SOIL SURVEY OF TRANSYLVANIA COUNTY, NORTH CAROLINA.

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DESCRIPTION OF THE AREA.

Transylvania County lies in the southwestern part of the State of North Carolina. It is a typical mountain county, having the Blue Ridge range along its southern border and the Tennessee and Pisgah ridges along its west and north boundaries. The greater part of the

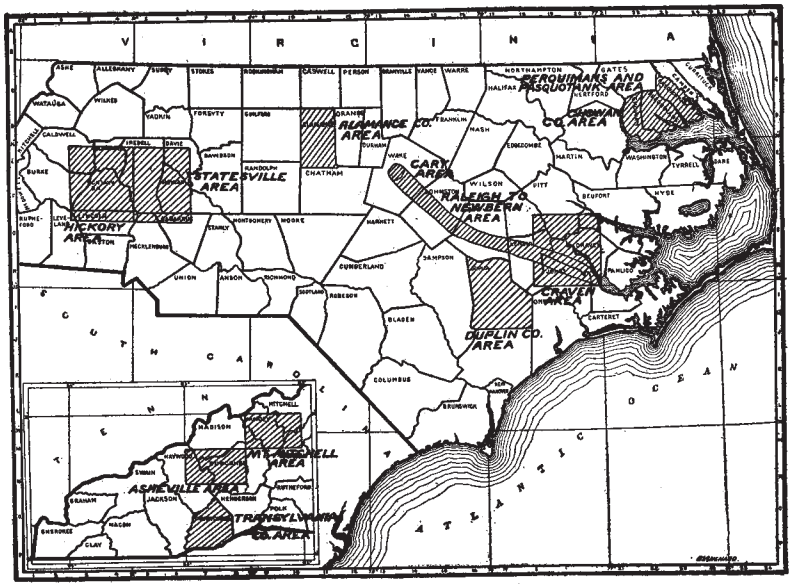

FIG. 8.—Sketch map showing location of the Transylvania County area, North Carolina.

county is included in the Pisgah quadrangle sheet of the United States Geological Survey.

The county is bounded on the east by Henderson County, on the northwest and north by Henderson and Haywood counties, on the west by Jackson County, and on the south by the South Carolina State line. The outline of the county is very irregular, following in many places the ridges or the tops of the mountains. It contains 238,272 acres, or about 372 square miles.

The surface features are those of a hilly to rough mountainous country, with many deep, narrow intervening valleys, and a beautiful, broad valley through the east-central part. The general slope of the southwest part of the county is to the south, while the northern and southern parts slope toward the east-central part of the county, forming a troughlike depression, which gives rise to a wide, level to gently rolling plateau valley along the French Broad River. The elevation of the county varies from 1,265 feet, where the Toxaway River enters South Carolina, to 6,043 feet on Chestnut Bald, in the northwest part of the county. The elevation is 2,230 feet at Brevard and 3,000 feet at Lake Toxaway. The western and northern boundaries are formed by a chain of mountains embracing the Tennessee and Pisgah ridges, in which are found the highest peaks in the county. The Blue Ridge range in the southern part attains an elevation of scarcely more than 3,000 feet along the county line. A series of mountains, the chief of which are Funneltop, Black, Lookingglass, Cedar Rock, Three Forks, Pilot, and Toxaway, together with the Tennessee and Pisgah ridges, constitute by far the roughest areas in the county. The sides of these mountains are in many cases steep, and the small streams have carved out deep, narrow gorges in their rapid descent to lower altitudes.

The southern part of the county is less mountainous than the northern, but becomes somewhat mountainous as the French Broad River is approached. Practically all of the level and gently rolling land in the county occurs along the French Broad, Davidson, and Little rivers and a small area at Pink Beds. There are some low, rounded hills and shallow valleys in many places. Some perpendicular walls of solid rock rising from 400 to 700 feet were noticeable, especially in Lookingglass Mountain, St. John's Rock, and Dunn's Rock. The county has excellent natural drainage, effected through the French Broad River and its numerous tributaries. The French Broad has its origin within the limits of the county, its headwaters being formed by the North Fork, West Fork, and East Fork. The river runs in a general northeast direction and has considerable fall. The most important tributaries are the Little, Davidson, and Mill rivers, and Bradley, Avery, Cathey, Carson, and Williamson creeks, all of which are very swift flowing and in many places diversified with falls and rapids, where much power could be easily and cheaply developed. Practically all of the farm houses in the county could be supplied by gravity with fresh cool water from the mountain springs. The southwest end of the county has splendid drainage through the Toxaway and Horsepasture rivers and their tributaries. A dam has been constructed across the Toxaway River at Lake Toxaway and a beautiful artificial lake has been formed with a shore line of 15 miles.

Transylvania County was formed from the counties of Henderson and Jackson in the year 1861. Brevard, the county seat, with a population of about 800, has made practically all of its growth within the last fifteen years. The greater part of the rural population are decendants of the first settlers of the county, who were American-born whites, and who moved into the county from other parts of the State. Within the last few years a few northern people have bought homes here on account of the cheapness of land and the healthfulness of this mountain section. Only a few negroes reside in the county.

The county, especially in the rough, mountainous localities, is very thinly settled. The majority of the population is found in the French Broad Valley. The natural advantages and resources of the county are sufficiently favorable, however, to support a population many times the present number, which is about 8,000.

A branch of the Southern Railway runs from Hendersonville to Lake Toxaway, affording good transportation facilities. Special trains are operated during the summer months, giving excellent service. The dirt roads, generally, throughout the county are in bad condition during the greater part of the year. There are a few well-graded roads on the sides of some of the mountains, and across the Vanderbilt estate some beautifully graded roads are being constructed. With the rock material at hand graded and macadamized roads could be built in all parts of the county.

