Series 1948, No. 5 Issued March 1958

SOIL SURVEY

Washington County Tennessee

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
TENNESSEE AGRICULTURAL EXPERIMENT STATION
TENNESSEE VALLEY AUTHORITY

How to Use THE SOIL SURVEY REPORT

THIS SURVEY of Washington County will help you plan the kind of farming that will protect your soils and provide good yields. It describes the soils; shows their location on a map; and tells what they will do under different kinds of management.

Find your farm on the map

In using this survey, you start with the soil map, which consists of the 40 sheets bound in the back of this report. These sheets, if laid together, make a large photographic map of the county as it looks from an airplane. You can see woods, fields, roads, rivers, and many other landmarks on this map.

To find your farm on the large map, you use the index to map sheets. This is simply a small map of the county on which numbered rectangles have been drawn to show where each sheet of the large map is located.

When you have found the map sheet for your farm, you will notice that boundaries of the soils have been outlined in red, and that there is a symbol for each kind of soil. All areas marked with the same symbol are the same kind of soil, wherever they appear on the map.

Suppose you have found on your farm an area marked with the symbol Ca. You learn the name of the soil this symbol represents by looking at the map legend. The symbol Ca identifies Chewacla loam.

Learn about the soils on your farm

Chewacla loam and all the other soils mapped are described in the section, Soil Types and Phases, and Miscellaneous Land Types. Soil scientists studied the soils as they walked over fields and through the woodlands. They dug holes and examined surface soils and subsoils; measured slopes with a hand level; noted differences in growth of crops, weeds, brush, or trees; and, in fact, recorded all the things about the soils that they believed might affect their suitability for farming.

After they mapped and studied the soils, the scientists judged what use and management each soil should have, and then they placed it in a management group. A management group is a group of similar soils that need and respond to about the same kind of management.

Chewacla loam is in management group 1. Turn to the section, Use and Management of Soils, and read what is said about soils of group 1. You will want to study the table which tells you how much you can expect to harvest from Chewacla loam under two levels of management. In columns A are yields to be expected under ordinary management, and in columns B are yields to be expected under improved management.

Make a farm plan

For the soils on your farm, compare your yields and farm practices with those given in this report. Look at your fields for signs of runoff and erosion. Then decide whether or not you need to change your methods. The choice, of course, must be yours. This survey will aid you in planning new methods, but it is not a plan of management for your farm or any other farm in the county.

If you find that you need help in farm planning, consult the local representative of the Soil Conservation Service or the county agricultural agent. Members of your State experiment staff and others familiar with farming in your county will also be glad to help you.

This publication on the soil survey of Washington County, Tennessee, is a cooperative contribution from the—

SOIL CONSERVATION SERVICE

TENNESSEE AGRICULTURAL EXPERIMENT STATION

TENNESSEE VALLEY AUTHORITY

Series 1948, No. 5 Issued March 1958

SOIL SURVEY OF WASHINGTON COUNTY, TENNESSEE

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Area inspected by L. E. ODOM, Soil Survey

United States Department of Agriculture in Cooperation With the Tennessee Agricultural Experiment Station and the Tennessee Valley Authority

Contents

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[3] Soil Survey was transferred to the Soil Conservation Service on November 15, 1952.

WASHINGTON COUNTY is in an agricultural-industrial area in northeastern Tennessee. About 29 percent of the county area is in forest, and a substantial acreage on the southern and eastern borders is part of the Cherokee National Forest. Most farms are small, and many are operated part-time by owners who earn some of their income in local industries. Nearly 90 percent of the total area of the county is suitable for either crops or pasture; the rest is suitable only for forest. Corn, small grains, hay, vegetables, and tobacco are the principal crops. Livestock is raised principally for home use.

To provide a basis for the best uses of the land, this cooperative soil survey of the county was made by the Department of Agriculture, the Tennessee Agricultural Experiment Station, and the Tennessee Valley Authority. Fieldwork for the survey was completed in 1948. Unless otherwise specifically noted, all statements except those regarding tobacco fertilization, which were revised in 1956, refer to conditions in 1948.

General Character of the Area

Washington County is in the northeastern part of east Tennessee (fig. 1). Jonesboro, the county seat, is 85 miles northeast of Knoxville; 32 miles southeast of

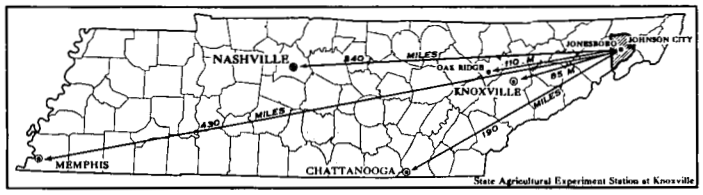

Figure 1.—**Location of Washington County in Tennessee.**

Bristol, Virginia; and about 69 miles north of Asheville, North Carolina. The total land area of the county is 327.8 square miles.

Migration to the area now in Washington County became general about 1770. The county was organized in 1777 under the government of North Carolina (*5*).[4] In 1796 it became one of the counties in the new State of Tennessee. The early settlers were mainly from North Carolina, but some were from Virginia and South Carolina. They were largely of English descent, but some were of Scotch or Irish descent.

The present population consists largely of descendents of the early settlers. The 1950 county population was 59,971, of which 53.5 percent was rural. Jonesboro, the county seat and oldest town in the State, had a population of 1,126. Johnson City, the principal business town, had a population of 27,864.

Physiography, Relief, and Drainage

Physiographically, most of Washington County is in the Great Valley part of the Ridge and Valley Province. Some of the county is in the mountains of the Blue Ridge Province. All of the county is within the Appalachian Highland (*3*).

[4] Numbers in parentheses refer to Literature Cited, p. 78.

Buffalo Mountain, a part of the Blue Ridge Province, is a massive ridge, with a few lateral spurs, in the southeastern part of the county. This steep-sided, narrow-crested ridge is underlain by quartzite, shale, slate, and conglomerate.

The Great Valley part of the county is a lowland belt characterized by numerous parallel low ridges and valleys that lie in a general northeast-southwest direction. Limestone predominates among the underlying rocks, but shale also is present. The character of both the limestone and shale varies considerably from place to place. Most of the limestone is dolomitic and somewhat clayey. The limestone also may contain sand or chert, or both. Some of the shales are high in lime (calcium carbonate); the others contain no lime and are generally acid. In most places the thin widely spaced layers of limestone are interbedded by acid shales. In a small area the rocks consist of interbedded calcareous sandstone and shale. In a very small area in the extreme northwestern part of the county, acid sandstones are at the surface.

That part of the county in the Great Valley is prevailingly rolling to hilly, though it ranges from nearly level to steep. The differences in elevation between the stream bottoms and adjacent ridge crests range from 50 to 300 feet, but in some places the difference is greater. Sinkholes are prevalent, and a karst relief is characteristic of some of the area underlain by limestone.

The county is drained by the Watauga and Nolichucky Rivers and their many tributaries. Small streams, many of them intermittent, are abundant nearly everywhere. Areas underlain by limestone generally do not have well-defined surface drainage because the drainage is underground. Areas underlain by shale, however, usually have fairly well defined drainageways on the surface.

The maximum difference in elevation between the highest and the lowest places in the county is about 1,900 feet.[5] Buffalo Mountain, having an elevation of 3,224 feet, is the highest point in the county. Chimney Top, in the northwestern part of the county, is 3,097 feet high. Jonesboro and Johnson City are about 1,700 feet above sea level. The lowest part of the county is in the northwestern part, near the headwaters of Lick Creek; the elevation is between 1,200 and 1,300 feet.

Climate

Washington County has a humid temperate climate. Summers are hot and winters are moderate. Cold spells are short and infrequent. The average annual precipitation is about 44 inches, about 12 inches of which is snow. Precipitation is fairly evenly distributed throughout the year.

Normal monthly, seasonal, and annual temperature and precipitation, recorded at United States Weather Bureau stations at Johnson City, are given in table 1.

The frost-free season averages 190 days. The average date of the last frost in spring is April 16, and of the first in fall, October 23. Spring frosts have been recorded as late as May 2, and fall frosts as early as September 26. Frost strikes in the valleys and depressions more often than on the ridgetops. Fruit trees are less likely to be

[5] Elevations are from United States Geological Survey topographic maps.

damaged by frost if planted on ridgetops or on north slopes. Buffalo Mountain, which is not an important agricultural area, apparently has more precipitation, both rain and snow, than any other place in the county. It is also cooler, cloudier, and foggier, and has a shorter frost-free period.

Rainfall is fairly evenly distributed throughout the year but is slightly higher in summer and slightly lower in fall than in the other seasons. In fall, there may be dry spells, but severe droughts are infrequent. Most of the rainfall comes in the form of light to medium-heavy showers, but heavy rainfall is not uncommon. Rainfall is ample, even for crops having very high moisture requirements. Destructive hailstorms and tornadoes occasionally occur.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Johnson City, Washington County, Tenn.*

[Elevation, 1,717 feet]

Month	Temperature [1]			Precipitation [2]			
	Average	Absolute maximum	Absolute minimum	Average	Total for the driest year	Total for the wettest year	Average snowfall
	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*	*Inches*
December	38. 7	75	−25	3. 46	2. 14	7. 00	3. 2
January	37. 6	76	−7	3. 31	1. 90	5. 15	3. 9
February	39. 5	80	−3	3. 40	1. 59	4. 38	3. 0
Winter	38. 6	80	−25	10. 17	5. 63	16. 53	10. 1
March	48. 0	87	1	4. 78	3. 57	6. 67	2. 4
April	55. 9	94	16	3. 48	. 83	5. 58	. 3
May	64. 9	98	31	4. 10	3. 67	3. 36	0
Spring	56. 3	98	1	12. 36	8. 07	15. 61	2. 7
June	71. 9	104	41	4. 65	3. 00	3. 76	0
July	75. 1	105	48	4. 76	3. 11	8. 86	0
August	73. 8	101	45	4. 41	4. 60	3. 62	0
Summer	73. 6	105	41	13. 82	10. 71	16. 24	0
September	69. 2	101	32	2. 75	2. 54	4. 40	0
October	57. 7	94	21	2. 66	1. 86	2. 74	. 2
November	46. 3	80	3	2. 63	2. 47	1. 74	1. 0
Fall	57. 7	101	3	8. 04	6. 87	8. 88	1. 2
Year	56. 6	105	−25	44. 39	[3]31. 28	[4]57. 26	14. 0

[1] Average temperature based on a 35-year record, through 1930; absolute maximum and minimum temperatures on a 20-year record, through 1930.

[2] Average precipitation and wettest and driest years based on a 36-year record, 1883 through 1930; snowfall, based on a 20-year record, through 1930.

[3] In 1930.

[4] In 1922.

The climate is favorable for growing practically all the common crops. The frost-free season is long enough for annual summer crops to mature. Perennial, biennial, and winter annual crops are grown successfully on the well-drained soils.

Water Supply

Shallow wells and springs provide most of the water for farm homes in areas underlain by high-grade limestone. Cisterns are the more common source of water for home use in the cherty limestone areas. Wells, cisterns, and wet-weather springs provide water in the shale areas. Perennial streams and springs furnish most of the water for livestock, but cisterns, tanks, and artificial ponds supplement these sources. During winter and spring months, intermittent streams carry enough water for livestock.

Vegetation

Forests undoubtedly covered all of the county at the time of the first white settlement; about 29 percent is now in forest.[6] The present forested area is distributed as follows: Upland hardwoods, 45 percent; oak-chestnut, 5 percent; yellow pine, 1 percent; white pine-hardwoods, 2 percent; yellow pine-hardwoods, 45 percent; and cedar-hardwoods, 2 percent.[7] A large part of the open farmland originally was covered by an upland-hardwoods forest type.

In 1945 [7] the county had a sawtimber volume of 72.5 million board feet. Of this volume, 79 percent was hardwoods and 21 percent was pine and cedar. The average volume per acre of timber was 1,186 board feet, and the average annual total growth per acre was 110 board feet. By size class, sawtimber occupied 20 percent of the acreage; cordwood, 45 percent; and smaller than cordwood, 35 percent.

Industries

About 9,700 people are employed in industries other than agriculture in Washington County (*8*). Most of them work in Johnson City, which is a retail and wholesale trade center. Manufacturing plants employ about 3,400 people, and retail and wholesale establishments about 3,600. The most important industries are hardwood flooring mills, clothing, textile, and synthetic fabric plants, and brick and concrete products manufacturing plants (*7*). East Tennessee State College is in Johnson City.

Agriculture

Washington County is in an agricultural-industrial region in the northeastern part of the State. According to the 1950 census, the total county population was 59,971. Many residents depend on industry for a living. Only 25.6 percent of the people in the county live on farms. An additional 27.9 percent live in rural fringe areas around cities and towns. but not on farms. The rest of the population is in cities, towns, and villages.

Johnson City is the county's principal market and shipping point for agricultural products. Elizabethton,

[6] Forestry data supplied by G. B. Shivery, Extension Forester, University of Tennessee, Knoxville, Tenn.

[7] 1945–46 Appraisal, State Department of Conservation and the American Forestry Association.

Kingsport, and Greeneville lie in adjoining counties, but they are also important markets and trading centers for the farmers living in Washington County.

