subsoil.

This gravelly soil occurs in scattered areas throughout a large part of the valley and is closely associated with Frederick silt loam. Rather large bodies have developed north of Spottswood, near Buffalo School, Oakland Church, and McKinley, in the vicinity of St. Johns Church, east of Fisherville and New Hope, west of Staunton, east of Churchville, and southeast of Mount Solon. The soil occupies positions on fairly smooth topped ridges and gentle to fairly steep slopes. On some of the steeper slopes the effects of erosion are manifested in small denuded areas, in which the clay subsoil is exposed.

Approximately 60 percent of the land is used for crops and about 30 percent for pasture, leaving only a small proportion in forest. The forest trees are white oak, red oak, post oak, chestnut oak, pine, maple, and locust.

The crops commonly grown are wheat, hay, corn, oats, and rye. Wheat yields from 12 to 15 bushels an acre, hay about 1 ton, corn 40 to 50 bushels, oats 25 to 30 bushels, and rye 10 to 12 bushels. Wheat and corn are fertilized with about 200 pounds an acre of 1¼–10–2 or 0–10–2 fertilizer. Some farmers give oats about the same fertilizer treatment as wheat.

Frederick silt loam, stony phase.—The 6- to 8-inch surface layer of the stony phase of Frederick silt loam is light brownish-yellow

or slightly grayish yellow silt loam. It is underlain by a subsurface layer of yellowish-red friable silty clay about 4 inches thick, and this layer, in turn, is underlain by the light-red or yellowish-red friable silty clay subsoil which at a depth ranging from 30 to 36 inches changes into mottled or streaked dull-red and yellow friable silty clay material. Scattered over the surface are many angular chert and a few fine-grained sandstone fragments ranging in diameter from 4 to 6 inches. Most of this stony soil is more rolling and steeper than typical Frederick silt loam, and, owing to these features and to the presence of stones on the surface, it is less desirable for cultivation.

Most of this soil lies in the southwestern part of the valley south of Greenville, south of Dutch Hollow Church, and south of McKinley. About 60 percent of the land is used for wheat, corn, and pasture, and a small acreage is planted to apple orchards. The rest is in forest composed chiefly of white oak and red oak, together with a few hickory, poplar, and locust.

Yields of wheat and corn and fertilizer treatments are about the same as on Frederick silt loam, gravelly phase.

Frederick very fine sandy loam.—The surface layer of Frederick very fine sandy loam consists of light grayish-yellow or slightly brownish yellow loam or very fine sandy loam, extending to a depth ranging from 6 to 9 inches. It is underlain by a brownish-yellow friable very fine sandy clay subsurface layer which continues to a depth ranging from 12 to 15 inches. The subsoil begins immediately below this layer and consists of yellowish-brown or brownish-red friable clay which contains some fine sand and, when dry, becomes hard and brittle. It is from 20 to 25 inches thick and is underlain by yellowish-brown, mottled with bright yellow and faint red, silty clay which is heavier than the overlying material. In many fields the surface soil is almost white when dry. In some areas gullying and sheet erosion are more evident than on Frederick silt loam. The soil is derived from impurities left from dissolved limestone and from the decayed products of fine-grained sandstone interbedded with the limestone. In some places sandstone fragments are scattered on the surface, and where sufficiently numerous such areas are shown on the soil map by stone symbols. Included with this soil northeast of Stokesville are several bodies in which the surface soil contains some water-worn rock. Here the surface layer is evidently the product of alluvial material deposited upon the land in the remote past.

Frederick very fine sandy loam is developed mainly on the tops of long comparatively narrow ridges, in association with Frederick silt loam, in the eastern, central, and northern parts of the valley. Comparatively large areas lie in the eastern part of the valley near Trinity Church; in the central part, west and southwest of Staunton and south from Valley Mills; and in the northern part near Union Church, Mount Zion Church, and Pisgah.

Approximately 85 percent of the land is used for crops or for pasture, and the rest is in forest consisting of white oak, post oak, scarlet oak, and locust, together with a few hickory and dogwood. The trees grow mostly on the highest part of the ridges.

Pasture occupies about one-third of the cleared land, and the rest is in such crops as wheat, corn, and hay. Oats occupy a comparatively small acreage. Some of the land is used for the production of

apples, and several comparatively large orchards are located on this soil. Crop yields are slightly lower than on Frederick silt loam, but the fertilizer treatment is practically the same for both soils.

Hagerstown silt loam.—The 6- or 7-inch surface soil of Hagerstown silt loam, locally known as "chocolate land", is brown or dark-brown silt loam or loam. The subsoil begins as brown or slightly reddish brown friable crumbly silty clay loam, but at a depth of about 12 inches it becomes brownish-red friable silty clay. It extends to a depth ranging from 28 to 34 inches and in most places is underlain directly by limestone. In some places, however, the subsoil grades into friable crumbly silty clay loam material which is slightly lighter in color than the subsoil and contains black mineral specks. This material in other places contains spots or faint mottlings of yellow. This layer is usually only a few inches thick and is a gradational layer between the subsoil and the underlying limestone. In some places, particularly on the slopes, the soil is shallow and the limestone comes within a few inches of the surface. In other places the limestone outcrops but not in large enough areas to interfere with cultivation. In some plowed fields are small brownish-red eroded spots of clay loam, but they are not sufficiently large to indicate on the map as a separate soil.

Hagerstown silt loam is developed mainly in the southwestern part of the county, southwest from Staunton almost to the base of Little North Mountain. Large areas are near Swoope, Hebron Church, Arbor Hill Church, Shemariah Church, Mount Tabor Church, Middlebrook, McNutt Chapel, and Providence Church. Smaller bodies are in the northern part of the valley near Parnassus and in the eastern part near Waynesboro.

This soil occurs as fairly smooth or rolling interstream areas and on gentle or moderately steep slopes. It is one of the important soil types of the county, and about 90 percent of it is in agricultural use. Approximately 10 percent is in timber consisting of white, red, black, and chestnut oaks, and locust, with a few hickory and cedar.

Hagerstown silt loam is well suited to bluegrass, and approximately one-half of its total area is used for pasture for cattle and sheep. The principal cultivated crops are wheat, corn, and hay; and each occupies about the same number of acres. Oats, rye, and barley are crops of minor importance grown on a comparatively small acreage. Small areas are planted to alfalfa, vetch, and sweetclover. Vetch and sweetclover give good yields, but alfalfa does not yield well when sown alone. There are several comparatively large apple orchards on this soil. The York Imperial variety of apples gives better results than on the lighter soils in the eastern part of the county, but other varieties are not so satisfactory.

Wheat yields range from 12 to 25 bushels an acre, the higher yields being obtained through the use of high-grade fertilizer. This soil is recognized as not being so good for wheat as Frederick silt loam, because it is inclined to freeze and thereby damage the plants. It is considered a good soil for corn, and yields range from 40 to 75 bushels an acre, the higher yields being obtained where the land is heavily fertilized with high-grade commercial fertilizer. Red clover and timothy give excellent yields, the clover producing from 1 to 2 tons of hay an acre the first cutting, and timothy about 1 ton.

The second cutting of clover is saved for seed, the yield of which is about 4 bushels an acre. Oats yield from 25 to 40 bushels, barley 20 to 35 bushels, and rye 10 to 15 bushels.

Wheat is fertilized with 200 pounds an acre of 2–10–4, 2–12–2, 2–10–0, or 1¼–10–2 fertilizer. Some farmers treat the wheatland with lime and apply 300 pounds an acre of 16-percent superphosphate or 200 pounds of 20-percent superphosphate. Corn receives about 200 pounds an acre of 1¼–10–2, 2–10–0, 2–12–2, or 2–10–4 fertilizer. Many farmers apply only stable manure or plant their corn following a legume crop. Some farmers fertilize oats and barley in about the same manner as wheat. Apple orchards are treated with about 4 pounds of 16-percent superphosphate and 3 pounds of nitrate of soda to the tree. A few farmers fertilize their pastures, using 16-percent superphosphate and lime with good results.

Crop rotations are practiced by many farmers, and the following is a favored 4-year rotation: Corn 1 year, wheat 1 year, and grass and clover for hay 2 years. A 3-year rotation, which is considered good, consists of corn the first year, wheat the second, and timothy or clover the third.

Hagerstown clay loam.—The 5- to 7-inch surface soil of Hagerstown clay loam consists of reddish-brown or brownish-red rather heavy clay loam, and the subsoil is brownish-red firm but friable clay, which extends to a depth ranging from 28 to 32 inches, where it is underlain by limestone. In some places, between the subsoil and the limestone, the soil material is reddish-brown friable clay containing faint spots of ocherous yellow and fine black mineral specks. In places the limestone lies within a few inches of the surface, and in other places it outcrops as small ledges. Near Swoope a few small areas of Decatur clay loam are included with this soil. The surface soil of the Decatur soil is somewhat darker than that of the Hagerstown, and the subsoil is dark-red or maroon friable clay which extends to a greater depth than the subsoil of Hagerstown clay loam.

Hagerstown clay loam is developed mainly in the southern part of the county. A rather large area is near Mount Tabor Church, smaller bodies are near Swoope and south of Shemariah Church, and a comparatively large area is near Stuarts Draft.

This soil occupies undulating, gently rolling, or rolling positions and lies favorably for farming operations. It is well drained, and on some of the steeper areas the soil is being eroded by heavy rainfall.

Practically all the land is used for crops. A few areas are in timber consisting of white oak, black oak, and locust. A small proportion is used for pasture, and a small acreage is in commercial apple orchards. The important crops are wheat, corn, and hay. Crop yields and fertilizer treatment are in general about the same as for similar crops on Hagerstown silt loam, but in some places the yields are slightly higher.

Hagerstown clay loam is a good, strong type of soil capable of being built up and kept in a high state of productivity.

Elk loam.—The surface soil of Elk loam ranges from light grayish-brown to brown or reddish-brown mellow loam ranging from 10 to 18 inches in thickness. The subsoil is light-brown or brown friable crumbly clay or silty clay loam and extends to a depth

ranging from 30 to 35 inches. Beneath the subsoil, the soil material is slightly reddish brown friable fine sandy loam containing some rounded sandstone and other gravel.

Elk loam occupies positions on high bottoms or terraces along a few streams. It has developed from deposits of sediments washed from nearby slopes of soils underlain by limestone, sandstone, or shale. The surface features are nearly level or gently undulating, and, with the exception of a few flats and some low places adjoining the uplands, the land is well drained.

This soil has developed in some places along South River in the eastern part of the county. Rather wide areas are near Waynesboro and Crimora, and fairly large bodies are along Middle River, north of New Hope and near Swoope, and along North River near St. Pauls Church and Sangerville.

Practically all of Elk loam is used for agricultural purposes. In places sycamore, walnut, cottonwood, birch, and willow trees grow. A few small areas are in pasture, but most of the land is devoted to crops. The principal crop is corn. Clover and alfalfa are grown to some extent for hay, and wheat is grown in a small way. Corn yields from 35 to 45 bushels an acre, hay 1 to 1½ tons, and wheat 12 to 20 bushels. Corn and wheat are produced mainly without fertilizer, but some farmers apply small quantities of fertilizer similar to that used for these crops on the uplands.