There is a good market at Brevard and Lake Toxaway for garden vegetables, potatoes, fruits, chickens, and eggs, all of which bring a high price. Some cattle are shipped out of the county, and these go either to Richmond, Va., or Asheville, N. C.

CLIMATE.

The following table, compiled from the records of the Weather Bureau, shows the normal monthly and annual temperature and precipitation at Brevard and Hendersonville, the latter place being in an adjoining county to the east. December, January, and February are the coldest months, with an average temperature of 37.1° F. June, July, and August are the hottest months, with an average temperature of 72.2° F. The winters are cold, though not severe, while the summers are cool and pleasant. There is quite a marked difference between the temperatures of the higher mountain ranges, at from 5,000 to 6,000 feet altitude, and the valleys.

April, May, June, and the early part of July usually have more rainy days, while from the middle of July to December there is a high percentage of sunshiny days. The summer of 1906 was an unusually wet season, the precipitation during the four months from May to August, inclusive, nearly equaling the total precipitation for

an average year. During the latter part of September and the month of October the weather is ideal, the air being dry, cool, and bracing.

The relative humidity in the French Broad Valley is rather high during the summer months, and fogs are quite frequent along the river in the early morning.

Normal monthly and annual temperature and precipitation.

Month.	Brevard.		Hendersonville.		Month.	Brevard.		Hendersonville.	
	Temperature.	Precipitation.	Temperature.	Precipitation.		Temperature.	Precipitation.	Temperature.	Precipitation.
	°F.	In.	°F.	In.		°F.	In.	°F.	In.
January	35.1	7.97	37.1	4.57	August	72.7	2.50	73.3	7.78
February	38.6	7.04	38.3	7.38	September	65.9	3.24	65.7	4.55
March	47.8	9.19	46.2	7.64	October	56.5	2.48	56.2	4.24
April	52.5	6.98	53.4	5.04	November	45.6	3.67	46.5	2.98
May	66.8	2.28	63.9	4.18	December	37.8	5.79	38.8	5.24
June	.....	.....	70.3	6.39	Year	.....	.....	55.2	65.90
July	72.7	2.36	72.9	5.91					

In the table below are given the dates of the last killing frost in the spring and the first in the fall. At Brevard the average dates are May 3 and October 13, which gives a growing season of about 163 days for the tenderest crops.

Dates of first and last killing frosts.

Year.	Hendersonville.		Brevard.	
	Last in spring.	First in fall.	Last in spring.	First in fall.
1900	May 11	Nov. 7	.....	.....
1901	Mar. 29	Nov. 3	.....	.....
1902	Apr. 14	Oct. 15	May 27	Oct. 13
1903	Apr. 24	Oct. 19	.....	Oct. 11
1904	Apr. 22	Oct. 15	Apr. 22	Oct. 15
1905	Apr. 19	Oct. 13	Apr. 19	Oct. 12
Average	Apr. 20	Oct. 22	May 3	Oct. 13

On the protected slopes and in coves of the mountains fruit is seldom injured by frost, and these areas offer excellent opportunities for the culture of apples and peaches on a large scale. Cattle and sheep find good grazing on the slopes of the mountains, and the weather is sufficiently open for them to be kept on the ranges from May till December.

On account of the delightful climate and pure water this county is becoming more and more a summer-resort section. A number of summer homes are located at Brevard and in the surrounding country. Lake Toxaway, located in the heart of the mountains at an altitude of 3,000 feet, has in the last few years grown to be a very popular resort.

AGRICULTURE.

Although Transylvania County has been settled for about a century, the agricultural development over the greater part of the area has been slow on account of the rough surface features and the remoteness from lines of transportation. The development along the French Broad River has been steady and marked improvements have taken place within the last few years. The Porters clay and strips of bottom land were probably the first soils to be used for farming purposes. Of the first farm products wheat and rye were the most prominent. A considerable quantity of flax was grown until about thirty or forty years ago, at which time this crop was abandoned. Tobacco has been grown only to a very limited extent. Within the last twenty years grass (timothy and redtop) has superseded wheat and rye in a great measure. The production of corn has been greatly increased since the semiswampy lands along the rivers have been brought under cultivation. Cattle raising has been a prominent industry in the development of the county. The Japan clover, a crop indigenous to this section, a little crabgrass, and a smaller amount of bluegrass afford excellent natural pasturage.

The greatest stimulus to both the agricultural and industrial development of this county was the building of the Hendersonville and Brevard Railroad in 1894. This road was extended to Rosman in 1900, and in 1903 it was built up the mountain to Lake Toxaway. Within the last two years the North Carolina department of agriculture has established a test farm near Blantyre. Along the French Broad River and Little River are several neat, painted, frame houses with beautiful lawns and commodious barns, all of which is some indication of the county's prosperity. These farms are usually supplied with modern machinery and well stocked with farm animals. In a few places in the valleys, and more especially in the mountain districts, are seen many small houses, and the surroundings indicate less thrift and progress.

Corn has been one of the cultivated crops since the settlement of the county, and is to-day the chief farm product, equaling in value all the other farm crops combined. Rye, grasses, including timothy and redtop, and oats are the most important of the secondary crops. A small acreage of wheat and clover is grown. Irish potatoes are becoming one of the staple money crops on the upland soils, and give promise of being a crop of considerable value for this part of the county. Cabbage is grown throughout the county. Sweet potatoes and other vegetables and tobacco are produced for home use. Nearly every farmer has a small patch of sorghum cane from which he manufactures sirup for home consumption. Quite a number of cattle are raised and shipped out of the county. A few hogs and

occasionally a flock of sheep are kept on the best regulated farms. The value of orchard products is considerable, and while only a little is shipped from the county, an active demand is met in the markets at Brevard and Lake Toxaway.