The Clinchfield Railroad Company and the Southern Railway pass through the county. Two paved federa highways and two hard-surfaced State highways pass through many important rural communities. Approximately one-third of all farms are situated along hard-surfaced roads. An additional 54.8 percent of the farms are located on gravelled roads. Good roads extend to nearly all parts of the county.

All rural communities have schools and churches, and nearly all have mail delivery. Eight-five percent of all farms are owner operated.

Land use

The approximate area of Washington County is 209,790 acres. According to the 1950 census, 170,624 acres, or 81.5 percent, was classified as land in farms. The rest of the land was mostly inside the Cherokee National Forest. In 1949, land in farms was distributed as follows:

	Acres	*Percent*
All cropland	111, 883	65. 6
Harvested	63, 708	37. 4
Used only for pasture	42, 316	24. 8
Not harvested and not pastured	5, 859	3. 4
All woodland	28, 501	16. 7
Pastured	11, 170	6. 5
Not pastured	17, 331	10. 2
All other land pastured	21, 062	12. 3
Wasteland and all other land in farms not cropped, pastured, or in woodland	9, 178	5. 4

Size of farms, farm tenure, and farm labor

Farms vary greatly in size, but small farms predominate. The fact that industries enable farmers to earn extra money is partly responsible for the large number of small units. According to the 1950 census, the average-size farm in Washington County has 46.3 acres. All farms in the county are distributed by size class as follows: Under 10 acres, 21.1 percent; 10 to 29 acres, 29.0 percent; 30 to 99 acres, 39.1 percent; and more than 99 acres, 10.8 percent. Only 9 farms had more than 500 acres, according to the census.

Many farms are operated on a part-time or subsistence basis. The proportion of all operators performing off-farm work is 45.9 percent. Operators of 38.4 percent of the farms had outside incomes in 1949 that exceeded the value of products sold from their farms that year. Owners and part-owners operated 85.1 percent of the farms; the rest were operated by tenants and managers.

Equipment and home conveniences

In 1950, 14.6 percent of the farms had telephones, and 73.6 percent used electricity. Milking machines were used on 176 farms, grain combines on 97, and pick-up hay balers on 87. Many types of household electric appliances were in use.

Farm power in the past was supplied almost entirely by horses and mules. Tractors gradually are replacing draft animals on the larger farms. In 1950 the number of tractors had increased from the 307 reported in 1945 to 836. The number of farms reporting tractors in 1950 was 752, compared to 280 in 1945.

Types of farms

The 1950 census reported 3,683 farms in Washington County. Of this total, 1,660, or 45 percent, were not classified. The remainder were classified as follows:

Type of farm:	*Number*	*Percent of total farms*
Dairy	541	14. 7
General (field crop and livestock)	496	13. 5
Other field crops	672	18. 2
Livestock	239	6. 5
Poultry	50	1. 4
Cash grain	25	0. 7

Crops and agricultural practices

Most farmers in Washington County grow crops for feed and for home use. Corn, wheat and other small grains, hay, vegetables, and tobacco occupied 42 percent of the farmland in 1949.

Commercial farms usually provide several sources of income for the operator. Some of the corn and hay and all the tobacco grown on such farms are sold; the other crops harvested are used on the farm or are fed to domestic or market livestock. Sales of forest products also are a source of income on a few farms. Table 2 shows the acreage of some of the important crops and numbers of bearing fruit trees on farms of the county in stated years.

Fruits, berries, Irish potatoes, sweetpotatoes, and a wide variety of vegetables are grown for home use on most farms. Only a few farmers grow them for sale.

Land in Washington County is farmed in several ways, because of the various suitabilities of soils to crops, the distribution pattern of soils on farms, the lay of the land, and the size of farms. Machinery generally is used by the larger operators that have level or smoother fields. In this county less than 100 farms, or 2.5 percent of the total number, have 180 acres or more of land. On small farms and on those in the hilly sections of the county, the soil is tilled by one-horse implements or by hand.

Small grains generally are harvested by using binders. Combines are being used on farms where large acreages of grain are grown. Most of the corn is picked by hand.

A wide variety of crops is grown, but many farmers do not use a planned rotation of crops. The crops grown usually depend on the needs of the operator and the fertility level of the soils. Some farmers use a rotation consisting of corn or tobacco, a small grain, and red clover.

Lime and commercial fertilizers have been used in increasing amounts in recent years. Most commonly used at the time of survey were 3–9–6, 5–10–5, or 4–12–4 mixed fertilizers and 16-percent or 20-percent superphosphate. Nearly all field crops are fertilized to some extent. Tobacco and truck crops get most of the commercial fertilizers and barnyard manure. The use of phosphorus on hay crops and pasture is becoming common.

TABLE 2.—*Acreage of principal crops and number of bearing fruit trees and grapevines in Washington County, Tenn., in stated years*

Crop	1929	1939	1949
	Acres	*Acres*	*Acres*
Corn, harvested for grain	20, 614	20, 214	14, 488
Small grains threshed:			
Mixed	88	1, 008	6, 013
Oats	530	1, 300	3, 212
Barley	1, 075	1, 693	837
Wheat	14, 042	12, 938	7, 242
Rye	415	518	216
All hay	22, 971	29, 318	36, 523
Annual legumes	1, 781	756	224
Lespedeza	(1)	14, 961	23, 189
Alfalfa	781	835	3, 166
Clover and timothy, alone or mixed	13, 760	7, 308	5, 014
Small grains for hay	106	376	607
Other hay cut	6, 543	5, 082	4, 323
Potatoes	540	358	[2] 160
Sweetpotatoes and yams	155	167	[2] 21
Tobacco, harvested	2, 501	2, 769	2, 964
Vegetables, except potatoes, for sale	385	238	239
Strawberries, for sale	45	34	19
	Number [3]	*Number* [3]	*Number* [3]
Peach trees	19, 107	13, 761	3, 571
Apple trees	58, 211	41, 488	28, 000
Pear trees	4, 682	3, 873	3, 319
Cherry trees	8, 695	6, 809	5, 296
Plum and prune trees	3, 993	2, 541	1, 914
Grapevines	5, 930	6, 277	5, 949

[1] Not reported.
[2] Does not include acres for farms harvesting less than 15 bushels.
[3] Number in the census year, which is 1 year later than the crop year shown at the head of the column.

Pasture

Land pastured totaled 43.7 percent of the land in farms in 1950. Rotation pastures may occur on any of the soils suitable for crops; they are included in the 42,316 acres of cropland used only for pasture. Permanent pastures are restricted to soils too steep or too stony to be easily cultivated. Very shallow soils and those on poorly drained bottom lands are also used for permanent pastures.

The quality of pasture depends on the character and management of the soil. In the past, pastures have not been as well-managed as cropland. Many soils are now producing better forage because farmers are applying lime and phosphorus to pastures and are controlling grazing and checking the growth of weeds.

Livestock

The trend is toward livestock-specialty farms. Table 3 shows the livestock population in Washington County in the period 1930–50. A large part of the livestock is raised for home use, so the number of animals per farm is small. Practically all the sheep, most of the beef cattle, and some of the hogs and poultry are sold to provide farm income. Poultry flocks average about 50 chickens per farm. Small numbers of turkeys and ducks are also raised. A few farmers have large numbers of beef cattle and chickens, but most operators have a few milk cows, hogs, turkeys, ducks, and chickens.

TABLE 3.—*Numbers of livestock, poultry, and beehives on farms in Washington County, Tenn., in stated years*

Livestock	1930	1940	1950
Horses and mules	[1] 4, 756	[1] 5, 155	4, 125
Cattle and calves	16, 464	[1] 17, 288	30, 299
Milk cows	6, 752	9, 070	12, 950
All cows and heifers over 2 years old.	7, 169	9, 653	16, 422
Swine	7, 514	[2] 6, 396	8, 765
Sheep and lambs	3, 432	[3] 1, 284	498
Chickens	[1] 162, 814	[2] 148, 204	[2] 182, 269
Beehives	1, 810	1, 169	[4] 1, 413

[1] Over 3 months old.
[2] Over 4 months old.
[3] Over 6 months old.
[4] In 1949.

The Soils of Washington County

General Nature

The soils of Washington County vary widely in color, texture, fertility, acidity, and other characteristics that affect their suitability for agriculture.

Colors range from white through gray, yellow, brown, and red. Browns and grays predominate in the surface soils, and reds and yellows in the subsoils. In texture and consistence, the soils vary from loose incoherent sand to plastic clay. The surface soils, for the most part, are friable silt loams or silty clay loams, and the subsoils, friable to strongly plastic silty clays or silty clay loams.

Relief ranges from nearly level to very steep, but it is predominantly rolling to hilly. Some places are uneroded or only slightly eroded, some moderately eroded, and others severely eroded. Loose fragments of stone that interfere with cultivation are common in many of the soils. Most of the soils are well drained, some areas are moderately well drained, and only a few small spots are poorly drained.

About 66 percent of the total area of Washington County is suitable for crops, and 22 percent is suitable for permanent pasture. The rest should be used only for forest.

Soil Series and Their Relations

To make full use of this soil survey, it is necessary to know the soils and to understand how they are related. These relationships are more easily understood if the soils are placed in groups according to their position in the landscape. The soils of this county have been placed in four physiographic groups: (1) Soils of the uplands, (2) soils of the terrace lands, (3) soils of the colluvial lands, and (4) soils of the bottom lands.

Soils of the uplands and high terraces have been severely leached; consequently, they are acid, contain

little organic matter, and are low in fertility. They differ from each other in fertility and organic-matter content, even under virgin conditions, and these natural differences have been intensified by cultivation and erosion. Soils of the low terraces and bottom lands are of moderately high fertility and are fairly well supplied with lime and organic matter.

Table 4 groups the soil series of the county according to position and geological material and shows the parent material and drainage classification for each. In table 5, the soils are classified by higher categories for the convenience of those interested in morphology and genesis of soils.

Soils of the uplands

The upland soils have developed from materials weathered from the underlying rocks. In Washington County, these rocks are mainly limestone, shale, and quartzite. Mixed with these are smaller quantities of sandstone, slate, and conglomerate.

DEWEY, DUNMORE, and GROSECLOSE soils were derived from residuum that weathered from several types of dolomitic limestone. Dewey soil materials came from high-grade limestone, Dunmore from slightly clayey limestone, and Groseclose from clayey or cherty limestone. Dewey surface soils are brown; the subsoils are red or yellowish red, and plastic. Dunmore surface soils are light yellowish brown, and the subsoils are yellowish red to reddish yellow, and plastic. Groseclose surface soils are light yellowish brown, and the subsoils are reddish yellow to brownish yellow and very plastic.

BOLTON soils were also derived from slightly cherty or sandy dolomitic limestone. They differ from Dewey, Dunmore, and Groseclose soils in being deeper, darker, and more friable. The Bolton surface soils are brown or reddish brown. The subsoils are yellowish red or reddish brown and moderately friable. Bolton soils generally occur on high ridges, and Dewey soils are in the lower lying valleys.

DANDRIDGE and LITZ soils are shallow and have numerous shale particles throughout the profiles. Dandridge soils, derived from calcareous shale, are near neutral in reaction. Litz soils, formed from acid shale that contained widely spaced beds of limestone or calcareous shale, are strongly acid. In most places, the Dandridge soils are finer textured and darker colored than the Litz.

RAMSEY soils occur on steep mountain slopes and ridge crests. They were derived from residuum weathered from quartzite sandstone, shale, and slate. They are light yellowish-brown or brownish-yellow, very friable stony loams that vary considerably in depth and distinctness of soil horizons, but in general they are shallow and weakly developed.

Soils of the terrace lands

Long ago, the rivers and streams of the county flowed at considerably higher elevations than at present. Gravel, sand, and clay were deposited on these high flood plains. As the stream channels deepened, new flood plains formed at lower levels. Remnants of the old, high flood plains, above the overflow level of the present streams, are called terrace lands, second bottoms, or benches.

Soils of the terrace lands are members of the Cumberland, Waynesboro, Nolichucky, Holston, Monongahela, Tyler, Sequatchie, Masada, and Augusta series. These soils have developed from different parent materials and differ in color, texture, consistence, and drainage.

CUMBERLAND soils were derived from old alluvium composed largely of limestone materials. They are well drained and have a brown surface soil and red subsoil. The surface soil is browner than that of the Waynesboro soils, and the subsoil is a darker red and less friable.

WAYNESBORO, NOLICHUCKY, and SEQUATCHIE soils have developed from alluvium derived chiefly from quartzite, sandstone, and shale. The Waynesboro soils are well drained and have a brown surface soil and red subsoil. The Nolichucky soils are well drained; they have a thicker, considerably lighter colored surface layer than the Waynesboro soils, and their subsoil is a lighter red. The Sequatchie is a well-drained brown soil.

HOLSTON, MONONGAHELA, and TYLER soils have developed chiefly from quartzite, sandstone, and shale material. The Holston are well-drained yellow soils; the Monongahela, imperfectly drained yellow soils; and the Tyler, a gray to pale-yellow, splotched, poorly drained soil.

MASADA and AUGUSTA soils have formed from materials weathered from granite and gneiss. The Masada are well-drained brown soils somewhat like the Cumberland and Waynesboro in color and texture but derived from different parent material. Augusta soil, though derived from parent material similar to that of the Masada, is an imperfectly drained soil with a pale-yellow subsoil.