SOILS UNDERLAIN BY SHALE AND SANDSTONE

The soils in this group are derived from the weathered products of underlying shale, from beds of colluvial sandstone, or from shale and sandstone material which has been transported and deposited along streams by flood waters. The soils included in the group are Berks silt loam; Allen fine sandy loam; Jefferson fine sandy loam; Holston loam; Holston fine sandy loam; Holston fine sandy loam, stony phase; Pope fine sandy loam; and Pope loam. These soils have a total area of 97.9 square miles and are developed mainly in the eastern, northeastern, and northern parts of the valley and at the bases of mountains in the eastern and western parts of the county. The Berks, Allen, and Jefferson soils have developed on the uplands and the Holston and Pope soils on flood plains along streams.

Berks silt loam is probably the smoothest upland soil in the county, and on most of it improved machinery can be used. This soil, however, is shallow and for this reason does not withstand drought so well as the deeper soils which have formed over limestone. The Allen and Jefferson soils have smooth, gently rolling, or rolling relief. These soils are sandy in texture and, owing to this feature, warm up earlier in the spring and can be plowed sooner after rains than the fine-textured soils. The Holston and Pope soils have nearly level or gently undulating surface features and loam or fine sandy loam surface texture. Because of these characteristics, they are easy to cultivate.

All the soils of this group have friable subsoils. Surface and internal drainage are almost everywhere good. The soils are slightly acid and are deficient in organic matter.

Berks silt loam.—The surface soil of Berks silt loam, locally known as blue-slate land, consists of brownish-yellow or pale-yellow

smooth floury silt loam to a depth of 6 or 7 inches. The subsoil extends to a depth ranging from 15 to 18 inches and is brownish-yellow friable silty clay which easily crushes to a silty mass. It is underlain by brown and ocherous-yellow friable crumbly decomposed or partly decomposed shale. Bedrock consists of light- to dark-colored shale. It is tilted at an angle of about 45°. In plowed fields the soil is brown when moist, and in slight depressions it is somewhat darker than elsewhere. When dry, the color in plowed fields is light brown. In both surface soil and subsoil a few soft brown shale fragments are present.

Included with Berks silt loam in the vicinity of New Hope are rather large areas that have considerable fine sand and very fine sand in the surface soil, and on this account the surface soil approximates loam in texture. The sandy material is derived from sandstone which occurs in the shale beds. A narrow strip of soil extending some distance north and south of Waynesboro is also included. This soil is derived from the weathered part of a different shale from that from which most of the material of Berks silt loam is derived, and as a result the soil is thicker in most places than normal Berks silt loam.

Berks silt loam is developed on smooth interstream ridges, and the surface features are undulating or gently rolling. Large areas lie north of Whitehill Church, west of Tinkling Spring Church, near and north of Fisherville and Waynesboro, north and south of New Hope, southeast of Verona, and near Weyers Cave.

The surface soil is well drained; but underdrainage is not so thorough as in Frederick silt loam, because of the retarding effect of the underlying shale. Owing to the resistance of this rock, deep gullies do not form. Considerable sheet erosion, however, is evident in cultivated fields.

The soil becomes cloddy if plowed when too wet. Some shale fragments are plowed up each year, but most of these soften and disappear during the following year. The total area of this soil is 43.6 square miles, and nearly all of it is cleared for agricultural use. A few small bodies are in forest consisting of white oak, and a few pine, locust, and dogwood trees.

The soil is used mainly for the production of wheat, corn, hay, and pasture. Crop yields are good when the rainfall is adequate, but crops maturing in late summer and early fall often suffer from lack of moisture. The soil, therefore, is better suited to early hay, early pasture, and small grain. It is not so well suited to apple trees as are some of the deeper soils of the valley.

Wheat yields range from 12 to 15 bushels an acre; corn, with a good season, from 25 to 35 bushels; and hay, three-fourths to 1 ton. Wheat is fertilized with an application ranging from 200 to 250 pounds an acre of 16-percent superphosphate or a 2–12–2 or 1¼–10–2 fertilizer. Corn receives about 200 pounds an acre of about the same kinds of fertilizer as are used for wheat.

Allen fine sandy loam.—The 8- to 10-inch surface layer of Allen fine sandy loam is grayish-yellow or slightly brownish yellow friable fine sandy loam. It is underlain by yellowish-red friable fine sandy clay which continues to a depth ranging from 12 to 15 inches. The subsoil is dark-red or brownish-red friable fine sandy clay which

readily crumbles to a mealy mass. At a depth ranging from 34 to 40 inches the subsoil passes into dark-red, faintly mottled or streaked with brownish yellow, friable fine sandy clay material. A few rounded and partly rounded sandstone rocks are present on the surface and in the soil. The texture of the surface soil varies from place to place and is in places very fine sandy loam. Some areas of soil having a loamy texture are included, the largest of which is 1 mile northwest of Parnassus.

This soil is closely associated with Jefferson fine sandy loam in the southern, eastern, and northern parts of the valley. Small areas lie north of Lofton, south of Calvary Church, near Rankins Chapel, and north of Waynesboro, and other areas are near Swoope, Mount Zion Church, Sangerville, and north of Christians. The total area is 9.1 square miles.

The relief ranges from smooth to rolling and strongly rolling, and drainage is everywhere well established. About 65 percent of the land is in forest consisting mainly of small white oak, red oak, and black oak trees, together with a few scrub pine, hickory, and dogwood. Small areas of the cleared land are used for pasture, and the rest is planted to corn and wheat or is used in a few places for apple orchards. Corn yields from 25 to 35 bushels an acre and wheat from 12 to 15 bushels. Corn and wheat are fertilized with about 200 pounds an acre of 1¼–10–2 fertilizer.

Jefferson fine sandy loam.—The surface layer of Jefferson fine sandy loam is pale-yellow or slightly brownish yellow fine sandy loam from 8 to 10 inches thick. It is underlain by slightly grayish yellow rather heavy fine sandy loam to a depth of about 15 inches. The subsoil, a yellow or brownish-yellow friable crumbly fine sandy clay which crumbles easily to a mealy mass, continues to a depth ranging from 30 to 35 inches, where it grades into mottled ocherous-yellow, brownish-red, and light-gray friable fine sandy clay material. On the surface and in the soil are a few rounded and subangular sandstone fragments ranging from 4 to 8 inches in diameter. In plowed fields the soil, when dry, is light gray or almost white. In some places the lower part of the subsoil is yellowish red.

This soil has a total area of 18.2 square miles, and it is developed mainly on the eastern side of South River in the eastern part of the county. Large areas are near Lofton and Ellard, south of Stuarts Draft and Waynesboro, north of Dooms, and north and south of Harriston. Bodies lie near Sangerville and Mount Zion Church, west of Churchville, near Swoope, and in the southwestern part of the county near Friends Church.

The relief is smooth or gently rolling, with short steep slopes near some of the drainageways. Owing to the favorable relief, porosity, and sandy texture of the soil, drainage is everywhere good. In cleared fields sheet erosion is evident.

Approximately 50 percent of the land is used for crops, pasture, and apple orchards, and the rest is in forest consisting of small white, red, and post oak trees, together with a few scrub pine, dogwood, and hickory. Corn is the principal crop. It yields from 25 to 30 bushels an acre. Wheat, which is grown on a much smaller acreage, yields from 8 to 12 bushels. Some of the land is in pasture, but the grass does not thrive so well as on the heavier soils of the

valley. Several bodies are devoted to apple orchards, and in normal seasons the yield of fruit is good.

Fertilizer treatment for corn and wheat is similar to that for these crops on Allen fine sandy loam.

Holston loam.—The surface soil of Holston loam consists of light grayish-yellow loam or silt loam, ranging in thickness from 6 to 10 inches. The subsoil is yellow or brownish-yellow compact but friable fine sandy clay which extends to a depth ranging from 34 to 40 inches. Beneath the subsoil is a layer of gray or brownish-yellow sandy clay material containing water-worn gravel. Small areas of poorly drained soil are included, because they are too small to indicate separately on the soil map. They have gray or dark-gray surface soils and gray or mottled gray and ocherous-yellow somewhat plastic clay subsoils.

Holston loam is a soil of alluvial origin, developed on high first bottoms or terraces. It has a total area of 6.2 square miles, and the largest developments are along South River near Dooms and Harriston; on Middle River south of Fort Defiance and near the county line; and on Calfpasture River near Deerfield. The soil is derived from mixed material washed from soils formed mainly from products of decayed sandstone and shale and deposited near streams. The relief ranges from almost level to gently undulating. Drainage is good, except in the small low flat places.

Nearly all this soil is used for agricultural purposes. A few sycamore, cottonwood, and birch trees grow in places near the streams. Corn, wheat, and hay are the principal crops. Corn yields from 25 to 35 bushels an acre, wheat 10 to 15 bushels, and hay about 1 ton. A few areas are in pasture.

Holston fine sandy loam.—The 8- to 10-inch surface soil of Holston fine sandy loam consists of grayish-yellow slightly compact fine sandy loam which is almost white when dry. The subsoil is brownish-yellow fine sandy clay, compact when dry but friable and crumbly when moist. This material continues to a depth ranging from 36 to 40 inches, where it is underlain by gray, grayish-brown, or brownish-yellow stratified sand, clay, and gravel material.

This soil occupies positions on terraces. It has been formed from alluvial deposits consisting mostly of sandstone and shale material. The relief is nearly level or gently undulating, and drainage is well established. The total area is only 3.5 square miles. The largest bodies lie along South River, near Stuarts Draft, and on North River near Emmanuel Church.

Most of the land is cleared, but in places there is a sparse growth of sycamore, birch, locust, and walnut. A small acreage is in pasture, and a large acreage is used for corn. Some of the land is planted to wheat and hay. Corn yields from 25 to 30 bushels an acre, wheat 10 to 15 bushels, and hay about 1 ton.

Holston fine sandy loam, stony phase.—The stony phase differs from typical Holston fine sandy loam mainly in the presence of stones. In places the soil is also less compact and contains a higher quantity of fine sand. On the surface and embedded in the soil are many water-worn rocks ranging in diameter from about 4 to 12 inches. In places the rocks are so numerous as to interfere with cultivation.

This soil has a total area of less than 2 square miles. It occurs mainly on North River near Towers School and along smaller streams in the vicinity of Deerfield. Most of the land is cleared and is used for about the same kinds of crops as those grown on Holston fine sandy loam.

Pope fine sandy loam.—The surface soil of Pope fine sandy loam consists of brownish-yellow or light-brown fine sandy loam ranging in thickness from 7 to 9 inches. The subsoil is light-brown fine sandy clay which, when dry, is compact but, when moist, is friable and crumbly. The subsoil extends to a depth ranging from 28 to 32 inches, where it grades into brownish-yellow or reddish-brown compact fine sandy loam. Near Stokesville and in smaller areas elsewhere, the surface soil has a dark-red cast, owing to the presence of sediments transported by overflow waters from areas of red sandstone and shale. A few rounded sandstone pebbles and stones are present in both surface soil and subsoil.