Several sawmills are in operation in the county, and some revenue is derived from the sale of lumber. There are areas of valuable merchantable timber in the vicinity of Lake Toxaway, and especially on the Vanderbilt estate. Oak, chestnut, poplar, and hemlock constitute the principal varieties of highest value. Many thousand cords of chestnut wood are annually sold at a good price to a tannin plant at Pisgah Forest. A considerable income is also obtained from the sale of tan bark taken mainly from the chestnut oak, with a small quantity from hemlock. The revenues from wood and bark support in the main a large percentage of the population in the more mountainous areas, where agricultural pursuits are not flourishing.

The coves and many of the mountain slopes are the natural homes of many plants and shrubs which are of value both medicinally and for decorative purposes. Rhododendron, kalmia, and azalea attain a size and profusion here nowhere excelled in this country. The chief varieties are *Rhododendron maximum*, *catawbiense*, and *punctatum*. The azaleas, *Azalea arborescens*, *nudifolia*, *vaseye*, and *viscosa* and *Kalmia latifolia* are abundant. In addition to these the balsam, hemlock, and white pine are marketed to some extent in other localities in the mountains. Many smaller plants are also marketed, such as galax, shortia, and arbutus. In the Carolina mountains, particularly in the western part of Transylvania County, medicinal herbs are gathered and find ready sale at local stores, furnishing in part a livelihood for the mountaineers. The names of plants occurring in greatest abundance and selling most readily are as follows: Eletus, yellow lady's slipper, witch-hazel, wild ginger, wild yam, wild cherry, wild carrot, upland cranberry, trailing arbutus, Solomon's seal, poison hemlock, pipsissewa, pennyroyal, maidenhair fern, American ipecac, Indian turnip, ginseng, gentian, black haw, and Canada balsam.

Occasionally grass, rye, and oats find their way into the rotation on a few farms; corn, the chief crop, is grown almost exclusively year after year on the same soil. The methods of handling the Porters clay are usually inadequate to secure the best returns. The Porters loam is cultivated with modern machinery and is fairly well tilled.

Since there has arisen a demand for cordwood and tanbark the price of farm labor has increased from 50 cents to $1 a day. In a few localities, remote from towns or railroad, some farm help can be secured for 75 cents a day. The labor, mostly American-born, is said to be fairly efficient. It is not uncommon in the mountain districts to see women and girls assisting in the field work.

About 65 per cent of the farms in Transylvania County are oper-

ated by the owners. The remaining farms are either rented for a part of the crop, which is usually one-third, or let on the share system. Under the latter arrangement the landowner furnishes the land, stock, feed for stock, and farming implements and receives one-half of all that is produced upon the farm.

The size of the farms varies from a few acres up to a thousand acres or more. In the southwest part of the county the Toxaway Company owns about 14,000 acres, while all the northern and northwestern parts of the county, embracing 64,345 acres in an unbroken body, are owned by Mr. G. W. Vanderbilt. As reported by the Twelfth Census, the average size farm contains 112 acres.

The value of farm land, and especially timber land, has increased wonderfully within the last six years. The rough mountain land which a few years ago sold for about $1 an acre is now held at from $5 to $25 an acre. Upland farms sell for $10 and $20 an acre, while the best agricultural and most highly improved bottom land brings from $60 to $100 an acre.

There is nothing that would add more to a rapid development of Transylvania County than good roads. These would enhance the value of farm lands, insure easy and quick marketing of farm products, wood, and lumber, and would tend to increase the number of summer tourists, a valuable factor in developing the county. The rough mountainous areas should be kept in permanent forests, and the present timber for market should be selected by expert foresters. More neat cattle should be raised, as well as a larger number of hogs and sheep. It should be the aim of every farmer to produce feed for his stock, especially the hay and roughage, for the prices paid for such feed are exceedingly high. Apple orcharding would in all probability prove profitable on the mountain slopes at suitable elevations, where there is good air drainage. Dairying, poultry raising, and more extensive truck gardening should prove highly remunerative. All of these products are scarce and command high prices, and many articles of food have to be shipped into the county during the summer months to supply the increasing demand.

SOILS.

The soils of Transylvania County may be divided into two general classes—residual and alluvial. The residual soils, which occupy the mountain areas, are derived in the main from metamorphic rocks and have been classified in the Porters series. They consist principally of loams, sandy loams, and clays, and are the characteristic soils of the mountain region of western North Carolina. The alluvial soils, formed by the deposition of material by the streams, occupy the valleys. They consist of very fine-textured loams and fine sandy loams, and have been classified in the Toxaway series.

Transylvania County lies in the area of gneissic and granitic rocks of pre-Cambrian age, which form the bed rock over the greater part of western North Carolina. The county is cut in a general northeast-southwest direction by a belt of Cambrian rocks, varying in width from 1 to 3 miles. South of the French Broad River the prevailing type of rock is a porphyritic gneiss, which outcrops in many places. This rock disintegrates readily, and where weathering has not progressed more than 3 to 5 feet below the surface, as is usually the case, the rather coarse-textured Porters sandy loam is found. In many cases decomposition of the constituent minerals has not taken place to a marked extent, and the material retains the structure of the original rock. Where the rock is not so near the surface and decomposition has progressed farther the soil is darker in color, finer in texture, and has been classified as Porters loam.

North of the Cambrian belt the prevailing formation is a fine-grained granitic rock, which although outcropping in many places and forming high cliffs of exposed rock, is usually weathered to considerable depth below the surface. The prevailing soil—Porters loam—is a smooth, even-textured loam. Wherever the rock is comparatively near the surface the material is coarser and isolated areas of the Porters sandy loam result.