Soils of the colluvial lands

Soils of the colluvial lands are at the bases of slopes, particularly the longer slopes on which erosion has been active. The parent materials were derived from soil materials and rock fragments washed and rolled from adjacent slopes. The soils occur in the following places: (1) Along small drainageways; (2) at the base of upland slopes; and (3) on small, sloping, colluvial-alluvial fans where small streams have deposited sediment over the flood plains of larger streams.

HERMITAGE and EMORY soils have formed from materials washed mainly from the darker colored soils of the uplands and terraces, for example, the Dewey, Bolton, Cumberland, and Waynesboro, and the better Dunmore soils. The Hermitage and Emory soils are brown or reddish brown and well drained. They differ principally in age. The Emory soil is young and has a fairly uniform texture throughout. Hermitage soils, in contrast, have distinct surface soil and subsoil layers. The Hermitage soils also differ from the Emory in being more erodible.

GREENDALE and PACE soils were derived chiefly from materials washed from lighter colored soils that developed from limestone, as for example, the Dunmore and Groseclose. The Greendale soil has light yellowish-brown or pale-brown surface soil and brownish-yellow subsoil only slightly heavier textured than the surface soil. The Pace soils differ from the Greendale in having distinct surface soil and subsoil layers.

TABLE 4.—*Soil series of Washington County, Tenn., and their topographic position, parent material, drainage, relief, and color*

[Soil series are placed under headings that most nearly describe them; variations are explained in footnotes]

Parent material or parent rock	Excessively drained; rapid to very rapid surface drainage and slow to rapid internal drainage. Rolling to very steep. Profiles indistinct because of rapid geologic erosion, and of variable color as determined by parent material	Well drained; undulating to steep. Profiles brown, reddish brown, or yellowish brown and free of mottling to a depth of about 30 inches	Imperfectly drained; nearly level to sloping. Profiles pale yellow (grayish brown or grayish yellow for alluvial soils) and mottled below 12 inches	Poorly drained; nearly level. Profiles brownish gray to light gray and mottled below 6 to 8 inches
SOILS OF THE UPLANDS				
Sedimentary rocks:				
High-grade dolomitic limestone		Bolton [1], Dewey [2]		
Slightly clayey dolomitic limestone		Dunmore [3]		
Clayey dolomitic or cherty limestone		Groseclose [4]		
Calcareous shale	Dandridge [5]			
Acid shale within limestone lenses	Litz [5]			
Quartzite, sandstone, and slate	Ramsey			
SOILS OF THE TERRACE LANDS				
Old alluvium (stream terraces):				
Chiefly limestone		Cumberland		
Sandstone, quartzite, shale, slate, and some limestone.		Waynesboro, Nolichucky, Holston		
Sandstone, quartzite, shale, and slate; some limestone (low terrace).		Sequatchie	Monongahela [6]	Tyler.
Chiefly granite and gneiss (low terrace)			Augusta	
Chiefly granite and gneiss (medium high terrace).		Masada		
SOILS OF THE COLLUVIAL LANDS				
Local wash and some colluvial material:				
Chiefly high-grade limestone		Emory [7], Hermitage		
Cherty low-grade limestone		Greendale [7 8]		
Limestone		Pace [8]		
Sandstone, quartzite, and shale		Barbourville [7]		
Sandstone and quartzite		Jefferson [9]		
Sandstone, quartzite, and shale, with some limestone influence.		Allen [10]		
Quartzite or sandstone, with some limestone influence.		Hayter [11]		
Shale (calcareous)			Whitesburg [7]	
Shale (calcareous and acid)			Leadvale [8]	
SOILS OF THE BOTTOM LANDS				
Alluvium (stream bottoms):				
Sandstone, quartzite, shale, and slate, some limestone.		Staser	Hamblen	Prader.
Granite, gneiss, quartzite, and shale	Buncombe	Congaree	Chewacla	Wehadkee.
Chiefly limestone			Lindside, Weaver [12]	Melvin.
Chiefly limestone (depressional)			Ooltewah	

[1] Dark red and friable.
[2] Red and firm.
[3] Yellowish red.
[4] Reddish yellow. Moderately well drained to well drained.
[5] Excessively drained to well drained.
[6] Imperfectly drained to moderately well drained.
[7] Do not have distinct horizons because their parent materials have been in place only a short time.
[8] Moderately well to well drained.
[9] Yellow.
[10] Red.
[11] Brown.
[12] Subsoil contains marl.

TABLE 5.—*Soil series of Washington County, Tenn., classified by higher categories, and factors that have contributed to differences among the series* [1]

Great soil group and series [2]	Relief	Parent material	Degree of horizon differentiation [3]
ZONAL SOILS			
Red-Yellow Podzolic soils:			
Bolton	Rolling to steep	Residuum of high-grade dolomitic limestone, slightly sandy, cherty, or both.	Medium.
Dewey	Rolling to hilly	Residuum of high-grade dolomitic limestone	High.
Dunmore	Rolling to steep	Slightly clayey dolomitic limestone	High.
Cumberland	Undulating to hilly	Alluvium chiefly from limestone	Medium.
Waynesboro	Undulating to hilly	Alluvium mainly from quartzite, sandstone, slate, and shale, with some limestone influence.	Medium.
Nolichucky	Undulating to hilly	Alluvium mainly from quartzite, sandstone, slate, and shale, with some limestone influence.	High.
Allen	Rolling to hilly	Colluvium or local alluvium from quartzite, sandstone, and shale, with some limestone influence.	High.
Groseclose	Rolling to steep	Residuum of clayey, or cherty dolomitic limestone	High.
Hermitage	Undulating and rolling	Colluvium or local alluvium from high-grade dolomitic limestone.	Medium.
Masada	Undulating to hilly	Alluvium mainly from granite and gneiss	Medium.
Sequatchie	Level to rolling	Alluvium mainly from sandstone, quartzite, slate, and shale, with some limestone influence.	Low.
Holston	Undulating to gently rolling	Mixed alluvium from quartzite, sandstone, and shale	High.
Jefferson	Undulating to hilly	Colluvium or local alluvium from sandstone or quartzite	High to low.
Pace	Undulating to rolling	Colluvium or local alluvium from limestone	High to very high.
Gray-Brown Podzolic soils:			
Hayter	Undulating and rolling	Colluvium or local alluvium from quartzite or sandstone, with some limestone influence.	Medium.
INTRAZONAL SOILS			
Planosols:			
Leadvale	Undulating and rolling	Colluvium or local alluvium from shale	Very high.
Monongahela	Level to undulating	Alluvium from sandstone, shale, slate, and quartzite	Very high.
Tyler	Nearly level	Alluvium from sandstone, shale, slate, and quartzite	Very high.
Augusta	Nearly level	Alluvium mainly from granite and gneiss	High to very high.
AZONAL SOILS			
Lithosols:			
Dandridge	Rolling to very steep	Residuum of calcareous shale	Low.
Litz	Rolling to very steep	Residuum of acid shale with thin lenses of limestone or calcareous shale.	Low.
Ramsey	Hilly to very steep	Residuum of quartzite, sandstone, slate, and shale	Low.
Alluvial soils:			
Staser	Nearly level	Mixed alluvium from sandstone, quartzite, shale, and slate with some limestone.	Very low.
Hamblen	Nearly level	Alluvium from calcareous shale, slate, quartzite, and sandstone.	Very low.
Prader	Nearly level	Alluvium from shale, slate, and sandstone	Very low.
Buncombe	Nearly level	Mixed alluvium from granite, gneiss, quartzite, and shale.	Very low.
Congaree	Nearly level	Alluvium from granite, quartzite, and shale	Very low.
Chewacla	Nearly level	Alluvium from granite, quartzite, and shale	Very low.
Wehadkee	Nearly level	Alluvium from granite and gneiss	Very low.
Lindside	Nearly level	Alluvium from dolomitic limestone	Very low.
Melvin	Nearly level	Alluvium from dolomitic limestone	Very low.
Weaver	Nearly level	Alluvium from dolomitic limestone	Very low.
Ooltewah	Nearly level to depressional	Colluvium or local alluvium from dolomitic limestone	Very low.
Emory	Undulating	Colluvium or local alluvium from high grade dolomitic limestone.	Low to very low.
Greendale	Undulating	Colluvium or local alluvium from cherty or other low grade limestone.	Low to very low.
Whitesburg	Undulating	Colluvium or local alluvium from calcareous shale	Low to very low.
Barbourville	Undulating	Colluvium or local alluvium from quartzite, sandstone, and shale.	Low to very low.

[1] Climate and vegetation are so nearly uniform that they cannot account for the broad differences in the soils.

[2] For a discussion of the natural classification and description of the higher categories and series, see the Sullivan County, Tenn., or Carter County, Tenn., soil survey report (*4*) (*6*) or the 1938 Yearbook of Agriculture (*9*).

[3] The degree of horizon differentiation is a measure of age, an important factor contributing to the local differences in soils.

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LEADVALE and WHITESBURG soils were derived from materials washed from upland soils underlain by shale, for example, from the Dandridge and Litz soils. Leadvale soils have a yellowish-brown surface soil and a yellow or brownish-yellow subsoil. The Whitesburg soil is darker than the Leadvale and lacks distinct surface soil and subsoil layers. Leadvale soils were derived almost entirely from material washed from the Dandridge and Litz soils.

ALLEN, JEFFERSON, HAYTER, and BARBOURVILLE soils were formed largely from materials washed or rolled from Ramsey soils, which have developed chiefly from quartzite. The parent material of the Allen and Hayter soils was influenced to some extent by limestone materials. The Jefferson soils have a light yellowish-brown surface soil and a yellow or brownish-yellow subsoil. The Hayter surface soil is brown, and the subsoil is yellowish brown to reddish brown. The Allen surface soil is light brownish gray to grayish brown, and the subsoil is yellowish red. Barbourville soils are well drained and have a pale-brown to yellowish-brown profile. The Barbourville soils consist of recent colluvium and lack the distinct surface soil and subsoil layers of the Allen, Jefferson, and Hayter soils.

Soils of the bottom lands

Bottom lands are flood plains—nearly level areas along streams where floods are likely to occur. The soils of the bottom lands are forming in stream-deposited materials, the nature of which depends on the source of the material and the velocity of the stream. The bottomland soils are young. The material in which they are developing has not lain in place long enough to permit formation of well-defined profiles. Differences among the soils result from differences in the nature of the alluvial material and from variations in internal drainage.

STASER, HAMBLEN, and PRADER soils consist of alluvium washed from uplands underlain by quartzite, sandstone, slate, and shale, with some limestone or other calcareous material. The soils differ in internal drainage. The Staser soil is well drained and is predominantly brown throughout the profile. The Hamblen soils are imperfectly drained; they are grayish brown or yellowish brown and splotched with gray and yellow at depths below 12 to 20 inches. The Prader soil is poorly drained and is yellowish brown to gray.

BUNCOMBE, CONGAREE, CHEWACLA, and WEHADKEE soils consist of alluvium washed chiefly from uplands underlain by granite, quartzite, gneiss, and shale. The Buncombe soil is excessively drained and is light yellowish brown, pale brown, or light brownish gray throughout. The Congaree soils are well drained and are dark gray to brown. The Chewacla soil is imperfectly drained and is grayish brown, splotched with gray below a depth of about 12 inches. The Wehadkee soil is poorly drained and chiefly brownish gray to gray throughout the profile.

LINDSIDE, WEAVER, MELVIN, and OOLTEWAH soils consist of alluvium washed from uplands underlain chiefly by limestone. The imperfectly drained Lindside and Weaver soils are dark yellowish brown or brown, splotched with yellow and gray below depths of 12 to 20 inches. The Weaver soil differs from the Lindside in having lime concretions or marl in the soil material. The Ooltewah soil has profile characteristics similar to those of the Lindside but differs in occupying small depressions rather than stream bottoms. The Melvin soil is poorly drained and brown, yellowish gray, and gray throughout its profile.

Soil Types and Phases, and Miscellaneous Land Types

In the following pages the soil types and phases and miscellaneous land types are described in detail, and their relationship to agriculture is set forth to the extent that present knowledge permits. The acreage and proportionate extent of the soil mapping units are listed in table 6. The location and distribution of the soils are shown on the accompanying map.

TABLE 6.—*Approximate acreage and proportionate extent of the soils mapped in Washington County, Tenn.*

Soil	Acres	Percent
Allen loam:		
Rolling phase	185	0.1
Eroded rolling phase	1,145	.5
Hilly phase	147	.1
Eroded hilly phase	888	.4
Allen stony loam:		
Eroded rolling phase	579	.3
Hilly phase	366	.2
Eroded hilly phase	1,141	.5
Augusta loam	191	.1
Barbourville loam	566	.3
Barbourville stony loam	231	.1
Bolton loam:		
Eroded hilly phase	466	.2
Eroded rolling phase	115	.1
Eroded steep phase	315	.1
Buncombe loamy fine sand	795	.4
Chewacla loam	185	.1
Cobbly alluvium, Staser and Congaree soil materials	609	.3
Congaree fine sandy loam	1,124	.5
Congaree loam	316	.2
Cumberland silt loam, undulating phase	948	.4
Cumberland silty clay loam:		
Eroded rolling phase	1,097	.5
Eroded hilly phase	526	.2
Dandridge shaly silt loam:		
Eroded rolling phase	1,443	.7
Eroded hilly phase	1,487	.7
Steep phase	2,614	1.2
Very steep phase	688	.3
Eroded steep phase	2,253	1.1
Dandridge silt loam:		
Rolling phase	500	.2
Hilly phase	361	.2
Dewey silty clay loam:		
Eroded rolling phase	1,321	.6
Eroded hilly phase	819	.4
Dunmore cherty silty clay:		
Severely eroded hilly phase	949	.4
Severely eroded steep phase	185	.1
Dunmore cherty silty clay loam:		
Eroded rolling phase	5,737	2.7
Eroded steep phase	538	.2
Eroded hilly phase	5,941	2.8
Dunmore cherty silt loam:		
Rolling phase	1,198	.6
Hilly phase	1,326	.6
Steep phase	251	.1

TABLE 6.—*Approximate acreage and proportionate extent of the soils mapped in Washington County, Tenn.*—Con.