This soil is developed in first bottoms near streams, and it is subject to overflow in times of high water. It is derived mainly from material of sandstone and shale origin, deposited along streams, but in some places from material which is of limestone or igneous rock origin.

The total area of this soil is 6 square miles, and the widest bodies lie along Back Creek and parts of South River in the eastern part of the county and along North River in the northern part. The relief is almost level or gently undulating, and soil drainage is well established.

Nearly all the land is used for agricultural purposes. A few birch, sycamore, and walnut trees grow in places near the streams. The principal crops are corn and hay, and a small acreage is used for wheat and pasture. Crop yields are slightly lower than those for similar crops on Pope loam.

Pope loam.—The surface soil of Pope loam, to a depth of 5 or 6 inches, is brown loam, and at this depth it changes to dark-brown silty clay loam which continues to a depth of about 15 inches. The subsoil is brownish-yellow friable fine sandy clay which extends to a depth ranging from 32 to 38 inches, where it grades into brown stratified sand and gravel. Included with this soil in mapping are a few bodies—too small to show separately on the soil map—which have a gray or dark-gray surface soil and a gray or gray mottled with yellow rather heavy subsoil. On the surface and throughout the soil are a few rounded sandstone rocks.

Pope loam is developed in the first bottoms along streams and is subject to occasional overflow by high waters. The soil is derived from sediments washed from nearby slopes which are underlain by sandstone and shale and, in a few places, by limestone. The bottoms occupied by this soil range from narrow to comparatively wide, and the relief is nearly level or gently undulating. In some places the land is slightly hummocky. In many places there is a gradual slope from the upland toward the stream. Owing to its porosity, this soil is in most places well drained.

The soil occupies a total area of 9.6 square miles, mainly along Calfpasture River and Little Calfpasture River in the western part of the county. A small area is near Mount Zion Church in

the northern part. This is an important soil along Calfpasture River, and much of the farming in that locality depends on it.

Practically all of Pope loam is used for agricultural purposes. In places near the streams there is a sparse growth of sycamore, white pine, locust, and walnut trees. The land is used mainly for the production of corn and hay, and some areas are in wheat or pasture. Corn yields from 20 to 30 bushels an acre, wheat 10 to 12 bushels, and hay 1½ to 2 tons.

PASTURE SOILS

Included in this group are Hagerstown stony clay loam; Frederick silt loam, hilly phase; Westmoreland silt loam; Colbert silty clay loam, dark-colored phase; Muskingum silt loam; and Huntington silt loam. These soils have a combined area of 103 square miles. The grouping is made because the cleared areas are used principally for grazing. Some of the smoother parts are utilized for cultivated crops, but the fields are small. The character of the soils precludes very great use of the land for cultivated crops, as most of it is too steep, hilly, or stony for profitable crop production. Colbert silty clay loam, dark-colored phase, has comparatively smooth surface features, but the subsoil is heavy and plastic, which makes it undesirable for general farming. Huntington silt loam is a smooth alluvial soil and is the only soil in the county that is not acid. Pasture grasses thrive on it, and probably for this reason a large proportion of the land is grazed. Westmoreland silt loam is hilly, and on account of this condition a large part of the land is in pasture. Hagerstown stony clay loam is characterized by numerous outcrops of limestone which prevent the use of machinery. Muskingum silt loam and Frederick silt loam, hilly phase, are too steep for general farming. The soils of this group are in general inherently strong and for this reason can be more profitably used for pasture than for forestry.

Hagerstown stony clay loam.—The surface soil of Hagerstown stony clay loam, locally called limestone clay or ledge land, is brown, dark-brown, or brownish-red heavy loam or clay loam from 5 to 7 inches thick. The subsoil is brown, brownish-red, or dark-red rather heavy clay which continues to a depth ranging from 18 to 45 inches, where it is underlain by limestone. In many places the exposed surface of the subsoil cracks on drying. In some places the lower part of the subsoil becomes lighter in color and texture, and in other places it is brown heavy clay. On the surface are many outcrops and ledges of limestone, which give the soil a distinctly stony appearance. Included with mapped areas of this soil are a few bodies in which the stones consist of loose limestone fragments scattered on the surface.

Hagerstown stony clay loam occupies positions mainly on gentle or fairly steep slopes leading to streams, but some bodies are developed on small knobs or ridge crests. This soil occurs mainly in the southwestern part of the county near Summerdean, south of McKinley, and near McNutt Chapel. Rather large areas are near Fordwick, southwest of Staunton, and near Spring Hill. Smaller bodies lie on slopes near streams in many parts of the valley.

On account of the many rock outcrops, this soil is not used to a great extent for cultivated crops. A few patches of corn and wheat

are grown. A small part of the land is in forest consisting mainly of white oak, black oak, and locust, and a few hickory, cedar, and walnut.

The soil is well adapted to bluegrass, and it is used mainly for pasture for cattle and sheep. It is one of the best pasture soils in the county, when the rainfall is normal; but in seasons of dry weather grass does not hold so well as on Hagerstown silt loam, because of the numerous rocks present and because of the slight depth of the soil in some places. A few small areas are in apple orchards.

Although most of the land is in pasture sod, sheet erosion and small gullies are noticeable on some of the steeper slopes.

Frederick silt loam, hilly phase.—The hilly phase of Frederick silt loam is similar to the typical soil, except that the relief is steeper and the surface soil is not everywhere so thick. In some places on the steeper slopes the subsoil is shallower than in the smooth areas.

The largest areas are northeast of Greenville and northwest of Verona. Because of the surface features, most of the land is used for pasture. Small areas are utilized for corn and wheat, but yields are not so good as on Frederick silt loam, although the fertilizer treatment is about the same.

Westmoreland silt loam.—The 6- to 8-inch surface soil of Westmoreland silt loam consists of grayish-brown or brown silt loam, and the subsoil is light-brown, brown, or reddish-brown rather heavy silty clay which is hard and brittle when dry but fairly friable when moist. At a depth ranging from 24 to 32 inches the subsoil grades into brownish-red, streaked with ocherous yellow, friable decayed shaly limestone material. It is underlain by beds of platy limestone and shale, occurring in alternate layers, and the soil is derived from an admixture of decomposed material from these two rocks. In places the underlying rock lies within a few inches of the surface, and in a few places small outcroppings appear, but these are not so conspicuous on the slopes as are those on Hagerstown stony clay loam.

This soil occupies positions on narrow winding ridges and hills with fairly steep or steep slopes. On the tops of ridges and hills are comparatively small smooth-surfaced areas. On account of the steepness of the land, the soil is subject to the forces of erosion, and in some places gullying and sheet erosion are evident.

Westmoreland silt loam has developed in the central, northeastern, northern, and western parts of the county, and the largest area is south of Centerville. Rather large bodies are near Brookewood, Sangerville, and Swoope. Smaller developments are near Verona and Mount Sidney, and northeast of Fisherville to the county line. The total area is 35.8 square miles.

About 85 percent of the land is cleared for agricultural purposes, and the rest is in forest. The forest trees grow mainly on the steepest parts, and they include white, black, and red oaks, together with a few cedar, hickory, and locust. Because steepness of slope precludes general farming, most of the cleared land is used for pasture. Corn and wheat are produced on some of the smoothest areas. Corn yields from 25 to 40 bushels an acre and wheat from 15 to 20 bushels. Fertilizer treatment for these crops is similar to that used for the same crops on Berks silt loam.

Colbert silty clay loam, dark-colored phase.—The surface soil of Colbert silty clay loam, dark-colored phase, is dark-brown silty clay loam 4 or 5 inches thick. The subsoil begins as yellowish-brown heavy plastic clay, and at a depth of about 18 inches it becomes light brownish-yellow heavy tough plastic clay. On exposure to the weather, the clay, through drying, shrinks and cracks. The soil is underlain by dark-colored massive limestone, and in places the limestone is near the surface or outcrops as ledges.

This soil has developed almost entirely in two comparatively large areas, one of which is on the eastern slope of Long Glade Run and the other at Weyers Cave.

On account of the heavy texture of the surface soil, the land cannot be plowed so soon after rains as can the lighter textured soils. Although the subsoil is heavy, internal drainage is good, and crops do not suffer from too much moisture. The relief is smooth or gently rolling. The soil is well suited to bluegrass and clover, and most of it is used for pasture. A few areas are in forest which consists of oak, hickory, and walnut trees. An area of this soil, having a somewhat lighter textured surface soil, lies south of Weyers Cave, and it is used for the production of corn and wheat. Corn yields from 30 to 40 bushels an acre and wheat about 15 bushels. The fertilizer treatment for these crops is about 200 pounds an acre of 2–12–2 or 1¼–10–2 fertilizer.

Muskingum silt loam.—The surface soil of Muskingum silt loam is light-brown or brownish-yellow silt loam 6 or 8 inches thick, and the subsoil consists of brownish-yellow or brown friable crumbly silty clay ranging from 16 to 22 inches in thickness. Below the subsoil is reddish-brown and yellow soft decayed shale material which passes into beds of unweathered shale at a depth ranging from 36 to 40 inches. A few platy shale fragments are scattered on the surface of the ground.

This soil is developed on the lower slopes of mountains in the western and southwestern parts of the county, and the total area is 11.5 square miles. The relief is characterized by steep and rounded hills and moderately steep or steep mountain slopes. Drainage is good, but in places on the steeper slopes heavy rains have caused some erosion.

About 40 percent of the land is cleared, and the rest is in forest consisting mainly of white, red, and post oaks, and a few chestnut oak, chestnut, pine, and poplar. A large part of the cleared land is in pasture, and the rest is used for the production of corn, wheat, and hay. Corn yields from 18 to 25 bushels an acre, wheat 10 to 14 bushels, and hay about three-fourths of a ton. The fertilizer treatment is about the same as that for wheat and corn on Hartsells shaly silt loam.

Huntington silt loam.—The 8- to 10-inch surface soil of Huntington silt loam consists of brown or dark-brown silt loam, and the subsoil is dark-brown rather heavy but friable silty clay loam continuing to a depth ranging from 28 to 32 inches, where it is underlain by brown or light-brown gravelly loam. Along the upper reaches of Middle River the surface soil and subsoil are lighter, both in color and texture. In other places the surface soil in small areas is loam rather than silt loam, and near some of the streams issuing

from calcareous shale country, the subsoil, at a depth of about 24 inches, is dark gray or almost black. In places lime carbonate has formed on the soil particles, giving the soil a somewhat gray appearance.

This soil has developed in the first bottoms of many streams in the valley part of the county, and it lies only a few feet above the normal water level of the streams. With the exception of a few comparatively high areas, the land is subject to overflow. The relief is nearly level, with a slight downward grade toward the stream. With the exception of a few flats and seepy places near the uplands, drainage is adequate.

The soil material is derived from sediments that have been washed mainly from uplands underlain by limestone, although in places sediments of shale and sandstone origin enter into the composition of these deposits. The soil contains much organic matter and is naturally the most fertile soil in the county. Narrow to comparatively wide strips of this soil have formed along nearly all the streams in the valley, the widest bodies lying along Middle River which flows diagonally across the valley and traverses much limestone country.