The rocks of the Cambrian belt above mentioned consist chiefly of slates and schists, dipping at high angles and usually deeply weathered. In many localities the structure of the rocks is preserved to or very near the surface, but they are so thoroughly decomposed that they crumble easily and do not interfere with agricultural operations. The soils derived from these rocks are fine-textured clays of dark-red color. In some areas in this belt where the natural vegetation is very heavy and a large amount of organic matter has consequently been mixed with the soil, the Porters loam occurs. The prevailing type in this belt, especially in the middle and eastern parts of the county, is the Porters clay.

In the valleys of the rivers and larger creeks the two types of alluvial soil occur. Where the sediments were deposited by more or less rapidly moving water the material consists chiefly of fine-grained sands and mica scales, with a relatively small amount of silt and clay. These sediments, modified by the addition of organic matter, give rise to the Toxaway fine sandy loam.

During periods of overflow, when large bodies of slowly moving water heavily laden with the finer sediments brought down from the mountains have covered the flood plains, a great deal of silt and clay has been deposited. The frequent overflows have kept these areas for a long time in a semiswampy condition, and consequently a very large amount of organic matter has been accumulated. This has given rise to a heavy, fine-textured, dark loam, classified as Toxaway loam.

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Porters loam	151,424	63.6	Toxaway loam	7,424	3.1
Porters sandy loam	50,432	21.2	Rock outcrop	3,904	1.6
Porters clay	12,608	5.3	Porters black loam	3,840	1.6
Toxaway fine sandy loam	8,640	3.6	Total	238,272	

PORTERS LOAM.

The surface soil of the Porters loam consists of a yellowish-brown, reddish-brown, or dark-brown loam ranging in depth from 6 to 12 inches. The soil contains a fairly high percentage of decayed vegetable matter. There are small spots and narrow strips of very dark brown or black loam scattered throughout the more mountainous areas of the type where the forest growth has been densest and in the springy places at the heads of the streams. Other spots of grayish loam or heavy sandy loam are encountered here and there on the sides and in the foothills of the mountains, where the gneissic rocks come near the surface. Occasionally in isolated spots a few fragments of schist and gneiss are scattered on the surface, and on a few of the knolls and tops of the mountains their presence is quite noticeable and sometimes objectionable. The soil is mellow, friable, and easily tilled, and seldom clods or cakes to any extent.

The subsoil is a light-brown, red, or yellowish-brown clay loam or loam. In a few localities, especially near Lake Toxaway and in the northwestern part of the county, the subsoil is a red clay, being quite similar to the subsoil of the Porters clay. Mica scales in considerable quantity are present in the soil and subsoil throughout typical areas, and a few rock fragments are sometimes found in the subsoil, as well as an occasional quartz vein.

The Porters loam is the most important soil type in Transylvania County, covering approximately 65 per cent of the land surface of the county. It forms practically all of the mountainous area north of the French Broad River and all of the southwestern part of the county, excepting a small area occupied by the Porters sandy loam and the Porters black loam. The largest unbroken body of the type occurs in the vicinities of the Pink Beds, Gloster, and to the southwest of Lake Toxaway. A smaller area is found in the southeast corner of the county, and small spots are found scattered through the Porters sandy loam area and near Grange. The Porters loam is the type forming nearly all of the Vanderbilt estate in Transylvania County.

The topography of this type of soil varies from rolling to rugged and mountainous. The elevation ranges from 1,265 feet to about

6,000 feet above sea level. The greater part is mountainous and the slopes precipitous, but there are many round-topped mountains and intervening rolling valleys near some of the small streams where cultivation can be carried on easily. The type occupies some of the foothills in the Porters sandy loam area, but is more frequently found as eroded tops. It is the characteristic soil type of the mountain region of western North Carolina.

The natural surface drainage of all areas of this type is excellent. The rainfall flows rapidly from the sides of these mountains, leaving the soil well drained soon after a rain. Erosion is active and pronounced over areas which have been cultivated or denuded of their forest growth. The type is exceptionally well watered by numerous springs which give rise to a very intricate stream system.

The Porters loam is a residual soil formed through long processes of weathering, mainly from the gneissic and fine-grained granitic rocks which lie north of the Cambrian belt. These fine-grained rocks are especially noticeable in the vicinity of the Pink Beds and to the southwest through the county. To the mineral particles derived from these rocks have been added the decayed remains of plants, the resulting material being a mellow loamy soil. Mica scales are present where mica schists have entered into the composition of the soil, and quartz fragments occur here and there, left in an unweathered state on account of their more obdurate character. Some areas of the type are also found in the Cambrian, and these have been derived from certain phases of the slate and schistose rocks found in that formation. The native forest consists practically of deciduous hardwoods, among which chestnut oak, red oak, white oak, post oak, chestnut, poplar, hickory, and maple are prominent. There is some pine and hemlock. In many places there is a thick undergrowth of laurel, rhododendron, and chinquapin, and in the coves and shaded mountain sides a great variety of ferns and medicinal herbs.

The larger proportion of the type is too rugged for general farming operations and should be kept as a permanent forest reserve. However, in many of the coves and on some of the slopes are areas suited to the production of apples on a commercial scale, and these should be developed whenever transportation facilities warrant. The Albemarle Pippin, Winesap, York Imperial, and Magnum Bonum would be suitable varieties for this locality. There are also large areas of the Porters loam naturally adapted to pasture for cattle and sheep, an industry which should be more extensively developed. The gently rolling slopes and narrow valleys are suited to the production of corn, wheat, oats, rye, clover, potatoes, tobacco, and vegetables. At present only a very small proportion of the area of Porters loam is under cultivation and comparatively light yields are secured. Corn produces from 15 to 25 bushels per acre. Some rye, oats, wheat, Irish

potatoes, and sweet potatoes are grown with a fair degree of success. Cabbages and garden vegetables do well. Very small patches of tobacco are seen around each home. Some apple trees and a small number of peach trees were seen on some parts of the type. One or two young orchards which were in splendid condition indicate what can be done when the proper care is given the trees. The young orchard of apple trees belonging to the State experiment farm is located on the Porters loam on the north side of Fodderstack Mountain.