Soil	Acres	Percent
Dunmore loam:		
Rolling phase	582	0.3
Eroded rolling phase	3,132	1.5
Hilly phase	838	.4
Eroded hilly phase	3,200	1.5
Steep phase	266	.1
Eroded steep phase	482	.2
Dunmore silty clay:		
Severely eroded rolling phase	328	.2
Severely eroded hilly phase	3,315	1.6
Dunmore silty clay loam:		
Eroded steep phase	663	.3
Eroded rolling phase	29,633	14.2
Eroded hilly phase	21,117	10.1
Dunmore silt loam:		
Rolling phase	2,082	1.0
Hilly phase	2,375	1.1
Emory silt loam	1,006	.5
Greendale silt loam	12,370	6.0
Groseclose cherty silt loam:		
Rolling phase	214	.1
Hilly phase	401	.2
Eroded hilly phase	991	.5
Steep phase	108	.1
Eroded steep phase	217	.1
Groseclose cherty silty clay loam, eroded rolling phase	555	.3
Groseclose silty clay loam:		
Eroded rolling phase	326	.2
Eroded hilly phase	367	.2
Gullied land, Dunmore soil material	394	.2
Hamblen loam	686	.3
Hamblen silt loam	315	.2
Hayter loam:		
Undulating phase	350	.2
Eroded rolling phase	168	.1
Hayter stony loam, undulating phase	211	.1
Hermitage silt loam:		
Eroded rolling phase	744	.4
Undulating phase	693	.3
Holston cobbly loam:		
Eroded rolling phase	188	.1
Eroded hilly phase	167	.1
Holston loam:		
Eroded rolling phase	270	.1
Undulating phase	250	.1
Jefferson loam:		
Undulating phase	413	.2
Eroded rolling phase	387	.2
Jefferson stony loam:		
Undulating phase	374	.2
Rolling phase	334	.2
Eroded rolling phase	1,095	.5
Hilly phase	950	.4
Eroded hilly phase	1,313	.6
Leadvale silt loam:		
Undulating phase	636	.3
Eroded rolling phase	734	.3
Lindside silt loam	4,575	2.2
Litz loam:		
Rolling phase	90	(1)
Eroded rolling phase	75	(1)
Eroded steep phase	258	.1
Steep phase	136	.1
Very steep phase	1,251	.6
Litz shaly silt loam:		
Eroded rolling phase	649	.3
Eroded hilly phase	1,222	.6
Steep phase	2,307	1.1
Eroded steep phase	1,368	.6
Very steep phase	368	.2
Litz silt loam:		
Rolling phase	289	0.1
Hilly phase	497	.2
Masada clay loam:		
Eroded rolling phase	227	.1
Eroded hilly phase	95	.1
Masada loam, undulating phase	226	.1
Melvin silt loam	1,230	.6
Monongahela loam	108	.1
Monongahela silt loam	259	.1
Nolichucky loam:		
Rolling phase	221	.1
Eroded rolling phase	1,369	.6
Hilly phase	147	.1
Eroded hilly phase	520	.2
Nolichucky cobbly loam:		
Eroded rolling phase	146	.1
Eroded hilly phase	183	.1
Ooltewah silt loam	532	.2
Pace silt loam:		
Undulating phase	3,418	1.7
Rolling phase	494	.2
Eroded rolling phase	9,760	4.7
Prader silt loam	196	.1
Riverwash	63	(1)
Ramsey stony loam:		
Steep phase	1,439	.7
Hilly phase	1,525	.7
Very steep phase	18,320	8.8
Sequatchie cobbly fine sandy loam	499	.2
Sequatchie loam	862	.4
Staser loam	394	.2
Stony colluvium, Jefferson soil material	674	.3
Stony hilly land, Dunmore soil material	6,257	3.0
Stony rolling land, Dunmore soil material	2,719	1.3
Stony steep land, Dunmore soil material	1,481	.7
Stony very steep land, Ramsey soil material	150	.1
Tyler silt loam	148	.1
Waynesboro cobbly loam:		
Eroded rolling phase	305	.1
Eroded hilly phase	269	.1
Waynesboro loam:		
Undulating phase	212	.1
Eroded rolling phase	2,495	1.2
Eroded hilly phase	1,087	.5
Weaver silt loam	2,128	1.0
Wehadkee silt loam	127	.1
Whitesburg silt loam	687	.3
Water	947	.4
*Total	209,790	[2] 99.9

[1] Less than 0.1 percent.

[2] Does not total 100 percent because areas less than 0.1 percent are not included.

Allen loam, rolling phase (5 to 12 percent slopes) (Aa).—This well-drained soil of the colluvial lands has a light-colored surface soil and a red subsoil. The colluvial deposits are spread over the valley floor adjacent to the base of the steep mountain slopes from which they were washed. The parent materials have washed largely from uplands underlain by quartzites and sandstones but include a small admixture of materials washed from soils of limestone origin. The colluvial deposits are underlain largely by limestones at depths of 3 feet or more.

This soil occurs in small widely scattered areas on the foothills of Buffalo Mountain. It is associated with

the Jefferson, Hayter, Sequatchie, and Dunmore soils.
Profile description:

0 to 7 inches, light brownish-gray to grayish-brown very friable loam; has a thin surface layer stained dark with organic matter.
7 to 13 inches, pale-yellow to reddish-yellow friable loam to clay loam.
13 to 30 inches, yellowish-red moderately friable clay loam to sandy clay; moderate medium blocky structure.
30 inches+, yellowish-red moderately friable silty clay loam to sandy clay, splotched with pale yellow and olive yellow.

The soil is medium to strongly acid. It allows easy penetration of plant roots and is permeable to air and moisture.

Rainfall is readily absorbed and well retained. The inherent fertility is moderate to low. A few small angular or semiangular quartzite or sandstone fragments may be scattered over the surface and through the soil mass. They interfere with tillage.

Use suitability.—Practically all of this soil has a cover of cutover forest.

This soil is a good producer of all crops common to the county, including the more exacting ones such as alfalfa and red clover. Because of its moderately low natural fertility, it requires heavy applications of fertilizer for high yields. The soil is deficient in lime, phosphorus, potassium, and nitrogen for most crops, but it is very responsive to these amendments. Good tilth is easily maintained. Erosion control is not a serious problem, although the soil is moderately susceptible to erosion. Though not suited to intensive use, the soil is well suited to practically any row crop grown in a rotation of medium length. For a discussion of use and management, see group 6.

Allen loam, eroded rolling phase (5 to 12 percent slopes) (Ab).—This soil occurs in widely scattered areas on the Buffalo Mountain foot slopes. It is rather widely distributed in small areas and is associated with the Dunmore, Hayter, Jefferson, and Sequatchie soils and with other members of the Allen series.

Profile description:

0 to 6 inches, brownish-gray to brownish-yellow very friable loam.
6 to 13 inches, pale-yellow or reddish-yellow friable light clay loam or loam.
13 to 30 inches, yellowish-red moderately friable clay loam to sandy clay; moderate medium nut or blocky structure.
30 inches+, yellowish-red moderately friable clay loam to sandy clay, streaked and splotched with pale yellow and olive yellow in some places; bedrock at 3 to 15 feet.

A considerable part of the original surface layer has been lost by erosion. The remnants of this layer are mixed with the subsoil in the plowed layer. The present surface layer is therefore highly variable in both color and texture. Small severely eroded spots are common and are conspicuous because the subsoil has been exposed. The texture of the more severely eroded spots is a clay loam.

The soil is medium to strongly acid, moderate in content of plant nutrients, and low in organic matter. A few small sandstone or quartzite fragments may be scattered over the surface and through the soil, but they do not interfere with tillage. The soil allows easy penetration of plant roots and normal circulation of air and moisture. Rainfall is readily absorbed, and moisture is well retained. Surface runoff is medium and internal drainage is moderate.

As mapped, this soil includes areas in which there is a gradual transition from shallow colluvial material over limestone residuum (Dunmore soil material) to deep colluvial material that forms the typical Allen soils. The soil grades toward Dunmore soil near streams and toward Allen stony loam or Jefferson stony loam near the bases of mountains. This soil also includes small areas that resemble the associated Hayter and Jefferson soils.

Use suitability.—All of this soil has been cleared and cultivated. It is now used for corn, small grains, hay, pasture, tobacco, and some truck crops.

This soil is well suited to the general field crops grown in the area. For some crops, the soil is deficient in lime, phosphorus, nitrogen, and possibly potassium. Under cultivation, much of the original surface soil has been lost by erosion. With the progressive loss of the original surface soil, there has been a loss of organic matter. As a result, the soil has become slightly more droughty, more erodible, lower in plant nutrients, and less productive of most crops. With proper fertilization and other good management, high yields of any crop common to the area are possible. For a discussion of use and management, see group 6.

Allen loam, hilly phase (12 to 25 percent slopes) (Ac).—This soil differs from Allen loam, rolling phase, chiefly in occupying steeper slopes, in being slightly shallower, and in generally having a more variable depth of colluvial material. The colluvial deposit is usually underlain by limestone.

This soil occurs in widely scattered, small areas along the narrow colluvial belt at the base of the steep mountain slopes. It is closely associated with the Jefferson, Dunmore, Hayter, Ramsey, and Barbourville soils and with other Allen soils.

This soil varies greatly in the depth to underlying material. Where it is shallow to limestone, the soil is generally darker and much heavier. There are shallow variations from 12 to 30 inches in depth, and along sharp breaks the limestone residuum may be exposed.

Use suitability.—All of this soil is in forest. Many of the areas are not easily accessible and should not be cleared.

This soil would not be suited to cultivated crops unless they were grown in a long rotation consisting chiefly of close-growing crops. It is susceptible to runoff and erosion because of the strong slopes, and it is difficult to conserve. The soil is moderate in natural fertility and has a moderately high water-supplying capacity. It could be used for close-growing crops and pasture if adequately fertilized. For a discussion of use and management, see group 13.

Allen loam, eroded hilly phase (12 to 25 percent slopes) (Ad).—This soil differs from Allen loam, rolling phase, chiefly in having stronger slopes and in being eroded. It also differs in having a more variable, generally shallower, depth of colluvial material.

A considerable part of the original surface layer has been removed by erosion. In a few small severely eroded spots all of the original surface has been removed and the yellowish-red subsoil is exposed. In many places the present surface soil consists of remnants of the original surface soil mixed with the upper part of the subsoil by tillage. The resulting surface soil is a brownish-gray friable loam to light clay loam. The subsoil is a yellow-

ish-red moderately friable clay loam to sandy clay loam. The colluvial deposit is underlain by limestone at depths of 3 feet or more.

This soil is in scattered areas in the narrow belt of colluvial soils that occurs at the base of the steep mountain slopes. Closely associated soils are the Jefferson, Ramsey, Dunmore, Hayter, Sequatchie, and Barbourville.

The depth of colluvial deposit is highly variable in this soil. Where it is shallow and overlies limestone, the soil is generally darker and heavier textured than in other places. The soil in the shallow areas is from 15 to 30 inches deep. Along sharp breaks and where erosion has been severe, however, limestone soil material may be exposed, and the Dunmore subsoil materials are at the surface.

Use suitability.—Practically all of this soil has been cleared and cultivated. An estimated 20 percent is now in corn, 20 percent in hay, and 45 percent in pasture, largely unimproved. About 15 percent is idle.

This soil is not well suited to intertilled crops, but presumably it can be used for crops if properly managed. The crop rotation should be long and should consist mainly of close-growing legumes and grasses. Strong slopes and susceptibility to erosion make this soil difficult to work and conserve. It is moderate in natural fertility and water-holding capacity, and it produces close-growing crops and pasture fairly well if adequately fertilized. Fertilization is needed for most crops, as the soil is deficient in organic matter, lime, phosphorus, and potassium. This soil responds very well to fertilizers. For a discussion of use and management, see group 13.

Allen stony loam, eroded rolling phase (5 to 12 percent slopes) (Ae).—This well-drained soil of the colluvial lands occurs at the base of steep mountain slopes and on the adjacent valley floors. The parent materials from which the soil has formed were washed largely from uplands underlain by quartzites and sandstones, but they include a small admixture of material washed from uplands underlain by limestone. The soil is underlain by limestone at depths of 3 feet or more.

This soil occurs in widely scattered small areas on the foot slopes of Buffalo Mountain. It is associated with the Jefferson, Sequatchie, Hayter, and Dunmore soils, and with other members of its own series.