Practically all the land is cleared for agricultural use. A few scattered areas support a growth of sycamore, locust, and walnut trees. Bluegrass thrives, and for this reason most of the land is in pasture. A comparatively small acreage is devoted to corn and hay. Corn yields from 40 to 70 bushels an acre without the application of fertilizer, and hay produces from 1½ to 2 tons.

FOREST SOILS

The forest soils include Muskingum stony fine sandy loam, steep phase; Muskingum fine sandy loam; Muskingum fine sandy loam, stony phase; Muskingum shaly silt loam; Berks shaly silt loam; Hartsells shaly silt loam; Porters stony loam; Porters stony loam, steep phase; Jefferson stony fine sandy loam; Allen stony fine sandy loam; Hagerstown stony clay loam, steep phase; Clarksville gravelly silt loam; Clarksville stony silt loam; Pope stony fine sandy loam; Pope stony fine sandy loam, colluvial phase; and rock outcrop.

These soils occur in areas ranging from comparatively small to large continuous tracts including many square miles. They are developed mainly in the mountains or in the foothills, only a small proportion occurring in the valley proper. The combined area of the soils of this group is 523.1 square miles, or slightly more than one-half of the total area of the county. A large percentage of these soils is owned by the United States Government as national forests and national parks.

These soils occupy hilly to steep valley country, benchlike and comparatively smooth country near the bases of mountains, steep and rugged mountain slopes, and narrow mountain ridges. Many of the soils have the roughest and most broken relief in the county. Owing to the prevailing surface features, drainage is everywhere good. Rock fragments are scattered over the surface and in many places embedded in the soil. In the roughest parts, large boulders and ledges are numerous.

The surface soils range from brown loam to light-brown or yellowish-brown fine sandy loam and the subsoils from brown or light-brown clay to yellow or brownish-yellow friable fine sandy clay. In many places in the steep mountain country, a subsoil has not developed and the surface soil directly overlies the bedrock.

Practically all the original forest has been cut for lumber, and the present growth is composed mainly of young white oak, scarlet oak, red oak, and black oak, and in places some scrub pine, poplar, and hickory. In a few places the timber is being cut for lumber, cross ties, and pulpwood.

Although the soils of this group are almost completely covered with forest, they do not produce better timber than other soils. They have been left in forest mainly because the relief is too steep for general farming, and in the more level areas stone fragments are so numerous that the land is not desirable for cultivation. In the event that the land were cleared of timber, the soils on the steeper slopes would soon be destroyed through erosion, as the cost of preventive methods would be too great.

Small areas of the smoothest parts of some of the soils are used for pasture, crops, and apple orchards, and it is possible (to a limited extent) that more of the land could be used for such purposes. These soils should be left in forest, as they cannot compete with the more favorable agricultural lands.

Muskingum stony fine sandy loam, steep phase.—The 5- to 7-inch surface soil of the steep phase of Muskingum stony fine sandy loam is grayish-yellow, light-brown, or brown fine sandy loam or loam. On the surface is a thin layer of dark organic matter derived from decayed leaves. The subsoil is yellow, brownish-yellow, or light-brown friable fine sandy clay which extends to a depth ranging from about 10 to about 15 inches below the surface. In some places the subsoil has not developed, and the surface soil directly overlies the bedrock. On the surface are numerous broken rocks and in places large boulders. Included with this soil in the northwestern part of the county are some areas which have an Indian-red surface soil and a purplish-red subsoil. Some steep rough areas of shaly silt loam which have outcrops of partly decomposed shale are also included. The total area of this soil is 221 square miles. Large tracts occupy the slopes of the Blue Ridge in the southern, eastern, and northeastern parts of the county. Still larger areas are on the tops and slopes of Little North Mountain, Great North Mountain, Walker Mountain, and Shenandoah Mountain in the western part.

The relief is steep and broken, and none of the land is used for crops. A few areas are used for cattle range. The land is covered mainly with forest consisting mostly of small oaks and a few scrub pines, and the best use for this steep soil is forestry.

Muskingum fine sandy loam.—The surface soil of Muskingum fine sandy loam consists of grayish-yellow or light brownish-yellow friable mellow fine sandy loam from 8 to 10 inches thick. The subsoil is light yellowish-brown, light-brown, or faintly reddish brown slightly compact friable fine sandy clay extending to a depth ranging from 28 to 34 inches. It is underlain by yellow or brown decayed sandstone and shale material. A few sandstone fragments lie on the surface, and others are embedded in the surface soil and subsoil.

This soil has developed mainly on lower mountain slopes, but a few small areas are on the ridges. The largest bodies are in the eastern part of the county, northeast of Waynesboro; and in the western part, north of Stokesville, south of Deerfield, and south of Craigsville. The total area is about 10 square miles.

The relief is that of moderately steep or steep mountain slopes and fairly smooth mountain ridges.

Forest covers most of the land. White, red, and post oaks are the dominant trees, and there are a few pine, dogwood, and black gum. A small proportion of the land is used in the production of wheat, corn, and hay, some is in pasture, and a small area is devoted to apple orchards. Wheat yields from 10 to 12 bushels to the acre, corn 15 to 25 bushels, and hay three-fourths to 1 ton. Wheat and corn are fertilized with about 200 pounds an acre of 16-percent superphosphate of 1¼–10–2 fertilizer.

Muskingum fine sandy loam, stony phase.—The surface soil of Muskingum fine sandy loam, stony phase, is light grayish-brown, grayish-yellow, or pale-yellow loose friable fine sandy loam to a depth ranging from 7 to 10 inches. On the surface is a thin layer of dark leaf mold. Beneath the friable fine sandy loam layer the soil is brownish-yellow friable heavy fine sandy loam which continues to a depth ranging from 15 to 18 inches. Below this layer is the subsoil of brownish-yellow or yellowish-brown crumbly fine sandy clay which extends to a depth ranging from 24 to 34 inches below the surface. It is underlain by sandstone. A few areas having a purplish-red surface soil and a dark-red subsoil are included in mapping. On the surface and in places throughout the soil are many sandstone fragments ranging in diameter from 5 to 8 inches. These rocks give the soil a distinctly stony character.

The total area of this soil is 57.6 square miles. The soil has developed in large bodies on the middle and lower slopes of the Blue Ridge and on many of the lower slopes of Little North Mountain, Great North Mountain, Shenandoah Mountain, and Walker Mountain. The relief ranges from gently sloping to moderately steep. Small drainageways have cut into the slopes, causing somewhat steep and broken relief in many places.

From most of the land the merchantable timber has been removed, and the present tree growth consists mainly of young white, red, and chestnut oaks, together with a few scrub pine, poplar, and maple. A comparatively small proportion of the land is cleared for crops, pasture, or apple orchards. The principal crops are corn, wheat, rye, and oats. When the land is fertilized with about 200 pounds an acre of 1¼–10–2 fertilizer, corn yields from 20 to 25 bushels an acre, wheat 10 to 15 bushels, oats 25 to 30 bushels, and rye 10 to 12 bushels. With fertilization and proper treatment the commercial apple orchards are thrifty and productive.

Muskingum shaly silt loam.—The 5- or 6-inch surface soil of Muskingum shaly silt loam is grayish-yellow or brownish-yellow silt loam. On the surface is a thin layer of dark-colored organic matter formed from decayed leaves. The subsoil consists of brownish-yellow friable silty clay to a depth ranging from 15 to 18 inches. Beneath the subsoil and continuing to a depth of about 40 inches is reddish-brown or yellow friable decomposed shale which has retained its original bedding planes. Hard bedrock of shale lies below this

layer. The surface soil contains a large quantity of thin soft shale fragments, ranging in diameter from about one-fourth to about one-half inch. In cultivated fields the shale fragments are larger, some of them being as much as 6 inches in diameter. The subsoil also contains a large proportion of shale fragments, and in places these amount to as much as 50 percent of the material. In some places the shale outcrops.

This soil occupies large areas in the western part of the county, mainly in places on the lower slopes of Great North Mountain and Shenandoah Mountain. The total area is 45.7 square miles.

This soil has developed on hills and long parallel ridges at the foot of mountains. Owing to the steep relief, erosion is severe in cultivated fields.

Most of the land is covered with culled forest, and the tree growth consists of white, red, black, and scrub oaks, and a few hickory, white pine, and shortleaf pine. A few small areas are used for the production of corn, oats, and hay, and some are in pasture. Corn yields from 15 to 20 bushels an acre, oats 15 to 20 bushels, and hay about three-fourths of a ton. Most of this soil should remain in forest.

Berks shaly silt loam.—The 5- to 7-inch surface soil of Berks shaly silt loam is brown, light-brown, or pale-yellow silt loam or loam. It is underlain by an 8- or 10-inch yellowish-brown friable silty clay subsoil which, in turn, is underlain at a depth ranging from 12 to 20 inches by broken shale. The surface soil is strewn with brown platy shale fragments, ranging in diameter from one-half inch to more than 6 inches, and many such fragments are intermixed with the soil. Some of the pieces of shale are hard, but others have softened through weathering.

This soil is considerably shallower than Berks silt loam, and in many places dark-colored shale outcrops. The soil occupies long narrow ridges and steep slopes leading to streams. The relief is much steeper than that of Berks silt loam.

Berks shaly silt loam is developed in close association with Berks silt loam. Large areas are near Hammon Chapel and Brand and east of Fort Defiance and Mount Sidney. The total area is 25.7 square miles. More of this soil than of Berks silt loam is in forest, and the trees are mainly white oak, with some pine, dogwood, and locust. Most of the cleared land is used for pasture and this, together with forestry, appears to be the best use for this soil. A small acreage is devoted to wheat and corn, but on account of the steepness of the relief and the shallowness of the soil, yields are much less than on Berks silt loam.

Hartsells shaly silt loam.—The surface soil of Hartsells shaly silt loam is light grayish-yellow silt loam from 4 to 6 inches thick. It is underlain by a grayish-brown, pale-yellow, or slightly brownish-yellow heavy silt loam or friable silty clay loam subsoil which continues to a depth ranging from 10 to 15 inches. Below the subsoil is brown and ocherous-yellow friable decayed shale which within a few inches passes into the unaltered shale. On the surface and within the surface soil are numerous black and brown thin shale chips which give the soil a distinctly shaly character. In places the bedrock comes within 3 or 4 inches of the surface, and on the steeper slopes it outcrops. Included with this soil in mapping are several small areas

of Hartsells silt loam, in which the 6- or 7-inch surface soil is light-gray or grayish-yellow silt loam. This layer is underlain by a yellow or slightly brownish yellow friable silty clay subsoil which continues to a depth ranging from 20 to 30 inches, where it is underlain by shale.

The relief ranges from smooth to rolling and hilly. The effects of erosion are evident on some of the steeper slopes.

Hartsells shaly silt loam is developed in the western part of the county near the bases of mountains. Its total area is about 10 square miles. The largest bodies are near Augusta Springs, Hiner Mill, Craigsville, and Deerfield.