The cultural methods on the more remote areas of this soil are in the main rather primitive. Owing to the hilly surface, the use of modern machinery is precluded, except in a limited way. There is scarcely no rotation of crops practiced. The 64,345 acres of the Vanderbilt estate and about 14,000 acres belonging to the Toxaway Company are at present held as a forest reserve, and the few areas once cultivated are being pastured and allowed to return to forest. Practically no commercial fertilizer is used, but occasionally a little lime is applied to some field. There are areas which can be brought to a high state of productiveness by proper cultivation and rotation of crops.

The value of the Porters loam at present is largely determined by the quantity and character of the timber and its accessibility to market or to shipping points. It ranges from $5 to $35 an acre.

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

Mechanical analyses of Porters loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
15906, 15910	Soil	2.0	7.4	5.1	19.9	12.6	27.7	25.0
15907, 15911	Subsoil	1.1	7.2	5.3	20.7	10.8	28.1	26.3

PORTERS SANDY LOAM.

The typical soil of the Porters sandy loam is a light to dark yellowish-gray medium to coarse sandy loam, varying in depth from 6 to 15 inches. The irregularity in shape and size of the sand particles in some instances gives the soil a rather coarse texture, while in others fine particles mingled with the relatively large amount of silt and clay gives in the heavily forested areas a soil of dark color and loamy texture. This latter phase is encountered in the southeastern part of the county near the South Carolina line, where the Porters sandy loam grades into the Porters loam. In some areas, particularly in the southeastern part of the county, spots of this type occur

which contain very little silt and clay, being composed almost entirely of sand. This phase closely resembles Porters sand, but such areas are very small and are not of sufficient importance to be represented on the map. The soil is loose and open in texture and is easily tilled. The subsoil to a depth of 36 inches varies from a yellowish-red, heavy, sticky, sandy loam to a stiff red clay. In some localities where the parent rock is within 3 or 4 feet of the surface the subsoil is a yellowish-brown, coarse, sandy loam, containing a considerable quantity of rock fragments. On many of the steeper slopes the subsoil at 8 to 25 inches grades into disintegrated but imperfectly decomposed gneissic rock. Such areas are liable to be droughty and unproductive. Considerable amounts of rock fragments are scattered through both soil and subsoil.

The largest continuous areas of this type occur in the southeastern part of the county, where it is the predominant type. It is typically developed in that part of the county drained by Little River, Williamson Creek, and East Fork. Prominent though smaller areas occur in the southwestern part in the vicinity of Lake Toxaway. In the northern and northwestern parts of the county, north of the French Broad River, small isolated areas occur.

As a rule the Porters sandy loam occupies the steeper slopes and summits of the mountains in the areas of gneissic and granitic rocks. South of the French Broad it occupies steep mountains and slopes, while farther southeast, in the vicinity of Cedar Mountain, the topography is more rolling. On account of its loose, open texture and the position which it occupies this soil has excellent surface drainage. When deforested it erodes very readily, and heavy rains do serious damage to the cleared land when it is improperly cultivated.

This is a residual soil, the larger areas of which are formed by the decomposition of a coarse-grained porphyritic gneiss; smaller areas in the northern and northwestern parts of the county are derived from a finer-grained granitic rock. In many cases where the rock is near the surface very little decomposition of the mineral particles has taken place, in which cases the subsoil retains the structure of the parent rock. These rocks are traversed at frequent intervals by veins of quartz, varying from less than an inch to several inches in width, which causes both soil and subsoil to contain a considerable amount of angular quartz fragments.

The natural vegetation of this type consists principally of the hardwoods, of which white, red, chestnut, and post oak and chestnut predominate. A few white and shortleaf pines occur, but not in large bodies. Along the streams there is an abundant growth of laurel and rhododendron, while the forest floor is thickly covered with galax and trailing arbutus.

The greater part of this type is too rough and mountainous for

cultivation, and as it is subject to rapid erosion it had best be kept under forest. The best phases of the type—those areas which are not too steep for cultivation—are better adapted to garden and truck crops than to general farm crops. On some of the higher mountains—Mount Toxaway, for instance, at an altitude of 5,000 feet—very good garden crops are raised. Apples and peaches do well on the deeper phases of the type, but it can not be said to be a good orchard soil where the bed rock comes within 3 feet of the surface. Corn, rye, and sorghum are cultivated to a small extent. Corn yields from 10 to 20 bushels per acre, but the yields of rye are very low. In the valleys potatoes do well, especially when properly cultivated and fertilized. Tobacco is grown on this type to a very limited extent.

On account of the rugged character of the surface practically no farm machinery is in use, and the methods of cultivation are, as a rule, rather crude. No rotation of crops is practiced and very little commercial fertilizer is used. A systematic rotation and the cultivation of leguminous crops on a larger scale would bring the better phases of the type up to a good state of productiveness.

The areas of the Porters sandy loam in the more remote sections of the county are valued at about $3 an acre, while along the French Broad farming land of this type is worth from $10 to $20 an acre. Where there is merchantable timber the value depends upon the stand of trees, their kind, size, and qualities, and the cost of putting the timber on the market.

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

Mechanical analyses of Porters sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
15912, 15914	Soil	4.1	14.4	8.3	29.1	13.6	18.1	12.1
15913, 15915	Subsoil	2.9	13.4	6.9	23.9	10.7	15.9	26.2

PORTERS CLAY.