Profile description:

0 to 6 inches, light brownish-gray to reddish-yellow very friable stony loam; virgin areas have a thin surface layer stained dark with organic matter.
6 to 13 inches, pale-yellow to yellowish-red or reddish-yellow friable light stony clay loam or loam.
13 to 32 inches, yellowish-red moderately friable sandy clay or sandy clay loam; moderately well developed medium blocky structure.
32 inches +, yellowish-red moderately friable stony sandy clay to clay loam, streaked and splotched with pale yellow and olive yellow in most places.

Much of the original surface layer has been lost by erosion. The present surface layer, therefore, is highly variable in thickness, color, and texture. The thickness ranges from 0 to 10 inches. Subsoil is mixed with remnants of the original surface layer in the plow layer. As a result, the plow layer, in many places, is heavier textured than the original surface layer. Small severely eroded spots are common; they are conspicuous because the red subsoil material has been exposed.

The soil is medium to strongly acid and appears to contain a moderate amount of organic matter. It has varying amounts of 2-inch to 8-inch semiangular sandstone or quartzite fragments on the surface and throughout the soil. Almost everywhere, these are numerous enough to interfere with tillage, and in places they make tillage impossible. The soil allows easy penetration of plant roots and normal circulation of air and moisture. Rainfall is readily absorbed and well retained. Surface runoff is medium, and internal drainage is moderate. Fertility is moderate to low.

Mapped with this soil are areas in which there is a gradual transition from shallow colluvial material over limestone residuum (Dunmore soil material) to the deep colluvial material that gives rise to the typical Allen soils. In many places on the tips of the hills near larger drainageways, there is a foot or less of colluvial material over the limestone residuum, and limestone material is mixed with the colluvium. The soil from the shallow colluvium is darker in color and heavier throughout the profile.

Other variations are very small areas that resemble the associated Hayter, Jefferson, or Sequatchie soils.

Use suitability.—All of this soil has been cleared of its original forest and used for crops. It is now used largely for corn, small grains, hay, and pasture.

This soil is only moderately well suited to crops that require tillage. Its suitability is somewhat restricted by stoniness and droughtiness. Stones interfere with tillage and in some localities make it impossible. The stones increase the droughtiness of this soil; they make it more porous and reduce its ability to hold moisture. This soil is apparently well suited to vegetable crops that can be harvested before the dry summer period. It is also fairly well suited to crimson clover, red clover, and the small grains. It is not so well suited to crops such as corn that mature late in summer or early in fall, nor to alfalfa. It is moderate to low in plant nutrients and organic matter and medium to strongly acid. For a discussion of use and management, see group 7.

Allen stony loam, hilly phase (12 to 25 percent slopes) (Af).—This soil differs from Allen loam, hilly phase, in having more stones throughout the profile, especially in the surface layer. Stones 2 to 8 inches wide are numerous enough to interfere with tillage. The parent material consists mainly of quartzite and sandstone materials rolled or washed from the Ramsey soils. The colluvial deposit is variable in depth and is underlain in practically all places by limestone materials.

The soil occurs in small to medium-sized areas throughout the Allen-Jefferson-Barbourville soil association.

Use suitability.—All of this soil is in forest, and this is probably its best use because of the inaccessibility of many areas.

The soil is not suitable for cultivated crops. It would be difficult to till because of strong slopes and stones, and would be difficult to conserve because it is susceptible to erosion. The accessible areas could be used for close-growing crops or pasture, but the soil is low in plant nutrients and its water-supplying capacity is poor, and therefore it is not productive. For a discussion of use and management, see group 16.

Allen stony loam, eroded hilly phase (12 to 25 percent slopes) (Ag).—This soil differs from Allen stony loam, eroded rolling phase, chiefly in occupying stronger slopes

and in being slightly more eroded. It occurs in both small and medium areas, most of them less than 40 acres in size, throughout the colluvial belt at the base of Buffalo Mountain.

The soil materials are partly colluvial and partly alluvial. From 25 percent to 75 percent of the original surface soil has been removed by erosion, and in small areas nearly all of the original surface soil is gone. This soil is lower in organic matter and plant nutrients and is less productive for most crops than the uneroded phase of Allen stony loam. The surface layer also is heavier, more droughty, and more susceptible to further damage by erosion.

This soil varies greatly in depth to underlying material. Where the soil is only 12 to 30 inches deep over limestone, it is generally darker and heavier. Along sharp breaks, however, limestone soil material may be exposed, and the Dunmore subsoil materials constitute the present surface soil. These exposures range from ⅛ to ½ acre in size. Other variations are small areas that resemble the associated Hayter, Jefferson, or Sequatchie soils.

Use suitability.—All of this soil has been cleared and cultivated. An estimated 15 percent is now in corn, 5 percent in wheat, 5 percent in other small grains, 20 percent in hay, and 35 percent in pasture. About 20 percent is temporarily idle.

The workability of this soil is poor to very poor because of the hilly relief and stones. Because of this poor workability, it is generally not suitable for crops. It has poor moisture conditions for plant growth and is low to very low in natural fertility. Although pasture plants do not do well, on most farms pasture is probably the best use for this soil. A suitable pasture mixture is bluegrass, orchardgrass, white clover, hop clover, and lespedeza. For a discussion of use and management, see group 16.

Augusta loam (0 to 3 percent slopes) (Ah).—This is a pale-brown imperfectly drained soil of the low terraces. The old alluvium from which the soil has formed has washed largely from uplands underlain by granite and gneiss, but in most places it includes a small admixture of a wide variety of materials. The soil occupies nearly level or slightly depressed areas on the low terraces along the Nolichucky River. It occurs in very small areas and is closely associated with the Wehadkee, Chewacla, and Congaree soils.

Profile description:

0 to 8 inches, light brownish-gray to pale-brown friable loam; mica flakes dispersed throughout this layer.
8 to 20 inches, pale-brown to brownish-yellow or reddish-yellow firm but moderately friable sandy clay or sandy clay loam, mottled with pale yellow and brown; moderate medium irregular blocky structure.
20 inches +, profusely mottled pale-yellow, brown, and reddish-yellow very fine sandy loam, sandy clay, and in places silty clay loam; alluvial deposit 15 feet or more thick and underlain by limestone.

The soil is medium to strongly acid throughout and is only moderately well supplied with organic matter and plant nutrients. It is permeable to plant roots, but circulation of air is slowed by a high water table during wet periods. Surface runoff is medium, and internal drainage is slow. The soil has a high water-supplying capacity. It is practically free of stones except for an occasional cobblestone on the surface or in the soil mass.

As mapped, this soil may include very small areas of the Chewacla and Wehadkee soils or of soils that are intermediate between the Chewacla or the Wehadkee and typical Augusta soils. These inclusions generally occur along the lines of separation, which in many places are indistinct. Also included is a small acreage that is better drained than the soil described.

Use suitability.—All of this soil has been cleared and used for crops and pasture. It is now used for corn, small grains, hay crops, and pasture. Soybeans is a common hay crop.

The soil is suited to most of the common field crops of the county but is poorly suited to deep-rooted crops or to crops that are sensitive to slow internal drainage, such as alfalfa and tobacco. It is believed to be adequately supplied with potassium because it contains large amounts of micaceous material, but it is deficient in lime, phosphorus, and nitrogen. There is no erosion problem because the soil is level. This soil can be used intensively for adapted crops if adequately fertilized. For a discussion of use and management, see group 5.

Barbourville loam (2 to 7 percent slopes) (Ba).—This is a pale-brown, well-drained soil of the colluvial lands. It has formed at the base of slopes in small fanlike positions where small lateral drains empty onto larger flood plains, and along narrow intermittent drainageways. Most of the colluvium from which this soil was formed came from the Ramsey soils.

The soil occurs in small, irregularly shaped areas widely distributed along the foothills of the mountain area in the southern part of the county. It is closely associated with the Hayter, Jefferson, Allen, Sequatchie, and Hamblen soils.

Profile description:

0 to 10 inches, pale-brown to yellowish-brown very friable loam.
10 to 36 inches, light yellowish-brown to yellowish-brown friable loam.
36 inches+, light yellowish-brown friable loam to clay loam, splotched with olive yellow and pale yellow.

This soil is medium to strongly acid. It is relatively free of stones but has variable amounts of small stone fragments throughout the soil mass. It allows easy penetration of plant roots and normal circulation of air and moisture. Water is readily absorbed and retained. The lay of the land is favorable. The mapping unit includes a few small areas that are imperfectly drained.

Use suitability.—Practically all of this soil has been cleared and is now farmed intensively to tobacco, corn, small grains, hay, and truck crops.

The soil is well suited to intensive farming if it is adequately fertilized and if organic matter is maintained by adding crop residues, green manure, or barnyard manure. Although not generally susceptible to flooding, the soil receives sediments from the adjacent slopes which replenish its supply of plant nutrients and organic matter. It is well suited to corn, hay, tobacco, and truck crops. It is not very well suited to small grains, which lodge, mature late, and are susceptible to disease. Nevertheless, good yields are obtained in many places. Alfalfa is sometimes grown successfully, but there is evidence that the soil is much better suited to red clover than to alfalfa. For a discussion of use and management, see group 2.

Barbourville stony loam (2 to 7 percent slopes) (Bb).—This soil differs from Barbourville loam chiefly in content

of stones. It occurs in very small areas widely distributed throughout the mountain foothills. It consists of recent colluvial or local alluvial material that washed or rolled from the Ramsey, Allen, or Jefferson soils. It is usually in fanlike positions at the base of slopes or in narrow bands along intermittent drainageways. It is closely associated with the Jefferson, Hayter, and Ramsey soils.

Profile description:

0 to 10 inches, pale-brown to yellowish-brown very friable stony loam.
10 to 36 inches, light yellowish-brown to yellowish-brown friable stony loam or light clay loam.
36 inches+, light yellowish-brown friable stony clay loam or very fine loam, splotched with olive yellow and pale yellow.

This soil is medium to strongly acid and apparently high in organic matter and plant nutrients. Surface runoff is moderate, and internal drainage is moderately rapid. The soil is very permeable to air, roots, and water. Numerous stones up to 12 inches in diameter are on the surface and throughout the soil mass in quantities sufficient to interfere with tillage. In some places the stones make tillage almost impossible. Boulders up to 36 inches in size occur on the soil, but they are not numerous. Water is readily absorbed and moderately well retained.

Use suitability.—An estimated 25 percent of this soil is still in hardwood forest. Most of the cleared areas are used rather intensively for crops, but some are being used for pasture.

This soil is suitable for most crops common to the county, but because of stones, it is much less desirable for crops than Barbourville loam. Tillage is often difficult and in some places impossible. Yields are generally lower than on Barbourville loam. This soil is fairly well suited to corn, tobacco, hay, and truck crops. It produces better yields of red clover than of alfalfa. Although fair crop yields are obtained without amendments, fertilizers will be required to increase yields or to maintain them over a long period. The soil is not normally susceptible to erosion or to flooding. This soil is suited to intensive use, but the best practice is to use a short rotation in which a legume is included. For a discussion of use and management, see group 2.

Bolton loam, eroded steep phase (25 to 50 percent slopes) (Be).—This deep permeable soil of the uplands has a brown or dark-brown surface soil and a reddish-brown subsoil. It has developed from siliceous dolomitic limestone or from dolomitic limestone that contains thinly interbedded bands of sandstone. It normally occurs on the southeast-facing slopes of relatively high, narrow ridges that cross the county in a southwest-northeast direction. The shaly Litz soils ordinarily occupy the opposite side of the slope, and the ridgetop forms the dividing line between this soil and the Litz. This soil is associated with the Dunmore and Dewey soils and with other members of its own series.

Profile description:

0 to 8 inches, brown to reddish-brown very friable loam to light silt loam; includes a thin surface layer stained dark by organic matter.
8 to 17 inches, reddish-brown friable clay loam to silty clay loam.
17 to 44 inches, yellowish-red to reddish-brown moderately friable silty clay loam to silty clay; numerous black concretionary particles and stains common in this layer.
44 inches +, yellowish-red firm but moderately friable silty clay loam to silty clay, splotched with yellow; layer may contain a few small fragments of chert; bedrock 10 to 20 feet or more below the surface.

A considerable part of the original surface soil has been lost by erosion, and the subsoil is exposed in a few small spots. The present surface layer is quite variable in texture and color because it consists of remnants of the original surface layer mixed with the upper part of the subsoil.

The soil is medium to strongly acid and has a fair supply of organic matter and plant nutrients. It is practically free of stones, except for a few angular chert fragments on the surface and throughout the soil mass. The soil is easily penetrated by plant roots and is permeable to air and moisture. It absorbs moisture readily, and its water-holding capacity is high. Surface runoff is rapid, and internal drainage is moderate. Although the surface soil is predominantly a loam, it grades toward a silt loam, and in some areas is a silt loam.

Use suitability.—Practically all of this soil has been cleared of hardwood forest. An estimated 60 percent is now in pasture, 20 percent in hay crops, and 15 percent in corn. About 5 percent is idle. Because of steep slopes and susceptibility to severe erosion, this soil is not suited to intertilled crops. It is fair for pasture. Its natural fertility is moderately high, and the color indicates that the supply of organic matter is also high. Nevertheless, a good response can be expected from the use of fertilizers. A good pasture can be established and maintained under proper management, which includes the use of lime and phosphorus and careful control of grazing. For a discussion of use and management, see group 17.