About 60 percent of the land is in forest consisting mainly of white, red, and post oaks, together with a few pine, hickory, poplar, cedar, and locust. The rest is used for pasture and the production of wheat, corn, and oats. Wheat yields from 10 to 12 bushels an acre, corn from 15 to 25 bushels, and oats from 20 to 30 bushels. Wheat and corn are fertilized with about 200 pounds an acre of 16-percent superphosphate or 1¼–10–2 fertilizer.

Porters stony loam.—The surface soil of Porters stony loam consists of grayish-brown or brown loam from 6 to 8 inches thick. The subsoil is yellowish-brown or slightly reddish brown friable clay loam or clay, which extends to a depth ranging from 20 to 24 inches. Beneath the subsoil the material is slightly reddish brown or yellowish-brown clay loam containing yellow soft decayed rock which, within a few inches, grades into mixed yellow and reddish-brown disintegrated rock. This soil is derived from the weathered product of greenstone. Some of this rock is scattered on the surface, and some is embedded in the soil. On top of the Blue Ridge, southeast of Waynesboro, a fairly large body, having a grayish-yellow surface soil and a brownish-yellow friable clay subsoil, is included with Porters stony loam.

The total area of Porters stony loam is 11 square miles. This soil is developed exclusively on the Blue Ridge Mountains, both on the crest and lower slopes. Large bodies lie along the headwaters of Back Creek and on the top of the mountain northeast of Waynesboro.

Most of the land is in forest, mainly of black, scarlet, and white oaks, together with a few pine, poplar, maple, and locust. Some areas have been cleared of forest and are used for pasture, and a few small patches are planted to corn. In places where the relief is favorable, the soil is well suited to pasture, but other areas are suited only to forestry.

Porters stony loam, steep phase.—The steep phase of Porters stony loam differs from the typical soil in that the surface relief is steeper and more broken and the soil is not everywhere so deep. In addition to the stones on the surface, large boulders are present in places.

This soil occupies a total area of 10.4 square miles. It has developed on and near the crest of Blue Ridge Mountain. The largest body is south of Sherando.

All the land is in forest consisting mainly of white, black, and scarlet oaks, and forestry is the best use for it.

Jefferson stony fine sandy loam.—The surface soil of Jefferson stony fine sandy loam consists of light-gray, grayish-yellow, or pale-yellow fine sandy loam to a depth ranging from 12 to 15 inches. It is underlain by a slightly brownish yellow, yellow, or slightly

reddish yellow friable fine sandy clay subsoil which continues to a depth ranging from 28 to 36 inches. Underneath the subsoil is mottled ocherous-yellow, brownish-red, and light-gray friable fine sandy clay material. On the surface and embedded in the soil are numerous rounded or subangular sandstone fragments which range in diameter from about 5 to 10 inches. These rocks are so plentiful in places that they interfere with cultivation.

This soil occupies sloping benchlike positions leading out from the bases of the mountains toward the valley. The relief ranges from smooth to rolling in most places, but it is steep near some of the drainageways.

Large areas of this soil lie at the foot of the Blue Ridge in the southern and eastern parts of the county, south of Stuarts Draft, north of Dooms, in the vicinity of Harriston, near the base of Little North Mountain, and at the foot of Great North Mountain near Deerfield.

Practically all of this soil is in forest of black, scarlet, and white oaks, and there are a few pine, poplar, maple, and locust. A small proportion of the land has been cleared of forest and is used for the production of corn, wheat, and pasture. Several acres are devoted to apple orchards. Yields of corn and wheat are somewhat lower than on Jefferson fine sandy loam.

Allen stony fine sandy loam.—The 8- to 10-inch surface layer of Allen stony fine sandy loam is pale-yellow or slightly brownish yellow fine sandy loam. It is underlain by a yellowish-red friable fine sandy clay layer 4 or 5 inches thick. The subsoil is red or brownish-red friable crumbly fine sandy clay to a depth ranging from 35 to 40 inches, where it grades into dark-red, mottled faintly with yellow, friable fine sandy clay.

This soil has a total area of 4.5 square miles. It has developed in small bodies in the southern part of the county in association with Jefferson stony fine sandy loam. Some of the larger areas are near Lofton, Ellard, Sherando, and Lyndhurst, and in the west-central part of the county near Swoope.

The surface features range from smooth to rolling and somewhat hilly, and drainage is well established.

Most of the soil is in forest consisting mainly of white, red, and black oaks, and a few pine, poplar, hickory, walnut, locust, and dogwood. Probably 35 percent of the land has been cleared and is used for corn, wheat, and pasture. A few commercial apple orchards are on it. Yields of corn and wheat are slightly lower than on Allen fine sandy loam.

Hagerstown stony clay loam, steep phase.—The steep phase of Hagerstown stony clay loam resembles the typical soil, except that the relief is much steeper. This steep soil occupies positions on steep slopes where streams have cut deep narrow valleys, exposing ledges of limestone. It occurs in small bodies in the southwestern part of the county, near other Hagerstown soils. The land is too steep for cultivation or pasture, and it has been left in timber which consists of white, red, and black oaks, and a few hickory, locust, walnut, and cedar.

Clarksville gravelly silt loam.—The 8- to 10-inch surface layer of Clarksville gravelly silt loam, locally called "chestnut land", is light grayish-yellow or pale-yellow smooth silt loam, and this is

underlain by slightly brownish yellow heavy silt loam extending to a depth ranging from 12 to 15 inches. The subsoil is yellow or brownish-yellow friable silty clay which when dry becomes very hard. It extends to a depth ranging from 30 to 35 inches and grades into rust-brown, with spots or streaks of yellow and almost white, friable silty clay material which in the lower part contains decomposed chert, shale, and in places fine-grained sandstone. Scattered on the surface and intermixed with the soil are many small broken chert particles which compose from 15 to 35 percent of the soil. A few angular chert rocks are mixed with the gravel. Some chert fragments are embedded in the subsoil. In cultivated fields the surface soil, when dry, is very light gray or almost white.

Included with mapped areas of this soil are small bodies in which the lower part of the subsoil is yellowish red or light red. Some bodies of smooth relief, in which very few or no gravel are present in the surface soil, are also included. The largest developments of such soil are south of Round Hill and south of Greenville.

This soil occupies the lower slopes of ridges and hills, and the relief ranges from smooth to gently rolling and rolling. It is developed in close association with Frederick silt loam. Rather large areas are south of Greenville, north of Snyder, near Hermitage, west of Trinity Church, in the vicinities of Parnassus and Union Church, and north of Spring Hill.

Approximately 60 percent of the land is in timber consisting of white and red oaks, and a few chestnut, dogwood, hickory, poplar, locust, pine, and walnut. A small proportion of it is used for pasture and some areas for apple orchards. Wheat, corn, and oats are produced to a comparatively small extent. Yields of wheat range from 10 to 15 bushels an acre, corn 25 to 30 bushels, and oats 20 to 25 bushels. The fertilizer treatment is about the same as that for similar crops on Frederick silt loam, gravelly phase.

Clarksville stony silt loam.—The surface layer of Clarksville stony silt loam is grayish-yellow or pale-yellow silt loam to a depth of 8 or 10 inches. It is underlain by a 4- or 5-inch layer of slightly brownish yellow or grayish-yellow rather heavy silt loam. The subsoil is yellow or brownish-yellow friable silty clay which becomes hard on drying. This layer continues to a depth ranging from 30 to 35 inches, where it is underlain by decomposed chert material. Numerous angular chert particles are embedded in the soil from the surface downward, and scattered on the surface are many white and gray chert fragments and stones, the stones ranging in diameter from 4 to 8 inches. The rock fragments are so numerous on the surface that they give the soil a distinctly stony character. The soil is derived from the residue of impure limestone containing much chert.

Clarksville stony silt loam is developed mainly in the southern and eastern parts of the county, and comparatively large areas are near Providence Church and Oakland Church, south of McKinley, southeast of Staunton, north of Calvary Church, south and east of Fisherville, south of Hermitage, east of New Hope, and south of Mount Horeb School.

The soil occupies high ridges and knolls, and the surface features range from moderately to steeply sloping. Owing to the stony and gravelly character of the soil and its sloping position, drainage is good.

Most of the land supports a forest growth of white and red oaks, and a few chestnut, dogwood, hickory, poplar, locust, pine, and walnut trees. A few of the less stony areas are used for pasture and the production of corn. A small part of the land is in apple orchards.

Pope stony fine sandy loam.—This soil is similar to Pope fine sandy loam, but it contains a large number of rounded sandstones, ranging from 5 to 10 inches in diameter, on the surface and throughout the soil. The rocks are so numerous in places that they interfere with cultivation.

This soil has developed in fairly wide bodies on the first bottoms along North River and in some places along Calfpasture River. The total area is about 6 square miles.

More of this soil than of Pope fine sandy loam is in forest. The trees are mainly sycamore, cottonwood, and birch. The land in some places has been considerably washed and trenched by flood waters.

This soil is used for crops similar to those grown on Pope loam, but yields are smaller. Owing to its open porous character, the land is nearly everywhere well drained.

Pope stony fine sandy loam, colluvial phase.—The surface soil of the colluvial phase of Pope stony fine sandy loam is brown, dark-brown, or faintly reddish brown friable fine sandy loam to a depth ranging from 5 to 8 inches. It is underlain by a light-brown crumbly fine sandy loam or loam subsoil extending to a depth ranging from 45 to 50 inches below the surface. Scattered on the surface and mixed with the surface soil and subsoil are many smooth rounded quartzite and sandstone rocks, from 4 to 8 inches in diameter. Along streams in the Blue Ridge some of the soil material comes from soils derived from weathered products of greenstone, but most of it is formed from sediments of sandstone and shale origin.

This soil is mainly alluvial in origin, and some colluvial material has washed upon it from adjoining slopes. It occupies first-bottom positions along streams and is subject to overflow by high waters. Comparatively wide areas are along Little River, the upper reaches of North River, and along Skidmore Run in the western part of the county, and narrower bodies lie along some of the streams issuing from the Blue Ridge.

Most of the land is in forest of white and red oaks, maple, hemlock, white pine, locust, and walnut. A few areas are used for pasture.

Rock outcrop.—Rock outcrop consists of almost bare exposures of solid rock. Bushes and stunted trees grow on ledges and in crevices where sufficient plant nutrients have accumulated for them to subsist. Rock outcrop appears in scattered areas, mainly on the Blue Ridge.

AGRICULTURAL METHODS AND MANAGEMENT [7]

With the single exception of Huntington silt loam, the soils of Augusta County are more or less acid, and the use of lime is recommended, as it corrects soil acidity, improves the physical condition of the soil, helps the proper decomposition of organic matter, probably makes the commercial fertilizers used more available, and aids

[7] Information furnished by G W. Patteson, agronomist, Virginia Agricultural Experiment Station.

the growth of clover and other legumes. Lime may be applied at any time, but for quickest results the land should be limed a short time before a legume is to be sown. It should be spread broadcast and mixed well with the topmost 3 or 4 inches of soil. The lime should be applied once in every rotation, if used at the rate of 1 ton to the acre of ground limestone or its equivalent in other agricultural liming material.