The soil of the Porters clay consists of a red or brown clay loam, varying in depth from 4 to 7 inches. In a few of the badly eroded areas a red stiff clay is found on or near the surface, while in other localities where the surface is gently rolling a grayish to brown loam containing a noticeable proportion of sand is observed. A considerable quantity of rounded quartz gravel occurs here and there on the surface and distributed through the soil. Generally the soil is

fairly easily tilled, and it is only on the heaviest phases that any difficulty in tillage is experienced. The subsoil to a depth of 36 inches or more is a stiff red clay. In a few places, however, the red clay subsoil passes into a creamy-white silty clay at about 20 inches, and a few areas are underlain at from 2 to 4 feet by a white (pipe) clay. Spots of reddish-yellow clay were observed in one or two localities. Occasionally at varying depths in the subsoil a stratum of rounded quartz gravel is seen.

The Porters clay is confined largely to the east-central part of the county, where it occurs in narrow strips or bands along the Southern Railway between Blantyre and Rosman. The largest areas lie in the vicinity of Brevard, Selica, and to the southeast of Ecusta. A few small spots are found in the northeast part of the county. This type of soil forms a part of the State Test Farm at Blantyre.

The type occupies ridges, low hills, and the foot hills of the mountains. It seldom extends to any great distance up the mountain sides. The surface is rolling to very hilly, but only in a few places is it too precipitous for cultivation. It occupies a unique position between the Toxaway loam of the bottoms and the Porters loam of the mountains. The natural surface drainage is splendid. Many badly gullied and eroded hillsides were seen.

The Porters clay is a residual soil which has been derived from the weathering of shale and gneissic rocks. In the Cambrian belt of rocks it is the chief soil derived from the shales and schists of the series. In many places these rocks have disintegrated to a considerable depth, while in other localities the partially weathered or rotten rocks come near the surface and even outcrop in a few places.

The native forest growth consisted of a variety of oaks, chestnut, and poplar, with an undergrowth of chinquapin bushes. This soil was among the first soils to be cultivated when the county was settled. Since other types have been brought under cultivation, parts of the clay areas have been neglected, and a deteriorated soil is sometimes the result.

The Porters clay is best suited to the production of corn, oats, clover, wheat, and Irish potatoes. It is also adapted to pasturage purposes and apple orcharding. Grapes might prove a profitable crop. Corn produces from 12 to 30 bushels per acre; oats, 20 to 30 bushels; wheat, 8 to 15 bushels, and Irish potatoes, 80 to 100 bushels. Sorghum cane, sweet potatoes, cabbage, and garden vegetables give fairly good returns. The cultural methods followed upon this type in some instances are rather inadequate for a clay soil. Deeper plowing and a more thorough preparation of the seed bed should be practiced. Clover and other leguminous crops would, if turned under, greatly improve this soil. At present no definite rotation is practiced. Coarse manures and lime give excellent results. The soil

by reason of its texture is capable of great improvement. The more hilly areas should be terraced and seeded to pasture grasses or planted to apples. In the French Broad Valley areas a small quantity of commercial fertilizer is used, in addition to an occasional application of about 40 bushels of lime per acre. For corn about 200 pounds of a mixture of cotton-seed meal, acid phosphate, and kainit is used. For Irish potatoes a 7:5:8 mixture is employed successfully by some.

The land of this type sells at from $10 to $60 an acre, depending upon location and state of improvement.

The following table shows the results of mechanical analyses of the fine earth of the Porters clay:

Mechanical analyses of Porters clay.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
15922	Soil	0.6	3.0	2.5	11.9	6.2	47.8	28.2
15923	Subsoil	.7	2.7	1.8	9.4	3.5	49.8	31.3

PORTERS BLACK LOAM.

The soil of Porters black loam is a rich, loose, mellow loam from 8 to 12 inches deep. The color varies from a dark brown in the thinly forested areas to deep black in the heavily shaded coves. Where there is a thick growth of rhododendron and ferns, so much vegetable matter has accumulated that it gives the soil a mucky appearance. In these areas the soil often extends to a depth of 3 feet. The subsoil is a yellowish-brown to dark-brown heavy loam, in some instances underlain by red clay. Both soil and subsoil are fine textured and contain practically no rock fragments.

The Porters black loam occurs in small areas, at high altitudes, in the northern and northwestern parts of the county. It occupies steep mountain slopes, usually in the sheltered coves. It is most typically developed at high altitudes, from 4,000 to 6,000 feet. On some of the higher mountains in the Blue and Tennessee ridges, for instance, Cold Mountain and Chestnut Bald, this soil is found on the tops of the mountains as well as in the coves. These areas are usually very moist and the soil is dark and mucky. Owing to the steep slopes on which it occurs, this soil in general has excellent surface drainage.

The Porters black loam is a residual soil derived from fine-grained granitic and gneissic rocks. The rocks first weather into a loam which, on further decomposition of the mineral particles and the accumulation of large amounts of vegetable matter under moist condition, passes into the black loam. None of this type was found in

the belt of Cambrian rocks which crosses the county, but this is probably due to the fact that the slopes are more gentle throughout this belt and the forest cover is not so thick, for the type of rock does not appear to have any direct influence on the formation of this soil.

The natural vegetation consists mainly of hardwoods, the oaks, chestnut, and poplar predominating. A few hemlocks are found, and on some of the higher peaks in the Tennessee Ridge there is a heavy growth of balsam. There is usually a dense undergrowth of rhododendron and laurel, and beneath these shrubs there is a thick growth of ferns and other shade-loving plants.