Bolton loam, eroded rolling phase (5 to 12 percent slopes) (Bc).—A considerable part of the original surface layer of this soil has been removed by erosion. The present surface layer is 4 to 10 inches thick. In a few severely eroded spots, all of the original surface has been removed and the reddish subsoil is exposed. Depending on degree of erosion, the present surface soil ranges from brown to reddish brown in color and from loam to silty clay loam in texture.

This soil is confined chiefly to ridgetops, where it is associated with the Litz and Dunmore soils and other Bolton soils. This soil is distinguished from other limestone soils of the area by the friability of the surface soil and subsoil and the darker color throughout the profile.

Profile description:

0 to 7 inches, brown to dark-brown very friable loam; in virgin areas, the top one or two inches is stained dark by organic matter.
7 to 18 inches, reddish-brown friable clay loam to silty clay loam.
18 to 44 inches, yellowish-red to reddish-brown moderately friable silty clay to silty clay loam; numerous black or brown concretions and stains.
44 inches +, yellowish-red, firm but moderately friable silty clay loam or silty clay; numerous black or brown concretions and stains throughout layer.

This soil is medium to strongly acid and has a fairly good supply of plant nutrients and organic matter. It is practically free of stones, except for a few angular fragments of chert or sandstone on the surface and throughout the soil mass. Plant roots penetrate easily,

and air and moisture circulate freely. Moisture is readily absorbed and well retained. The water-holding capacity is high.

Use suitability.—All of this soil has been cleared and is now used for crops or pasture. An estimated 35 percent is in crops, and 60 percent in hay or pasture. About 5 percent is idle land.

This soil is very well suited to all the common crops, including deep-rooted legumes such as alfalfa. It cannot be cropped intensively, however, because it is moderately susceptible to erosion. Proper management requires a rotation of medium length that includes close-growing crops. Observations show that a row crop may be grown safely once every 4 to 6 years if fertilization and other management practices are good. This soil is confined chiefly to the narrow ridgetops, and its use is generally governed by that of Bolton soils on the adjacent slopes. For a discussion of use and management, see group 6.

Bolton loam, eroded hilly phase (12 to 25 percent slopes) (Bd).—This soil differs from Bolton loam, eroded rolling phase, chiefly in having a stronger slope. Erosion has removed a large part of the original surface layer.

The present surface layer is a brown friable loam to silt loam. The subsoil is a reddish-brown to yellowish-red silty clay loam or silty clay. Small severely eroded areas are common; they are conspicuous because the reddish subsoil is exposed. A few uneroded areas are included with this soil; they differ chiefly in having a thicker surface soil that is higher in organic matter. This soil is widely distributed in small areas throughout the hilly limestone uplands.

Use suitability.—Practically all of this soil has been cleared and cultivated. An estimated 35 percent is now in crops, and 60 percent in hay or pasture (fig. 2). The

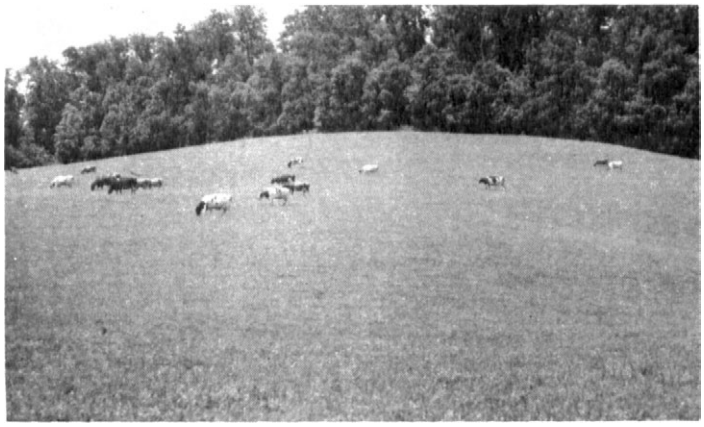

***Figure 2.*—Dairy cattle on excellent orchardgrass-Ladino clover pasture on Bolton loam, eroded hilly phase.**

rest is idle, temporarily abandoned, or in unimproved pasture.

This soil is fairly well suited to crops but is probably better for pastures. The moderately strong slopes make the soil difficult to work and highly susceptible to further damage by erosion when it is bare of vegetation or is in intertilled crops. It is fairly high in natural fertility but responds well to fertilizers. It produces a wide variety of crops. For a discussion of use and management, see group 13.

Buncombe loamy fine sand (0 to 3 percent slopes) (Bf).—This is an excessively drained brownish-yellow soil of the bottom lands. The alluvium from which the soil has formed was washed from uplands underlain primarily by granite and gneiss. The soil is similar to Congaree fine sandy loam in location, parent material, geographic distribution, and associated soils. It differs in texture, color, stoniness, productivity, and use suitability.

The soil occupies almost level flood plains along the Nolichucky River. It occurs in small areas in association with Chewacla and Congaree soils.

This soil is a loose, light yellowish-brown, pale-brown, or light brownish-gray loamy fine sand throughout. In many places the top 3 or 4 inches is stained a somewhat darker color than the rest of the profile. Local areas may be gravelly or cobbly or both. The subsoil is typically stratified with coarse-textured materials, which range from fine sand to fine gravel.

The soil is naturally medium or strongly acid, although much of it has been limed recently and is less acid. The organic-matter content, plant-nutrient content, and water-holding capacity are all low. The entire soil contains a moderate amount of small mica flakes. It also contains some gravel and cobblestones, but these interfere with cultivation in only a few places.

About 160 acres of this soil occurs along the Watauga River. In color and texture the soil along this stream is similar to the main body of this soil, but it developed from materials washed largely from uplands underlain by quartzite and sandstone, mixed with some material from shale, slate, limestone, granite, and gneiss.

Use suitability.—Practically all of this soil has been cleared and is now cultivated. Most of it is in pasture or is idle. Only a small part is used for crops.

The use suitability of this soil is limited because it is droughty, low in fertility, and subject to flooding. Yields of corn, small grains, and most of the hay crops are very low. The soil is best suited to early maturing crops such as early potatoes and early garden vegetables. On most farms it is probably best used for pasture, although most pasture plants do not grow well. For a discussion of use and management, see group 1.

Chewacla loam (0 to 3 percent slopes) (Ca).—This is an imperfectly drained soil of the first bottoms. It consists of alluvium washed from uplands underlain largely by granite. It has a small admixture of material washed from uplands underlain by quartzites and shales. It has formed from parent materials similar to those of the Congaree and Wehadkee soils, and the differences are chiefly due to drainage. In drainage and in many profile characteristics it is intermediate between the well-drained Congaree and the poorly drained Wehadkee soils.

This soil occurs principally in low areas on the Nolichucky River flood plains. It is closely associated with the Congaree, Wehadkee, and Augusta soils.

Profile description:

0 to 14 inches, grayish-brown very friable loam; mica flakes dispersed throughout this layer.
14 to 30 inches, medium to dark-gray loam to clay loam, mottled with brown.
30 inches +, light-gray to gray silty clay loam, stained and streaked with brown.

The soil is medium to strongly acid and appears to be moderately low in organic matter. It is fairly well

supplied with plant nutrients. The soil occupies almost level areas that slope gradually in the direction of stream flow. It is subject to overflow during periods of high water. Surface runoff and internal drainage are slow. The subsoil at depths of 2 feet or more is saturated during most of the winter and early in spring.

Use suitability.—Practically all of this soil has been cleared and cultivated for many years. It is now used chiefly for corn, hay, pasture, and small grains.

This soil is suited to intensive use for crops, but the choice of crops is restricted by the imperfect drainage and susceptibility to flooding. This soil is well suited to corn and annual hay crops. Alfalfa is poorly adapted, but red clover apparently does well. Small grains are susceptible to lodging and disease and generally mature later than on soils of the uplands or terraces. Tobacco also appears to be poorly suited. Under continuous cropping, fair yields are obtained without fertilizers. For high yields, fertilizer will probably be required, and a short rotation that includes a legume. See group 1 for a discussion of use and management.

Cobbly alluvium, Staser and Congaree soil materials (0 to 3 percent slopes) (Cb).—This miscellaneous land type occurs along the two major streams of the county. It consists of very stony alluvium washed from uplands underlain by different classes of rocks. The areas along the Nolichucky River have washed chiefly from granite and gneiss, and the areas along the Watauga River from sandstone, quartzite, slate, and shale.

The characteristics of this land type are variable because of the stoniness and variable nature of the materials. The predominant color of the soil material is light yellowish brown. The texture varies from loamy sand to loam, but a large proportion of the soil mass consists of gravel and cobblestones. The accumulated materials are from 15 to more than 30 feet deep.

The material is medium to strongly acid. It is low in organic matter because of the coarse texture and many cobblestones. It is also low in plant nutrients. In most areas the surface soil is too cobbly for cultivation, but it is porous and friable, and consequently allows easy penetration by plant roots and free circulation of air and water. All of this land type is subject to overflow.

Use suitability.—An estimated 65 percent of this soil is in cutover forest. Most of the rest is used for pasture; a few areas are used for corn and truck crops, and some are idle.

This land type is not suited to cultivated crops or to hay because of gravel and cobblestones. All of it is cobbly enough to prohibit cultivation. It is fairly well suited to pasture on most farms, although yields would likely be low. It is low in fertility and in water-holding capacity. For a discussion of use and management, see group 16.

Congaree loam (0 to 3 percent slopes) (Cd).—This is a brown well-drained soil of the first bottoms. It consists of general alluvium that washed mainly from land underlain by granite, but it also has small admixtures of materials washed from lands underlain by quartzite and shale. It occurs in narrow strips along the Nolichucky River. The soil is closely associated with the Chewacla, Masada, Sequatchie, and Augusta soils, and with other soils of its own series.

Profile description:

0 to 10 inches, grayish-brown to brown, very micaceous, friable loam.
10 to 25 inches, very dark gray to brown friable loam containing abundant mica flakes.
25 inches +, grayish-brown friable loam; alluvial deposit 6 to 15 or more feet thick.

The soil is medium to strongly acid and is well supplied with organic matter and plant nutrients. The plow layer is almost free of gravel and cobblestones. The open friable texture of this soil makes it permeable to plant roots and air. Rainfall is easily absorbed and well retained. Surface runoff is slow, but internal drainage is moderate to rapid. In most places, the soil is subject to periodic overflow. Numerous mica flakes occur throughout the profile. Some very small areas are included where the soil is darker than that described, but this variation does not affect agriculture.

Use suitability.—All of this soil has been cleared and is now intensively farmed. An estimated 30 percent is now in corn, 25 percent in small grains, 30 percent in hay crops, 5 percent in tobacco and vegetable crops, and 10 percent in other crops and pasture.

This soil is well suited to intensive cropping. It is susceptible to flooding, and for this reason its use is restricted mainly to the summer annual crops. The flooding helps maintain the fertility of the soil by depositing material that is high in organic matter and plant nutrients. The soil is well suited to corn and many hay crops, but it is better suited to red clover than to alfalfa. Alfalfa appears to be better suited to other soils of the uplands, although on some farms it is grown successfully on this soil. Small grains tend to lodge and to mature late, and they are susceptible to disease, but yields are good in many places. See group 1 for a discussion of use and management.

Congaree fine sandy loam (0 to 3 percent slopes) (Cc).—This is a well-drained grayish-brown soil of the first bottoms. It consists of general alluvium that washed mainly from uplands underlain by granite but includes small admixtures of materials washed from uplands underlain by quartzite and shale. It occurs in narrow strips along the Nolichucky River and is closely associated with the Buncombe, Chewacla, and Sequatchie soils, and other soils of its own series.

Profile description:

0 to 12 inches, grayish-brown micaceous loose fine sandy loam.
12 to 26 inches, dark-gray or very dark gray to yellowish-brown very friable loam to fine sandy loam.
26 inches+, light yellowish-brown or brownish-yellow loose fine sandy loam to loamy fine sand.

The soil is almost free of gravel and cobblestones. Small amounts are scattered over the surface and through the profile in a few places, but they do not interfere with tillage. The lower layers in some places contain considerable amounts of gravel or cobblestones. The soil is permeable to plant roots, air, and moisture. Rainfall is readily absorbed but is not retained as well as by Congaree loam. Surface runoff is slow to moderate, and internal drainage is moderate to rapid. The soil is medium to strongly acid and is moderate in supply of organic matter and plant nutrients. It is subject to overflow during periods of high water. The mapping unit includes small areas of Buncombe loamy fine sand, State loam, and Congaree loam.

Use suitability.—All of this soil has been cleared. An estimated 25 percent is now in corn, 20 percent in small grains, 25 percent in hay, 20 percent in pasture, and 10 percent in tobacco, vegetables, and various other crops.

This soil is well suited to intensive cropping. It is susceptible to flooding, which limits its use suitability, but the overflows deposit organic matter and plant nutrients. This soil is adapted to about the same crops as Congaree loam, but it has less capacity to hold water and fertilizers and, consequently, produces lower yields. It is well suited to corn and to many hay crops, including red clover, but is not well suited to small grains and alfalfa. It is susceptible to overflow during winter and early in spring. Small grains tend to lodge and to mature late. Good yields of small grains are obtained, however, on many farms. For a discussion of use and management, see group 1.

Cumberland silty clay loam, eroded rolling phase (5 to 12 percent slopes) (Cf).—This is a well-drained fertile red soil that occurs on the high terraces of the major streams, mainly along the Nolichucky River near Limestone. It is closely associated with the Waynesboro, Nolichucky, and Dunmore soils and other soils of its own series.