Many of the farmers practice long rotations of crops, that is, 4- and 5-year rotations. The following short rotations are considered good for farms producing grain and grass: First year, corn; and second year, wheat with sweetclover sown in the spring to be turned down the following spring for corn. Another rotation is: First year, corn; second year, wheat; third year, clover. A rotation with 2 years of clover and grass is as follows: First year, corn; second year, wheat; and third and fourth years, clover and grass. Good rotation of crops may aid in keeping a supply of organic matter in the soil and also may assist in maintaining the soil supply of nitrogen. Crop rotations also regulate the use of plant nutrients from the soil and increase crop yields.

For the improvement of old established pastures used for grazing beef cattle and sheep, the following fertilizer treatment is recommended: A top dressing each spring of 300 pounds of superphosphate to the acre until a good sod is established. Three consecutive applications will be sufficient in most places for the establishment of a good sod. Superphosphate also encourages the growth of white clover, and this aids in keeping up the nitrogen supply in the soil. If there is no white clover or other legume in the pasture, lespedeza and hop clover may be sown. For the improvement of pastures for high-producing dairy cows, nitrogen from some available source, at a rate ranging from 30 to 50 pounds an acre, may be added to the fertilizer treatment suggested for pastures for beef cattle. In addition to the foregoing fertilizer treatment, 1 ton an acre of ground limestone should be applied every 4 or 5 years, and the bare spots in the pastures should be reseeded with pasture-grass mixtures. On soils lacking in potash, a fertilizer of an 0–12–5 grade should be used instead of superphosphate.

Table 4 gives recommendations for the use of fertilizer for the various crops grown.

TABLE 4.—*Recommendations for the use of fertilizers for the principal crops on the soils of Augusta County, Va.*

Soil group	Fertilizers [1] recommended for—					
	Corn [2]	Small grains [2]	Perennial legumes	Annual legumes	Grass, or grass and clover mixed [3]	Pasture
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Upland soils underlain by limestone.	200 of 4–16–4 or 6–16–4.	200 of 4–16–4 or 6–16–4.	200 of 4–24–8.	200 of 0–16–4.	200 of 4–16–4 or 6–16–4.	200 of 0–24–0 or 0–40–0.
Upland soils underlain by sandstones and shales.	200 of 4–16–5 or 6–16–5.	200 of 4–16–5 or 6–16–5.	200 of 4–24–10	200 of 0–16–5.	200 of 4–16–5 or 6–16–5.	Do.
Bottom-land soils.	-----do-----	-----do-----	---do----	---do----	-----do-----	Do.

[1] The quantities given are acre applications of nitrogen, phosphoric acid, and potash, respectively.
[2] From 16 to 20 pounds of inorganic nitrogen added as side or top dressing.
[3] From 15 to 25 pounds of inorganic nitrogen mixed with an equal quantity of superphosphate for top dressing on old stands.

By making an acre application of 6 or more tons of manure, all nitrogen and potash may be dispensed with at seeding time; and when a good legume crop is turned under, the nitrogen may be omitted.

In considering the adaptation of the soils of Augusta County to livestock production, the Berks and Westmoreland soils, because of their shallowness, make late summer pasture and good corn yields uncertain.[8] These soils, however, are well adapted to raising lambs that are to be sold before July 1, and it is also practical to raise late lambs and beef cattle if good summer range is available elsewhere. Huntington silt loam is well adapted to the production of corn for fattening livestock or for silage, or to pasture for any kind of livestock. The Jefferson and Allen soils have very limited possibilities for livestock production, owing to the comparatively small crop yields and poor grazing. The Pope soils are particularly well adapted to feeder cattle and sheep because of their favorable location and the crop and grazing possibilities. The Holston soils have limited possibilities for cattle, sheep, or hogs. The smoother and less stony areas of the Muskingum soils would afford some summer grazing for light-weight cattle or sheep, and Porters stony loam would supply good summer grazing for beef cattle and sheep. The Frederick and Hagerstown soils are well suited to general or specialized livestock production, depending somewhat on the individual farm. Beef cattle may be successfully fattened on grass or finished on grain. The production of baby beef or light butcher cattle is practical on these soils. The soils are also well adapted to the production of good-quality market lambs and market hogs.

Apples can be grown over a wide range of soils, but some types of soil are better adapted than others, and some are not suited for fruit growing.[9] Compared with other crops, apple trees occupy the land for a long time, and it is important to give consideration as to the proper kind of soil on which to plant them. Generally, apple trees require a deep friable loamy soil, from 6 to 8 feet deep, to allow for proper root penetration and spread. The land should be well drained but should have the capacity to retain sufficient moisture throughout the growing season in order that the trees and crop will not suffer from drought. The soil, to produce good annual yields, should be well supplied with organic matter and should be neither too alkaline nor too acid. Because apple trees are deep rooted, the character of the subsoil is especially important.

Table 5 shows the suitability of the soils of Augusta County to apple growing.

The suitability of the soils of this county to peaches, grapes, and cane fruits is as follows: Berks and Westmoreland—peaches, fair if the soil is fertile; grapes, fair; cane fruits, not recommended, unless the soil is deep. Frederick and Hagerstown—peaches, good; strawberries and cane fruits, good. Holston and Jefferson—peaches, fair; cane fruits, good on elevated slopes; strawberries, fair to good. Clarksville—peaches, fair to good; strawberries and cane fruits, fair to good; grapes, good. Muskingum—peaches, fair; grapes, fair to good; cane fruits to be avoided if possible.

[8] The information on livestock production is obtained from notes supplied by G. C. Herring, extension animal husbandman, Virginia Polytechnic Institute.

[9] Notes on apple growing were supplied by A. H. Teske, horticulturist, Virginia Polytechnic Institute.

TABLE 5.—*Suitability of the soils of Augusta County, Va., for the production of apples*

Soils	Site	Suitability	Drainage	Retention of moisture	Content of organic matter	Varieties of apples grown	Quality and color of fruit	Size of fruit	Fertilizer requirements
Berks and Westmoreland.	Rolling land with fair air drainage.	Not recommended unless of good depth.	Surface drainage fair on deeper areas.	Droughty; soils suffer severely in dry seasons.	Low	Only early-maturing varieties.	Fair to poor	Fair	Nitrogen and phosphate.
Frederick and Hagerstown.	In general good; frost-free sites should be selected and sites containing much rock outcrop should be avoided.	Good to fair	Good	Fair to good	Fair to low	Lowry, York Imperial, Delicious, King David, Jonathan, Grimes Golden, Stayman Winesap; on lower elevations, Rome Beauty, Ben Davis, and Winesap; Arkansas where fertility is low.	Good	Good	Nitrogen and phosphate applied in spring or both fall and spring.
Huntington, Holston, and Jefferson.	Frost-free sites should be selected.	Fair, where elevated above surrounding land.	Good, except in depressions.	Fair	do	Delicious, Jonathan, Rome Beauty, Grimes Golden, Stayman Winesap, York Imperial, Ben Davis, and Gano.	Fair to good	do	Nitrogen and phosphate applied in spring.
Clarksville	Frost-free sites should be selected; steep slopes and low, flat areas not desirable.	Fair to good	Good on slopes; low level areas not so well drained.	Droughty	Lacking	On high elevations, Lowry, Arkansas, King David, Delicious, and early varieties; on lower elevations, Lowry, Arkansas, York Imperial, King David, Jonathan, Delicious, Rome Beauty, Ben Davis, Gano, and Grimes Golden.	Good, except in very dry seasons.	Fair on high elevations; good on low elevations in normal seasons.	Fairly large quantities of nitrogen and phosphate
Muskingum [1]	Mountainous in most places; good air drainage.	Fair; avoid using this soil if possible, as cost of production is high; trees small and of irregular shape.	Good	do	do	On high elevations, Lowry, Arkansas, Delicious, York Imperial, and early varieties; on lower elevations, early varieties, Lowry, Arkansas, Delicious, York Imperial, King David, Jonathan, Ben Davis, and Grimes Golden.	Good	Fair	Medium to large quantities of nitrogen, phosphate, potash, and lime.

[1] Established orchards on these soils are suffering from lack of moisture and organic matter.

THE FORESTS OF AUGUSTA COUNTY [10]

The forests of Augusta County, as they relate to soils and their use, may be classed in four main groups as follows: (1) Those of the broad agricultural valley, (2) those covering the more or less isolated knobs rising from the valley, (3) those growing on river bottoms and other alluvial soils, and (4) those occupying the rough mountain areas on both sides of the county.

The valley is essentially agricultural, and most of it will remain in agricultural use. Scattered throughout this farming section, however, are areas which, because of steep slope, shallow soil, excessive rock, or careless management in the past, are unsuited to profitable or permanent agricultural use. Most of these areas are small and so located as to form an integral part of some operating farm. Since they are better suited to tree growth than to agricultural use, and since it is always desirable that a farm have a home supply of fuel wood, fencing, and repair materials, such land should be kept in timber and managed as farm forests for the perpetual supply of these items.

Most of the valley is included in two main soil groups—those developed from limestone, represented by the Frederick and Hagerstown series; and those developed from shale, represented by the Berks and Westmoreland series. The areas of the former are more rolling than those of the latter, but they support dense sods of bluegrass which hold the soil even on steep slopes. The soils developed from shale are nearly level and have been extensively cleared, but they are distinctly inferior to those from limestone, both for crops and pasture. Because they do not support a dense sod, the shale soils cannot be used on steep slopes without excessive washing and therefore should be retained in timber.

The best use of much of the sloping land in this county depends on the erosiveness of the soil under different types of management. The soil must be so managed that it does not wash away faster than it is being developed from the underlying rock. Soils that wash under cultivation may be ideal for permanent pastures. In those areas where it is impractical to control erosion under pasturage, the soils should be devoted to timber production until such time as further or changed economic conditions make it possible to put them to some more intensive use without deterioration.

White oak is the characteristic tree of the soils developed from limestone. It is associated with other oaks, hickory, and other hardwoods. On the shale soils the timber is not quite so good, white oak is not the dominant species, and pine is an important part of the stand. Shortleaf is the predominant pine on uncleared areas, but on abandoned farm land, a scrub pine (*Pinus virginiana*) is generally the first species to seed in. Abandonment of farm land is largely confined to those soils developed from shale.

The soils on the isolated knobs (the Clarksville soils) differ from the valley limestone soils principally in their content of loose rock. They are in general too steep and rocky for successful cultivation and afford rather indifferent pasture. Most of the areas have never been

[10] This section of the report was written by J. W. O'Byrne, extension forester, Extension Service, Virginia Polytechnic Institute.

cleared, and many of those which have are now abandoned and allowed to revert to brush and tree growth. The best economic use for most of these knobs seems to be as farm forests serving the surrounding farms. Chestnut oak is the characteristic tree, and it grows in almost pure stands near the tops of the slopes. Farther down, other oaks, hickory, walnut, and other dry-soil hardwoods appear in the forest.