None of this soil is cultivated in this county, the larger areas of it being in very inaccessible places or on large forest preserves where no agricultural operations are carried on. It is naturally a very productive soil, and when cleared there is a good growth of natural grass which makes excellent pasturage. There are no orchards located on this type, but it is probable that the areas occupying the lower elevations would be well adapted to the production of apples, such as the Albemarle Pippin and other varieties suited to mountain culture.

So far the value of this soil has been entirely determined by the amount of timber on it, no attention being paid to the agricultural value.

The following table gives the results of mechanical analyses of soil and subsoil of the Porters black loam:

Mechanical analyses of Porters black loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
15918	Soil	1.3	7.1	7.7	23.3	4.2	40.4	15.5
15919	Subsoil	.9	5.1	5.7	23.5	8.4	43.1	13.3

TOXAWAY LOAM.

The surface soil of the Toxaway loam to a depth of 8 to 15 inches consists of a black, dark-brown, or dark-gray silty loam or loam. The typical areas contain a large amount of organic matter. Spots of dark-gray or brown silty to very fine sandy loam are not of infrequent occurrence, but are too small in extent to be represented upon the soil map. The subsoil is a brown or yellowish brown silty loam or loam. In several places the silty material grades into a yellowish or white silty clay at 20 or 24 inches. Such white clay is locally called "pipe clay," and areas underlain by this material are said to be less productive than the true type. Occasionally at 30 inches a highly micaceous fine sandy loam or fine sand is encountered.

The Toxaway loam is a mellow, smooth, and easily tilled soil, and these facts coupled with the level surface permit of the use of modern labor-saving machinery to the best advantage of any type in the county.

Practically all of the Toxaway loam lies along the French Broad River between Blantyre and Rosman, the widest and largest areas being in the vicinity of Penrose, Pisgah Forest, and between Cherryfield and Calvert. There is a small area along Little River, and small strips extend for a short distance up some of the larger streams entering the French Broad. Part of the State experimental farm at Blantyre is located upon the Toxaway loam.

The type occupies the smooth areas of bottom land in the French Broad Valley. Some of the type has a very gradual slope from the foothills to the river, while a part of it appears to be perfectly flat. A considerable part, especially that bordering the river, is subject to overflow at times of high water, and likelihood of damage renders the soil unsuited to certain crops. The natural surface drainage of the flatter areas is poor. Open ditches are necessary and in use throughout the areas of this soil. The areas having the "pipe clay" subsoil do not drain out readily. On the higher elevations tiling would likely prove beneficial. In ordinary seasons the moisture conditions of the type are exceedingly favorable and large yields of the crops grown can be secured even in a dry year.

The Toxaway loam is of alluvial origin, being formed from the sediments deposited by streams at times of comparatively slow-moving water. This material consists chiefly of silt, very fine sand, and clay washed from the areas of Porters loam and Porters clay and laid down by the streams. Formerly this soil was in a semi-swampy condition with a thick growth of trees and a dense undergrowth of water-loving plants and grasses. The leaves, plants, and grasses, on decaying, become intermixed with the mineral particles, producing a black mellow soil.

The characteristic growth upon the Toxaway loam was elm and maple. Practically all of the type is under cultivation or included in pasture, and it is rightly considered the most productive soil in Transylvania County. It is especially adapted to corn, grass, (timothy and redtop), and rye. On some parts of it celery, cabbage, cucumbers, and pumpkins would likely do well. The yield of corn ranges from 20 to 50 bushels per acre, the average being about 30 bushels; hay, from 1 ton to 2 tons, and rye, from 12 to 20 bushels. Oats and wheat do not do well.

The cultural methods practiced upon this type are the best in the county, modern machinery being quite extensively used by the best farmers. At present corn is grown more than all other crops and more systematic rotation should be practiced. Liming this soil

proves highly profitable. The commercial fertilizer commonly used consists of a mixture of cotton-seed meal, acid phosphate, and kainit, from 150 to 250 pounds or more being applied. A great many dress the soil with from 20 to 60 bushels of lime per acre, the larger quantities being used on areas farther removed from the kilns, as this soil in the immediate neighborhood of the kilns has been limed from time to time and is not quite so deficient in this constituent.

The Toxaway loam is the most highly prized farming land in the county and sells at from $40 to $100 an acre.

Below are given the average results of mechanical analyses of typical samples of this type of soil:

Mechanical analyses of Toxaway loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
15924, 15926	Soil	0.7	7.0	3.6	4.5	3.8	52.9	26.9
15925, 15927	Subsoil	.3	1.3	.8	4.6	6.3	51.5	34.4

TOXAWAY FINE SANDY LOAM.

The soil of this type, to a depth of 8 to 10 inches, consists of light-brown to dark-brown, mellow, fine sandy loam. In the poorly drained areas the soil is a light loam, and in the depressions spots of brown loam containing very little sand are found. The subsoil to a depth of 36 inches or more is a light-brown or yellowish-brown, loose, fine sandy loam. In some places a loamy fine sand is encountered, and in the poorly drained areas, where silt and vegetable matter have accumulated, the subsoil is a yellowish-brown to brown loam or silt loam. In some of the areas bordering the larger streams a considerable quantity of stream gravel is encountered at a depth of about 2 feet. Both the soil and subsoil are very micaceous, and in some instances the proportion of mica present is sufficient to give the soil a smooth or greasy feel.

The Toxaway fine sandy loam occurs as small, narrow strips in the bends of the French Broad, Davidson, Little, East Fork, and North Fork rivers, and as small strips along the other large streams in the county. It occupies practically level areas along the creeks and in the oxbows of the rivers. On the whole, the drainage of the type is rather poor, the areas along the large streams and rivers being subject to frequent overflow. Owing to the loose, open texture of the soil, the more elevated areas above the flood line are well drained. Open ditches are necessary and are in use throughout the larger areas of the type.