This soil has a browner surface soil and a darker red, somewhat less friable subsoil than the associated Waynesboro soils. It has developed from old alluvium, most of which was washed from limestone materials. The native vegetation was chiefly hardwoods such as oaks, maples, hickories, chestnuts, and yellow-poplars.

Profile description:

0 to 8 inches, dark-brown to dark reddish-brown friable silt loam to silty clay loam.
8 to 21 inches, dark reddish-brown to dark-red firm but moderately friable silty clay or heavy silty clay loam.
21 inches+, red to reddish-brown firm silty clay or silty clay loam containing many black stains.

Very small dark-brown or nearly black concretions are common in the subsoil and substratum. The terrace deposit is usually more than 3 feet thick, and in a few places it may be 15 feet or more. Where the terrace deposit is less than 3 feet thick, the subsoil is not so deep nor so friable as described. The entire profile is medium to strongly acid.

The thickness of the surface layer varies because of losses from erosion. In some places the surface layer is less than 6 inches thick, and subsoil material is mixed with it in tillage. In a few areas, gravel and cobblestones are on the surface and throughout the profile but do not interfere with cultivation.

Use suitability.—Nearly all of this soil has been cleared and is now being used for practically all the crops commonly grown in the county.

The soil is suited to a wide variety of crops, including alfalfa and red clover. It is not suited for intensive use because of its slope and erodibility. Rotations should be of moderate length and should include close-growing crops; a row crop can be grown every fourth year if management is good. Yields of practically all crops are good, but can be increased and maintained by adding fertilizers. The natural fertility and water-holding capacity are high. For a discussion of use and management, see group 6.

Cumberland silt loam, undulating phase (2 to 5 percent slopes) (Ce).—This soil differs from Cumberland silty clay loam, eroded rolling phase, chiefly in having milder slopes and in being less eroded. It occurs on old high stream terraces 50 to 150 feet above the flood plains. The parent material has washed mainly from uplands underlain by limestone but generally includes an admixture of material from a variety of rocks, including shale, slate, sandstone, quartzite, and granite. Most of the terrace deposits are underlain by limestone at depths of 5 to 20 feet or more.

Practically all of this soil is on terraces of the Nolichucky River; it occurs most extensively in the vicinity of Limestone. It is closely associated with the Nolichucky, Waynesboro, and Dunmore soils.

Profile description:

0 to 10 inches, dark-brown to dark reddish-brown friable silt loam.
10 to 21 inches, dark reddish-brown to dark-red firm but moderately friable silty clay or heavy silty clay loam.
21 inches +, red to reddish-brown firm silty clay or silty clay loam; black stains numerous.

Almost one-third of the total area is uneroded, but in some places part of the original surface layer has been lost. In these places the subsoil is mixed with the surface soil, and the present surface layer varies greatly in color and texture within short distances. It ranges from brown to reddish-brown and from silt loam to silty clay loam. Small severely eroded areas are common and are conspicuous because the red subsoil is exposed. A few small areas of this soil are not cleared.

The soil is medium to strongly acid and moderate to high in organic matter and plant nutrients. In places a few small cobblestones are on the surface and scattered throughout the profile. Small dark-brown concretions are common in the lower part. The soil is permeable to roots, air, and moisture. Rainfall is readily absorbed and well retained; the water-supplying capacity is high.

Use suitability.—Practically all of this soil has been cleared and is now used for crops and pasture. Little of the open land is idle. This soil is easy to work and conserve, and it is suited to all the common crops of the area, including alfalfa (fig. 3). It has favorable slopes, good fertility, and a high water-supplying capacity and is suited to intensive farming. Lime, phosphorus, and nitrogen should be applied for maximum yields of some crops. Lime and phosphorus are essential for red clover and alfalfa. For a discussion of use and management, see group 3

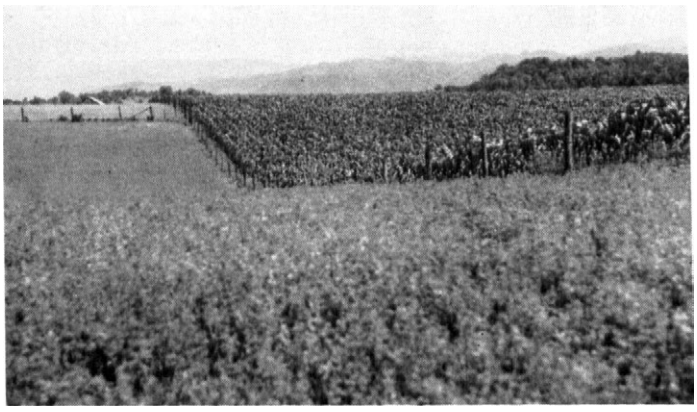

***Figure 3.*—Alfalfa and corn on Cumberland silt loam.**

Cumberland silty clay loam, eroded hilly phase (12 to 25 percent slopes) (Cg).—This soil is more varied in color, texture, stoniness, and depth than Cumberland silty clay loam, eroded rolling phase. Surface runoff is more rapid and in most areas more of the original surface soil has been lost through erosion. Small severely eroded areas are common.

The soil has formed from old alluvium washed mostly from uplands underlain by limestone. Some areas are included, however, that have developed from alluvium washed chiefly from quartzite and slate.

Most of this soil is on high terraces of the Nolichucky River, where it is closely associated with the Waynesboro, Nolichucky, and Dunmore soils and with other soils of its own series.

The surface soil is brown to dark reddish-brown silt loam or silty clay loam; the subsoil is dark-red to reddish-brown firm silty clay loam or silty clay.

Use suitability.—Practically all of this soil has been cleared and is now used for field crops and pasture. It is moderately well suited to intertilled crops. This use is restricted, however, by the eroded condition of the soil and susceptibility to further erosion. The soil needs more careful management than Cumberland silty clay loam, eroded rolling phase. Longer rotations that include a greater proportion of close-growing crops, more use of leguminous green manure, and contour tillage are necessary to maintain productivity. The steeper and more eroded areas are better suited to hay crops or permanent pasture. For a discussion of use and management, see group 13.

Dandridge shaly silt loam, steep phase (25 to 50 percent slopes) (Dc).—This light-colored well-drained to excessively drained shallow upland soil is known locally as black slate land. It has developed from residuum weathered from calcareous shales. It occurs on narrow steep ridge slopes in several small scattered areas throughout the county. The largest area occurs in the vicinity of Austin Springs. The soil is associated chiefly with the Hamblen, Leadvale, Whitesburg, and other Dandridge soils.

Profile description:

0 to 6 inches, light yellowish-brown to light brownish-gray friable shaly silt loam; in wooded areas, 2-inch surface layer is stained dark with organic matter; moderately well developed crumb structure.

6 inches+, light yellowish-brown moderately plastic shaly silty clay loam; partly disintegrated bedrock at depths of 10 to 25 inches.

This soil varies from place to place in texture, color, consistence, and particularly in depth to bedrock. The soil contains numerous small shale fragments, many of which are calcareous. It is therefore about neutral in reaction and well supplied with lime. Outcrops of bedrock are common in most areas. The supply of organic matter is low except in the thin surface layer in the wooded areas. The soil is moderately low in phosphorus and nitrogen but fairly high in potassium. Because of its shallow depth, surface runoff is very rapid. The water-holding capacity is low.

Use suitability.—Practically all of this soil is in cutover forest. The stand is small and includes a high proportion of cull trees. The soil is poorly suited to crops because it is shallow, steep, and extremely susceptible to erosion. It is best suited to pasture. Some of the steeper slopes probably should be kept in forest. Phosphorus is the only fertilizer needed for pastures. Lime is not needed in most places. Careful control of grazing is needed to maintain a good pasture sod. For a discussion of use and management, see group 17.

Dandridge shaly silt loam, eroded steep phase (25 to 50 percent slopes) (Dd).—This soil is like Dandridge shaly silt loam, steep phase, except for the effects of erosion. In most areas 25 to 75 percent of the original surface layer has been lost. In some areas all of the surface soil and a part of the subsoil are gone. This eroded phase, therefore, is lower in organic matter and plant nutrients than the steep phase, has a slightly heavier surface layer containing more shale fragments, and is more erodible.

No well-defined surface soil and subsoil layers can be seen because tillage and erosion have obliterated the slight differences between these layers.

This soil is distributed throughout the part of the county that is underlain by calcareous shales or black slate. It is associated chiefly with the Hamblen, Leadvale, and Whitesburg soils, and other soils of its own series.

The soil is about neutral in reaction in most places. It is low in organic matter and most plant nutrients, but the content of potassium is generally high. There are small shale fragments throughout the profile, and in the more severely eroded areas large fragments are on the surface. Outcrops of bedrock are common. Surface runoff is very rapid, and the water-holding capacity is low. The soil is moderately permeable to air, roots, and water.

Use suitability.—All of this soil has been cleared. Most of it is now used for pasture, but some is in crops, and some is idle. This soil is very poorly suited to crops because it is shallow, steep, and extremely erodible. It is productive of pasture plants, especially if phosphorus is applied, and in most places it is fairly well suited to pasture. On the severely eroded areas, pastures are poor, but such areas can be made more productive by establishing and maintaining a vegetative cover and applying the proper fertilizers. For a discussion of use and management, see group 17.

Dandridge silt loam, hilly phase (12 to 25 percent slopes) (Dg).—This soil differs from Dandridge shaly silt loam, steep phase, chiefly in having milder slopes. In addition, the soil is somewhat deeper and the surface and subsoil layers are more distinct. The scattered small areas of this soil occur throughout the part of the county that is underlain by calcareous shale or black slate.

Profile description:

0 to 6 inches, light yellowish-brown to light brownish-gray friable silt loam; wooded areas have a thin surface layer stained dark with organic matter.

6 to 18 inches, light yellowish-brown to brownish-yellow moderately plastic shaly silty clay loam; partly disintegrated bedrock is at depths of 10 to 25 inches.

In most places the soil contains calcareous shale fragments; it is about neutral in reaction. Numerous small shale fragments occur throughout the profile, and there are occasional outcrops of bedrock. The supply of organic matter is low except in the thin dark-colored surface layer. The soil is moderately low in nitrogen and phosphorus but is fairly high in potassium. It is moderately permeable, but surface runoff is very rapid. The water-holding capacity is low because the soil is shallow and strongly sloping.

The shale content and the number of outcrops vary a

great deal from place to place. Some small areas are almost shale-free. Although the subsoil is predominantly brownish yellow or light yellowish brown, some areas are included that have a yellowish-red subsoil.

Use suitability.—Practically all of this soil is in cutover forest. It is rather poor for crops, chiefly because of strong slopes and susceptibility to erosion. The soil is well suited to pasture. However, the water-holding capacity is low, so pastures, although generally good, are likely to be short during dry spells. For a discussion of use and management, see group 14.

Dandridge shaly silt loam, eroded hilly phase (12 to 25 percent slopes) (Db).—This soil differs from Dandridge shaly silt loam, steep phase, chiefly in having milder slopes and greater erosion loss.

It occurs in small, narrow, irregularly shaped areas in association with the Leadvale, Hamblen, and Whitesburg soils, and other soils of its own series.

An estimated 25 to 75 percent of the original surface layer has been lost by erosion, and in some areas all the surface soil and part of the subsoil are gone. As erosion advances, the depth to shale diminishes. On exposure, the shale soon breaks down and becomes part of the soil. For this reason, it is difficult to estimate the loss of soil material. Furthermore, erosion has caused little or no decline in productivity except where it has been recent and severe. Large shale fragments occur on the surface of some of the severely eroded areas.

Use suitability.—Practically all of this soil has been cleared and used for crops or pasture. An estimated 30 percent is now in cultivated crops and 50 percent is in pasture. About 20 percent is idle. Of the cultivated land, about 20 percent is in corn, 60 percent in hay or pasture, 10 percent in wheat, and 10 percent in other small grains and miscellaneous crops.

This soil is well suited to pastures and rather poorly suited to field crops. The chief factors limiting crop production are shallowness, low water-holding capacity, hilly slopes, and extremely high susceptibility to erosion. By very careful management, however, some farmers have used this soil for crops for a number of years. Erosion control is difficult. Some farmers have reported that yields have increased where erosion has brought the calcareous shale bedrock within reach of the plow. Severe erosion, however, is decidedly harmful and should be prevented.

This soil appears to be well adapted to grasses and legumes, including alfalfa, probably because of its high content of lime. Phosphorus is usually required for high yields of grasses and legumes, but potassium is apparently not needed in many places. For a discussion of use and management, see group 14.

Dandridge silt loam, rolling phase (5 to 12 percent slopes) (Df).—This soil differs from the hilly phase of Dandridge silt loam chiefly in having milder slopes and greater depths to bedrock. It occurs only as small areas on narrow winding ridgetops within strongly dissected areas of Dandridge soils.

The surface soil, generally a light yellowish-brown silt loam, has much organic matter in the top 1 to 2 inches. Under this layer is light yellowish-brown or brownish-yellow, moderately plastic, shaly silty clay loam that extends 20 to 30 inches below the surface. Underneath this is the variegated mixed parent material and shale fragments, which blend into the hard calcareous shale bedrock. On many of the narrow ridgetops the soil is only a few inches deep, and outcrops of shale bedrock are common. On some of the broader ridgetops and smoother areas, the soil is deeper.