The alluvial soils are of two types: Those bordering existing streams and those which came down from the mountains in former geological times. Those alluvial soils bordering the streams, and known as Huntington, Pope, and Holston, are the best suited to farming. Except where drainage is inadequate, these soils are too valuable to devote to so extensive a use as timber growing. The one exception to this rule is probably the production of walnut trees which are especially suitable for growing as isolated trees along stream banks, bluffs, and rocky spots in pastures or cultivated fields.

The older alluvial soils (the Jefferson and Allen) are as a rule higher, rougher, more leachy and rocky, and they are generally less valuable for agricultural use than the Huntington, Pope, and Holston soils. The two main areas of the Jefferson and Allen soils form a more or less uniform band extending entirely across the county at the foot of the Blue Ridge, and irregular bodies of considerable size lie at the bases of the mountains along the western side of the county. Only the best and least rocky areas of these soils have been cleared, and much of the cleared land has proved so disappointing that it has been allowed to revert to brush and timber. It is probable that more and more of this land will be returned to forest in the future. The timber growth on the Jefferson and Allen soils ranges from fair to poor, depending on the degree of drainage and slope. Scarlet and post oaks and pitch pine are the characteristic trees, although practically all the dry-land trees native to this section may be found in places. Where soils of this type occur as an integral part of an operating farm, they should serve their best purpose as farm forests. Where they occur as extensive areas, especially where they extend back against the bases of the mountains, they should be managed as a part of the adjacent mountain forest unit which is discussed later.

The mountainous areas on both sides of the county are essentially forest land. In the Blue Ridge section, areas of Porters soils have been cleared and developed into pastures. In the Shenandoah Mountain section there are valleys, of which that of Calfpasture River is most notable, including alluvial soils of high agricultural value, but the mountains themselves are almost wholly rough areas of mediocre soils which will serve their best purpose if they are planted to trees and used for various purposes, such as recreation and watershed protection. The soils of the nonagricultural areas of both mountainous sections are largely developed from quartzite, sandstone, and shale origin and are classed as Muskingum soils. They are, for the most part, low in fertility, except on protected slopes where the soil materials have collected to considerable depth and have accumulated large quantities of organic matter. At the bases of the mountains, these soils merge with the poorer alluvial soils without much change in type of timber growth.

The timber growth in the mountains varies widely, from heavy stands of white pine, hemlock, yellow poplar, oaks, and other hardwoods in stream bottoms and protected north slopes to sparse stands of short-stemmed oak, pitch pines, and scrub oak on exposed south slopes. It is worthy of comment that within the George Washington National Forest where there have been no forest fires for 12 or 15 years, areas that had appeared to be hopeless oak-brush areas are developing into areas supporting promising stands of young oak timber. As long as fires were frequent, the tree species were kept killed back so that they were scarcely distinguishable from the brush species. But when fires were controlled the tree oaks began to overtop the growing scrub oaks and by their shade have killed much of the scrub growth that was crowding them out.

A large part of the mountain area of Augusta County is either publicly owned or is in the process of becoming so. On the Blue Ridge side, the George Washington National Forest extends north to Rockfish Gap, and the Shenandoah National Park extends from that point northward. On the Shenandoah Mountain side, the George Washington National Forest includes all the mountains except Little North Mountain from Buffalo Gap southward. That these areas have been included in purchase areas does not necessarily imply that all the land within the exterior boundaries has passed to public ownership, but that the several agencies are willing to purchase and add to established units such areas as the owners wish to sell and which are found to be administratively suitable. Under this policy, most of the area within the national forest purchase areas, which is not suited to permanent agricultural use, will probably find its way into Federal ownership and be administered as forest properties. The park area is still in the acquisition stage, and policies are not so well established.

There is little exact information regarding the original forests. Indiscriminate cutting, forest fires, and grazing have so modified the forest growth that it bears little resemblance to the original. In the agricultural areas, grazing of the forest land is the principal unfavorable factor. It is common practice to allow livestock to run in the woods, with the idea that they can pick up some feed without doing any damage. This is a mistake. If the forest is dense enough to be of any value as a forest, there is little grazing available, and at the same time, the livestock kill out the young growth and open up the forest so that the leaves blow away, and the trampling hoofs compact the ground so that water runs away instead of soaking into the soil. If these farm-forest areas are to show a satisfactory return and contribute a reasonable share to the farm income, they must be fenced against grazing livestock and be cut intelligently. In the limestone sections, the forest will be largely hardwoods. On the shale and alluvial lands, pines should be encouraged to make up a considerable part of the stand. This is particularly true where abandoned farm land is to be reforested artificially, as pines require less fertile soil than most hardwoods, are easier to transplant, grow more rapidly, and are useful for a greater variety of purposes.

In the mountains indiscriminate cutting followed by numerous and severe fires has reduced much of the area to a mere brush jungle. Much of the original forest was cut years ago to supply charcoal to

iron furnaces and to supply cordwood for the railroads which at that time burned wood. On protected slopes where fires have not interfered seriously, the cutting was followed by second-growth stands of great promise. In the more exposed situations, however, fires have not only eliminated many of the more valuable species of trees but have kept all the growth down to the size of brush and in addition have so depleted soil fertility that it will take years of protection to return the land to reasonable production. What can be accomplished by fire protection alone is shown in the national-forest areas. Public ownership is clearly indicated.

SOILS AND THEIR INTERPRETATION

Augusta County lies in the Appalachian Mountain and limestone-valley physiographic divisions, each occupying about one-half of the total area. The limestone valley lies between the Blue Ridge on the east and the Allegheny Mountains on the west, and it ranges in elevation above sea level from about 1,200 to 1,800 feet. The elevations in the mountains range from about 2,000 to approximately 4,400 feet. Owing to the mountainous topography and the rolling valley country, drainage is everywhere well established.

This county is in the Gray-Brown Podzolic soil belt of the United States. The soils are prevailingly light in color, ranging from light gray or pale yellow to brown in the surface soil and from red, brownish red, and brown to yellow in the subsoil. Throughout the county the texture of the surface soil is fine, and this layer contains much silt or fine sand. Stone fragments occur on the surface in a large proportion of the soils, particularly those developed in the mountains and near their bases and on the higher ridges and knolls of the valley. The subsoils are prevailingly friable, and in only a few local areas are the surface soils and subsoils heavy or plastic. Many of the subsoils become hard and brittle when dry.

The soils do not contain a large quantity of organic matter. They have developed under forest cover mainly of hardwoods, but conditions were not favorable for the accumulation of vegetable matter. In the forests, a small quantity of leaf mold is mixed in the first inch or two of the surface soil, and in pastures which have been kept in grass a long time the first inch of soil is slightly darker with organic matter than the soil below. Much of the land in the valley has been farmed a long time, and any organic matter that may have accumulated has been lost through cultivation.

A feature common to all the soils is that the surface soils do not contain so much plant nutrients as the subsoils. The rainfall in this section is rather heavy, the temperature is warm, and active leaching of the surface soil continues throughout the greater part of the year. The soil is frozen for only short periods in the winter, not sufficiently long to check the leaching process as in areas farther north where the soil remains frozen for a long time. It is because of the washing out of plant nutrients through leaching that the surface soils do not contain so much of these elements.

The soils of this county are slightly acid. On account of the leaching process, free carbonate of lime is lacking in them, although many of them are formed over limestone.

Much of the cleared land has been protected by grass crops, and throughout the county soil erosion and gullying are not so evident as in sections of the piedmont plateau east of the Blue Ridge. In some of the more rolling and steep cultivated fields thin eroded areas appear, and in some places small gullies are formed. Gullies are also evident on some of the steep pasture slopes.

The material from which the soil is formed consists of disintegrated and decomposed limestone, shale, sandstone, quartzite, and greenstone, the limestone breaking down through dissolution rather than disintegration.[11] The greenstone includes meadow basalt, lava flows, and volcanics altered into schistose and epidote chlorite. At the bases of nearly all the mountains is a belt of sandstone fragments, some of which are rounded and others subangular. This belt of material in places extends out in the valley for a distance of 2 miles, and in other places it is narrow. The material is apparently an old alluvium or colluvial material which has had an addition of sandstone fragments rolled from adjacent mountain sides. The alluvial deposits along streams are derived from material washed from nearby valley and mountain soils.

Formations of the Paleozoic age underlie nearly all of the county, except a small area in the extreme northern part which is underlain by formations of the Mississippian age. Limestone formations cover approximately 75 percent of the valley section. They consist of the Beekmantown, Conococheagne, and Elbrook limestones undivided and a narrow belt of Chambersburg and Stones River limestones undivided. In the extreme southwestern part and also near Craigsville are small areas underlain by limestone, and in the eastern part near the foothills of the Blue Ridge is a narrow strip underlain by Shady dolomite. Throughout the limestone formations in the valley are areas underlain by impure limestone, the impurity consisting mainly of chert but with some fine-grained sandstone embedded in it. As the chert is more resistant than the surrounding limestone, the resultant land forms are stony or gravelly hills and ridges, which stand above the rolling valley country.

In general the limestones have furnished the material for the soils in the valley, although on many of the steeper slopes the rock outcrops. The subsoils are red, reddish brown, brown, or yellow and are for the most part friable and crumbly. The soil ranges in depth from about 30 inches to about 5 feet, but in many places where the rock outcrops the surrounding soil is shallow. From the limestone residues, soils of the Frederick, Hagerstown, Clarksville, and Colbert series are formed.

A large area of Martinsburg shale extends about two-thirds of the way across the county. It is developed east of Weyers Cave, between Fort Defiance and New Hope, a few miles east of Staunton extending to Fisherville, and ends a short distance from Greenville. A narrow strip of this shale lies at the foot of the mountains immediately west of Churchville. In the eastern part near Waynesboro is a narrow belt of Watauga shale, which varies in width and is not very extensive. The Martinsburg shale, in some of the unweathered parts, contains considerable limestone, but in most places, particularly

[11] Geological data based on data from Geologic Map of Virginia, by W. A. Nelson, State geologist.

on the slopes, it has weathered to such an extent that the limestone has disappeared, leaving the shale. Soils developed over the Martinsburg and Watauga shales are nearly everywhere shallow and range from only about 15 to 24 inches in thickness. The shallowness is probably due to more resistance to weathering agencies by shale than by limestone. Soils of Berks, Westmoreland, and, to a slight extent, Muskingum series have developed from the weathered products of these shales.

On the western slope of the Blue Ridge, throughout the mountain's extent in this county, is a rather large area of Erwin quartzite, and lying between this formation and the top of the mountain is a narrow strip of Unicoi quartzite. In the extreme northern part is a rather large area, very irregular in outline, of Hampshire red sandstones and shales, and southwestward from this formation are extensive areas of Jennings shale and sandstone. In the southwestern corner is a comparatively large area of Tuscarora sandstone, and in the northwestern part, at Stokesville, southwest of that place, and along the Pendleton County line, are areas of Price and Pocono sandstones. These various rock formations underlie a large part of the mountain section, and the soils above them have sloping, steep, and broken relief. Owing to the surface features and resistant rock formations, the soils are shallow, and over most of them rock fragments are scattered. From the disintegrated layer of these rock formations, types and phases of the Muskingum series have developed.