This is an alluvial soil, formed by the deposition of the coarser materials from the streams, modified in many places by the colluvial wash from the mountain slopes. The coarseness of the materials shows it to have been deposited by comparatively rapidly moving water, the opposite of the condition of slow sedimentation under which the Toxaway loam was formed. It is highly variable in texture, in some cases being composed entirely of very fine sand. A large amount of micaceous material is usually present. The loamy character of the soil is due to the vegetable matter accumulated before the valleys were cleared. Some areas in the larger valleys were once in a semiswampy condition.

Before the valley lands in the county were cleared this type was covered by a heavy growth of elms and maples with an undergrowth of small shrubs. At present practically all of the type is under cultivation. The better drained areas are well adapted to corn and grass (timothy and redtop), and on the sandy phase melons and vegetables do well. With proper cultivation corn yields from 10 to 30 bushels per acre and grass on the best areas from one-half to 1 ton per acre.

Farm machinery is used to some extent along the valley of the French Broad River, but on the areas farther removed from the railroad the methods of cultivation are rather primitive. Practically no rotation of crops is practiced and very little commercial fertilizer is used on this type. Considerable lime is used, particularly in the eastern part of the county in the vicinity of the lime kilns. From 20 to 30 bushels per acre is considered a good application of lime for this soil.

The results of mechanical analyses of the soil and subsoil of this type of soil are given in the following table:

Mechanical analyses of Toxaway fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
15916	Soil	0.6	3.9	5.2	40.0	16.1	24.1	8.9
15917	Subsoil	.3	4.6	9.0	40.1	12.3	24.6	9.9

ROCK OUTCROP.

The small areas of Rock outcrop indicated in the soil map consist of ledges outcropping on the sides and tops of some of the most precipitous mountains. The conspicuous areas are bald-faced rocks with perpendicular or almost perpendicular walls from 300 to 700 feet high. The Rock outcrop areas have no agricultural value.

SUMMARY.

The Transylvania County area lies in the southwest part of the State of North Carolina in the Appalachian mountain region. It is a typical mountain county, whose surface consists of a series of high mountains and ridges, broken by deep, narrow, canyonlike valleys. Throughout the east-central part of the county there occurs a beautiful valley along the French Broad River. In the southwestern part, in the mountains, at an elevation of 3,000 feet, a beautiful artificial lake—Lake Toxaway—has been formed. This is one of the conspicuous features of the county.

The climate is healthful and invigorating. The summers are cool, the falls are delightful, and the winters are not severly cold. Parts of the spring and summer are considered the wettest periods. The natural drainage is good in nearly all parts of the county, and is effected through the French Broad River and its numerous tributaries. An intricate network of small streams coming from thousands of mountain springs waters the county in all parts. A large amount of water power could be developed along most of the streams. All the gristmills are run by water power.

In the vicinity of Brevard and throughout the French Broad Valley the county is fairly thickly settled. The mountainous area, including the Vanderbilt estate and the lands of the Toxaway Company, is sparsely populated. Most of the land which is being cultivated lies along the French Broad, Little, and Davidson rivers. Only a small percentage of the area is under cultivation in other sections of the county.

Of the cultivated crops corn is the most important. Some grasses, oats, and rye are grown. Vegetables, fruits, and poultry products find a ready sale at Brevard and Lake Toxaway. Throughout the county a large revenue is derived from the sale of wood, tan bark, and lumber, and a smaller revenue from medicinal herbs.

Generally no regular rotation of crops is practiced. The wages paid for farm help have increased materially within the last few years. The scarcity of cheap farm labor is somewhat of a drawback to the farming operations.

In Transylvania County six different soil types were recognized, and the extent of each is shown on the accompanying map. Four of these, namely, Porters loam, Porters sandy loam, Porters clay, and Porters black loam are of residual origin and constitute the characteristic soils of western North Carolina. The Toxaway loam and Toxaway fine sandy loam are alluvial soils derived from materials brought down and deposited by the streams. Scattered over the county are small areas of Rock outcrop which are unsuited for agri-

cultural purposes. The upland farms or timber lands range in price from $5 to $35 an acre, while the best agricultural bottom land is held at from $40 to $100 an acre. Much of the rough mountain land should be kept permanently in forest.

The Toxaway loam is a black or dark-colored loam or silty loam occurring in the French Broad Valley. It is the most productive soil in the county and is used extensively for corn. It is adapted to corn, grasses, including timothy and redtop, and rye.

The Toxaway fine sandy loam is adapted to corn and grass, and the more sandy areas to vegetables. It is used chiefly for corn and general crops.

The Porters loam is the most extensive type, covering practically two-thirds of the county. The soil is a mellow, loose loam of yellowish-brown to dark-brown color, underlain by a loam or clay. It is the chief mountain type, and its topography is very rough. It is suited to general farming on the more gentle slopes and intervening rolling valleys, and to orcharding on some of the mountain sides. It makes excellent pasture lands.

The Porters sandy loam is a yellowish-gray sandy loam which is confined mainly to the southern part of the county. It is adapted to light farming and the growing of vegetables. The roughest areas should be kept in forest.

The Porters clay is a reddish to grayish clay loam or loam, underlain by a stiff red clay subsoil. It has only a comparatively small development in the county. It is suited to wheat, corn, clover, potatoes, apples, and pasturage.

The Porters black loam is a black to dark-brown soil occurring in the coves and on the high, well-shaded mountain sides. At present it supports a forest of oak, poplar, chestnut, and balsam, with usually a thick undergrowth of decorative and medicinal herbs.

The opportunities for apple orcharding and cattle raising on a large scale are excellent.

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