In the western part of the county, near Augusta Springs and Deerfield, are strips of Romney shale. The soil formed over this rock is shallow and contains fragments of shale. The Hartsells soils are developed from the decayed layer of this formation.

On part of the crest and on some of the slopes of the Blue Ridge is a narrow belt of Cotoctin greenstone. The soil overlying this formation is generally thicker than that above the sandstone, quartzite, and shales in the mountains. The relief ranges from sloping to steep and broken, and rocks are nearly everywhere on the surface. Soils of the Porters series have developed from weathered parts of this formation.

At the bases of many mountains an unassorted mass of rounded and subangular pieces of sandstone has been spread by colluvial processes over the rock formations. From the weathered product of this material soils of fairly smooth surface relief and sandy texture have formed. These soils are members of the Allen and Jefferson series.

Along many streams are deposits of alluvial material ranging from narrow to comparatively wide areas, and from these deposits soils of the Elk, Holston, Pope, and Huntington series have developed.

The normal soils have a light-textured surface layer, or A horizon, and a subsoil layer, or B horizon, which is heavier in texture than the A horizon. A third layer, the C horizon, ranges considerably in texture, but it is lighter than the B horizon and, in most places, heavier than the A horizon. The A horizon ranges in texture from clay loam, loam, and silt loam to fine sandy loam and the B horizon from clay to silty clay and fine sandy clay. The C horizon is com-

posed of partly decomposed rock material which is variable in color, structure, and texture. The horizons range considerably in thickness, the A horizon being from 5 to 7 inches thick in the clay and silt loams and about 10 inches thick in the fine sandy loam. The B horizons range from about 8 inches to about 3 feet in thickness.

Soils having this threefold development are grouped according to their color profile. The red soils include the Frederick and Allen soils. The red color of the B horizon indicates a high degree of oxidation and maturity. Frederick silt loam may be considered the normally well developed soil of the county. A virgin area of this soil has the following profile:

Horizon A_1: 0 to ½ inch, light-gray silt loam containing a small quantity of organic matter derived from decayed leaves, moss, and grass.
Horizon A_2: ½ to 8 inches, slightly brownish yellow silt loam.
Horizon A_3: 8 to 12 inches, salmon-colored friable silty clay loam which on drying breaks into angular fragments and is hard and brittle. Along breakage planes, lighter colored material has filtered, giving the soil a faintly mottled appearance when dry.
Horizon B: 12 to 37 inches, slightly brownish red friable silty clay which when dry is hard and brittle. It breaks into large, irregularly shaped lumps which break further into small angular particles. The color of a cut surface is lighter than that of the broken lumps.
Horizon C: 37 inches +, dark brownish-red, faintly mottled or streaked with ocherous yellow, friable silty clay material which is slightly lighter in texture than the B horizon. This material grades into broken chert or limestone.

The profile of Allen fine sandy loam resembles that of the Frederick soil, except that it contains more fine sand and is more friable in the B horizon.

A second group of soils, grouped according to their color profiles, are the Hagerstown, Porters, Berks, Westmoreland, and Muskingum soils. They are brown, grayish brown, or light brown in the surface soil, or A horizon, and range from brownish yellow to brown and reddish brown in the B horizon. The C horizon in most places is shallow, and under the Berks, Westmoreland, Muskingum, and Porters soils it consists of mingled, streaked, or mottled brown and yellow soft decayed rock material. Under the Hagerstown soils the C horizon is also shallow and consists of friable clay or clay loam, containing some small black mineral particles and in some places spots of ocherous-yellow decayed soil material. Included in the group of brown soils is the Colbert soil and the Elk, Pope, and Huntington soils which are alluvial in origin. The Colbert soil is similar to the Hagerstown, except that the A horizon is heavier and the B horizon is yellowish-brown heavy plastic clay. The Elk, Pope, and Huntington soils have not developed well-defined profiles because the materials from which they have developed are young, and because they occasionally receive new material from overflow waters. The surface soils are brown, and in the Pope and Elk soils they become lighter brown with increase in depth, but in the Huntington soil the color becomes darker in the lower part. Most of these soils are underlain by brown sandy material containing gravel.

Another color group is that of the yellow soils, and it includes the Clarksville, Jefferson, and Holston soils. The B horizon of the soils of this group is characterized by yellow or slightly brownish yellow friable silty clay or fine sandy clay. The C horizon of the Clarksville and Jefferson soils is mottled dark-red, brown, yellow, and gray

friable material, and of the Holston soils is grayish-brown or brownish-yellow sandy clay material. In the A horizon of soils of this group, the color is lighter, ranging from light grayish yellow to light brownish yellow, than in soils of the brown group.

A large number of soil phases or soils limited in development have formed, and the total area of such soils is great. Steepness of slope is the principal factor in the lack of development in these soils, although in some places the phase is due to rock fragments on the surface. Included in this group of slightly developed soils are Frederick silt loam, hilly phase; Frederick silt loam, stony phase; Hagerstown stony clay loam; Hagerstown stony clay loam, hilly phase; Berks shaly silt loam; Hartsells shaly silt loam; Muskingum stony fine sandy loam, steep phase; Muskingum fine sandy loam, stony phase; Muskingum shaly silt loam; Porters stony loam, steep phase; Jefferson stony fine sandy loam; Allen stony fine sandy loam; Clarksville stony silt loam; and Pope stony fine sandy loam, colluvial phase.

Table 6 gives the pH values, determined by the hydrogen-electrode method in the Bureau of Chemistry and Soils, of different layers of several soils in this county.

TABLE 6.—*pH determinations of samples of several soils from Augusta County, Va.*

Soil type and sample no.	Depth	pH	Soil type and sample no.	Depth	pH
Huntington silt loam:	*Inches*		Pope loam:	*Inches*	
212260	0 - 8	7.7	212263	0 - 5	5.2
212261	8 -28	7.9	212264	5 -15	5.6
212262	28+	8.2	212265	15 -35	5.0
Frederick silt loam:			212266	35 -50	4.8
212201	0 - ½	5.4	Hartsells shaly silt loam:		
212202	½- 8	4.9	212235	0 - 4	5.7
212203	8 -12	4.7	212236	4 -10	4.8
212204	12 -37	5.0	212237	10 -20	4.8
212205	37+	4.9	Allen fine sandy loam:		
Westmoreland silt loam:			212248	0 - ½	4.7
212216	0 - 6	5.7	212249	½-10	5.1
212217	6 -27	5.7	212250	10 -14	4.8
212218	27+	4.9	212251	14 -37	4.5
			212252	37+	4.6

SUMMARY

Augusta County is in the northwestern part of Virginia, and the northwestern boundary borders the State of West Virginia for a short distance. The general relief is that of a broad rolling valley bounded on the east and west by comparatively high mountains. Drainage is everywhere well established. The mountain sections and some of the steeper parts of the valleys are in forest, mainly oaks.

This county was formed in 1738. Most of the early settlers were Scotch and Scotch-Irish. The population, exclusive of Staunton, is 38,163, and it is confined mainly to the valley. Staunton, an independent city, is the county seat and largest town. Several schools and colleges are located here. Railroad facilities are adequate, and good roads extend to the rural communities.

The average annual rainfall is 37.68 inches, and the average frost-free season is 179 days.

Agriculture in the territory now included in Augusta County began about 200 years ago and at first was confined to the bottom

soils, but about 1800 farming was begun on the uplands. Commercial apple orchards were started about 1898.

The county lies in both the Appalachian Mountain and limestone-valley physiographic provinces, about one half of the county being mountainous country and the other half valley. As the mountains are for the most part rough and broken in topography, they have been left in forest, and much of the land is owned by the Government as national forests and national parks. Agriculture is confined mainly to soils in the limestone valley, and here most of the land is cleared for agricultural use.

The present-day agriculture consists of the production of wheat, hay, and corn as the principal crops; and oats, barley, and rye as the minor crops. The raising of cattle and sheep is important. In addition, the production of apples on a commercial scale is large in some localities, particularly near Staunton, Fisherville, Waynesboro, and Stuarts Draft.

The soils are separated into two main groups—agricultural soils and forest soils. The agricultural soils group is further divided into soils underlain by limestone, soils underlain by shale and sandstone, and pasture soils. The soils of the first subgroup practically dominate the agriculture. They occupy about one-half of the valley part of the county. The agricultural soils underlain by shale and sandstone are, in general, not so productive as the agricultural soils underlain by limestone. The pasture soils group embraces a number of soils which are practically excluded from general farming, mainly because of stoniness and steepness of slope.

The forest soils group includes soils which, on account of their unfavorable relief, stoniness, or shallowness, have been cleared for agricultural use to only a slight extent.

Grazing and the finishing of cattle on grain are important pursuits, and much of these are carried on in the eastern part of the county. Many cattle are sent in from Rockbridge and Highland Counties to be finished in Augusta County. Feed for the cattle is produced almost entirely within the county. Sheep are raised in nearly all sections, and lambs are shipped to the Jersey City market. Some hogs and much poultry are shipped to outside markets.

Applications of lime, shorter rotations of crops, and the use of fertilizer, mainly complete fertilizers, are recommended for improvement of the soils.

The Huntington, Pope, Frederick, and Hagerstown soils are particularly well suited for use in connection with the cattle industry. The Frederick, Hagerstown, and Clarksville soils are considered fair to good for apple orchards, and the Huntington, Holston, Jefferson, and Muskingum are considered fair soils for apples.

The soils are prevailingly light in color, low in organic matter, and more or less acid. In the valley they have developed mainly over limestone, although a fairly large proportion has formed over shale. In the mountains they have received their material chiefly from decayed sandstone, but rather large areas have originated from weathered products of shale or of greenstone. The alluvial soils have developed mainly from sediments of sandstone and shale origin, although some of the deposits have been washed from limestone areas.

U. S. GOVERNMENT PRINTING OFFICE: 1937

Accessibility Statement

This document is not accessible by screen-reader software. The U.S. Department of Agriculture is committed to making its electronic and information technologies accessible to individuals with disabilities by meeting or exceeding the requirements of Section 508 of the Rehabilitation Act (29 U.S.C. 794d), as amended in 1998. Section 508 is a federal law that requires agencies to provide individuals with disabilities equal access to electronic information and data comparable to those who do not have disabilities, unless an undue burden would be imposed on the agency. The Section 508 standards are the technical requirements and criteria that are used to measure conformance within this law. More information on Section 508 and the technical standards can be found at www.section508.gov.

If you require assistance or wish to report an issue related to the accessibility of any content on this website, please email Section508@oc.usda.gov. If applicable, please include the web address or URL and the specific problems you have encountered. You may also contact a representative from the USDA Section 508 Coordination Team.

Nondiscrimination Statement

In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident.

Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the

Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English.

To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at http://www.ascr.usda.gov/complaint_filing_cust.html and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by:

(1) mail: U.S. Department of Agriculture
Office of the Assistant Secretary for Civil Rights
1400 Independence Avenue, SW
Washington, D.C. 20250-9410;

(2) fax: (202) 690-7442; or

(3) email: program.intake@usda.gov.

USDA is an equal opportunity provider, employer, and lender.