The surface layer of the deeper soil shows some evidence of leaching. In addition, the subsoil is heavier and somewhat more plastic. Soils in these areas resemble the Needmore soils of other counties. They have been included with Dandridge silt loam, rolling phase, because in this county they do not occur uniformly in areas that are large enough to be delineated on the soil map.

This rolling phase of Dandridge silt loam is medium to slightly acid and moderately low in organic matter and plant nutrients. Because of shallowness to bedrock, the water-holding capacity is low and surface runoff is moderate to rapid.

Use suitability.—Most of this soil is in a cutover forest. Many areas are inaccessible, so clearing them is not practicable. An estimated 40 percent of the cleared areas is now in crops and 50 percent in hay or pasture. About 10 percent is idle.

This soil is not well suited to crops that require tillage, because it has low water-holding capacity and is susceptible to erosion. However, it supports good pasture where phosphorus has been applied. Some areas may also require lime. For a discussion of use and management, see group 14.

Dandridge shaly silt loam, eroded rolling phase (5 to 12 percent slopes) (Da).—This is a shallow, moderately well drained to excessively drained, light-colored soil of the uplands. It occurs in narrow, elongated areas on ridge crests. It is from 10 to 30 inches deep over calcareous shale. There are many outcrops of calcareous shale bedrock, and a great many shale fragments are distributed throughout the soil mass. The soil is moderately eroded.

The soil material is predominantly light yellowish-brown to brownish-yellow, moderately plastic, shaly silty clay loam. In distribution and associations, and in the type of variation included in the mapping unit, this soil is similar to others of the same series.

Use suitability.—All of this soil has been cleared and used for crops or pasture. An estimated 30 percent is now in crops and 60 percent in hay or pasture. About 10 percent is idle. This soil is not well suited to crops, because of its low water-supplying capacity. It produces good pasture, especially where phosphorus has been applied. It appears to be well suited to grasses and legumes, including alfalfa. For a discussion of use and management, see group 14.

Dandridge shaly silt loam, very steep phase (50+ percent slopes) (De).—This soil differs from Dandridge shaly silt loam, steep phase, chiefly in having stronger slopes and in being shallower. In addition, outcrops of bedrock are more common and the surface soil and subsoil layers are less distinct.

The soil material consists of light yellowish-brown to brownish-yellow shaly silt loam to shaly silty clay loam. It occurs in small scattered areas over the part of the county that is underlain by calcareous shale. The soil is from 5 to 15 inches deep.

Use suitability.—Practically all of this soil is still in forest. Because of the very steep slopes, rapid runoff,

and shallow depth to bedrock, this phase is subject to severe erosion. Forestry is its best use, and any cleared areas should be reforested. For a discussion of use and management, see group 18.

Dewey silty clay loam, eroded rolling phase (5 to 12 percent slopes) (Dh).—This well-drained soil of the limestone uplands has a brown surface soil and a light-red or yellowish-red subsoil. It has developed from relatively high-grade dolomitic limestone and generally occurs on the broader, smoother, or lower areas of the upland limestone. The soil differs from the Dunmore soils, with which it is closely associated, in being deeper, slightly darker in color, and more friable throughout the profile. It also appears to be more productive than the Dunmore soils.

Profile description:

0 to 7 inches, brown to yellowish-brown moderately friable silty clay loam; medium weak crumb structure; forest areas have a thin surface layer stained dark with organic matter.
7 to 32 inches, red to yellowish-red, dense, plastic silty clay to clay; strong coarse blocky structure that becomes less distinct in lower part; some yellow splotches and streaks in lower part.
32 inches +, yellowish-red, dense, very plastic silty clay or clay, splotched or streaked with yellow; bedrock at depths of 3 to 10 feet or more.

A large part of the original surface layer has been removed by erosion. The present surface layer, therefore, varies greatly in color, texture, and thickness. In some places this layer is 2 to 8 inches thick. A few small severely eroded areas have lost practically all of the surface layer, and the reddish-colored subsoil is exposed. In many places the present surface layer is a mixture of remnants of the original surface soil and the top part of the subsoil. The extreme variation in surface color is from light brown to red, and in texture, from silt loam to silty clay loam.

This soil is medium to strongly acid. Because of the dense subsoil, moisture is slowly absorbed and surface runoff is moderately rapid. The soil is moderately low in water-supplying capacity, and moderately high in its ability to hold or store plant food. It is virtually free of stones, but outcrops of bedrock occur locally. Small angular chert fragments may occur on the surface and in the soil mass, but they do not interfere with tillage.

Use suitability.—Practically all of this soil has been cleared. It is now being used for pasture and for all crops commonly grown in the area. Very little of it is idle.

This is a very desirable upland soil for crops or pastures. It is well suited to all the common crops, especially to alfalfa and other deep-rooted legumes. Good tilth is fairly easily maintained. Erodibility and unfavorable moisture conditions are the chief limitations of this soil. The restricted permeability of the subsoil slows the absorption and percolation of water; as a result, the surface soil tends to become either extremely wet or extremely dry. Erosion is a hazard because the slow absorption of water increases surface runoff. Good management can make the soil moisture problem less severe. For a discussion of use and management, see group 8.

Dewey silty clay loam, eroded hilly phase (12 to 25 percent slopes) (Dk).—This soil differs from Dewey silty clay loam, eroded rolling phase, primarily in having stronger slopes and in being shallower to bedrock. A considerable part of the original surface soil has been removed by erosion, and the present surface soil varies greatly from place to place.

The present surface soil is generally a brown or yellowish-brown, moderately friable silty clay loam or heavy silt loam. The subsoil is red to yellowish-red plastic silty clay or clay of well-developed coarse blocky structure. Depths to limestone bedrock are 3 to 10 feet. The soil occurs in small widely scattered areas throughout the limestone uplands. It is associated with the Dunmore, Emory, Greendale, and Hermitage soils and other members of its own series.

The soil is medium to strongly acid throughout and and has a moderate supply of organic matter and plant nutrients. The dense subsoil slows water absorption and causes surface runoff to be moderately rapid. The subsoil, however, is permeable enough for normal penetration of plant roots and circulation of air and moisture. The soil has a moderately high water-supplying capacity. Its ability to hold fertilizers is also moderately high. Although the soil is virtually free of stones, small angular chert fragments may be sparsely scattered over the surface and through the soil mass. They do not interfere with tillage or reduce productivity. Some small areas are severely eroded; others are uneroded.

Use suitability.—Practically all of this soil has been cleared and is used for crops and pasture. An estimated 60 percent is used for crops and 40 percent for pasture.

This soil is probably best suited to permanent pasture. The strong slopes and slow rate of water absorption make it susceptible to further damage by erosion, especially when it is bare of vegetation or is in row crops. However, the soil is productive of practically all the common crops, including the deep-rooted legumes such as alfalfa. If cropland is needed, this soil can be used in a long rotation consisting mostly of well-fertilized close-growing crops. This is one of the most productive soils for grasses and legumes in the entire county. This soil can be tilled only within a narrow range of moisture conditions. The surface soil is likely to be either very wet or very dry. Good tilth is rather difficult to maintain because of the clay content. For a discussion of use and management, see group 12.

Dunmore silt loam, rolling phase (5 to 12 percent slopes) (Dsa).—This well-drained soil occurs in the limestone valleys and has a light-colored surface soil and a yellowish-red subsoil. It has developed from slightly clayey to moderately high grade limestones. The soil differs from the Dewey soils chiefly in being lighter colored throughout the profile and somewhat less productive.

This soil is on rolling ridge crests or mild slopes and is widely distributed throughout the Great Valley. It is closely associated with the Dewey, Emory, Greendale, and Lindside soils, and with other members of its own series.

Profile description:

0 to 8 inches, light yellowish-brown friable silt loam of a medium soft crumb structure; upper 1 to 2 inches in forest areas stained dark with organic matter.
8 to 25 inches, yellowish-red to reddish-yellow, firm, dense, plastic silty clay; well-developed coarse blocky structure.
25 inches +, yellowish-red dense very plastic silty clay to clay, splotched or streaked with yellow; coarse blocky to subangular structure; bedrock at depths of 3 to 10 feet.

This soil is medium to strongly acid and well supplied with organic matter and plant nutrients. The dense subsoil makes water absorption rather slow and causes surface runoff to be moderately rapid. Once absorbed, the water is well retained. The water-supplying capacity is moderate. The ability of this soil to hold or store plant nutrients or fertilizers is also moderately high. It is virtually free of stones, although outcrops of bedrock occur locally, and there are a few small angular chert fragments on the surface and in the soil mass. These are not numerous enough to reduce productivity or interfere with cultivation.

Where this soil is associated with those of the high terraces, such as the Waynesboro, Cumberland, or Nolichucky soils, there are small areas that have a thin layer of terrace material on the surface. In these areas the top layer is generally somewhat coarser textured and slightly deeper and more friable. Occasional cobblestones occur on the surface. An example of this variation occurs in the vicinity of Washington College.

Where this soil is associated with the Allen and Jefferson soils, there are small areas that have a thin layer of colluvial material on the surface and mixed with the soil. In these areas the surface layer is also slightly coarser, deeper, and more friable, and angular sandstone or quartzite fragments may occur in some places. This variation occurs in many places along the mountain foot slopes where colluvium has spread over the limestone foothills and has been partly removed by erosion, or where the original deposit was very thin.

This mapping unit also includes soils formed from a clayey limestone, which in places contains a very small amount of shale. These included soils are slightly shallower, heavier, and less permeable than the soil described. They are rather extensive near Cherry Grove.

Use suitability.—Practically all of this soil is in cutover forest consisting chiefly of oaks and hickories. It is well-suited to crops and pasture, but most of the acreage is in small areas isolated from other cleared fields. If cleared, its use suitability would be similar to that of Dunmore silty clay loam, eroded rolling phase. For a discussion of use and management, see group 8.

Dunmore silty clay loam, eroded rolling phase (5 to 12 percent slopes) (Dse).—This soil differs from Dunmore silt loam, rolling phase, chiefly in having a finer textured surface soil. It is widely distributed throughout the Great Valley part of the county and is one of the most important and extensive soils of the entire area. It is closely associated with the Dewey, Emory, Lindside, and Greendale soils and the stony land types. The native vegetation was deciduous forest.

Profile description:

0 to 7 inches, light yellowish-brown to reddish-yellow, friable or moderately friable silt loam to silty clay loam; weak medium crumb structure.
7 to 28 inches, yellowish-red to reddish-yellow dense plastic silty clay; well-developed coarse blocky structure.
28 inches +, yellowish-red, dense, very plastic silty clay or clay, splotched or streaked with yellow; contains small shale fragments in places; bedrock at depths of 3 to 10 feet or more.

A large part of the original surface layer has been lost through erosion, and the present surface layer varies greatly in color and thickness. The present surface layer generally is 3 to 7 inches thick, and the color ranges from light yellowish brown to yellowish red. In a few small areas all the original surface soil is gone and the reddish subsoil is exposed.

This soil is medium to strongly acid, moderate in organic matter except in the more severely eroded areas, and fairly high in plant nutrients. It is practically free of stones, although the bedrock is exposed in a few places. Because of the dense subsoil, moisture is absorbed rather slowly and surface runoff is moderately rapid. The soil has a medium water-supplying capacity.

Most of this soil is moderately eroded, but there are a few uneroded areas, and also some severely eroded areas. The severely eroded areas are slightly shallower, heavier, and less permeable. An example of this severely eroded variation occurs in the vicinity of Cherry Grove. Another variation occurs adjacent to the terrace soils. Here the surface soil includes some alluvial material. It contains a few cobbles and is more friable and coarser textured.

This soil is also adjacent to and associated with the colluvial soils of the mountain foothills, so it includes areas where there are thin smears of colluvial materials from the Jefferson, Allen, and Ramsey soils. The colluvium creates a slightly more friable, coarser textured surface soil. Angular sandstone fragments may sometimes occur on the surface of this colluvial variation.

Use suitability.—Practically all of this soil has been cleared and cultivated. An estimated 60 percent is now in crops, 25 percent in hay, including lespedeza and alfalfa, and 15 percent in pasture. Very little of it is idle.

This soil is well suited to a wide variety of crops and to pasture. It is especially well suited to alfalfa and the other deep-rooted legumes, and it is considered one of the best upland soils of the county for pasture (fig. 4).

***Figure 4.*—Dunmore silty clay loam, eroded rolling phase. Alfalfa in foreground, orchardgrass in shocks, and pasture and hay crops in background.**

Tobacco, corn, and truck crops are not so well suited to this soil as to the coarser textured more friable soils, but good yields are obtained in many places. The subsoil is slowly permeable; this slows the absorption and percolation of water and causes the surface soil to be alternately very wet and very dry. This condition limits the use of the soil for crops. The slow absorption

of water naturally increases the rate of runoff and partly accounts for the erodibility of this soil. For a discussion of use and management, see group 8.

Dunmore silty clay, severely eroded rolling phase (5 to 12 percent slopes) (Dsc).—This soil differs from Dunmore silty clay loam, eroded rolling phase, chiefly in being more eroded. Most of the original surface soil and, in most places, a part of the subsoil have been lost through erosion.

The present surface layer ranges from yellowish-red to yellowish-brown in color and from silty clay loam to silty clay in texture. The subsoil is a reddish-yellow to yellowish-red plastic silty clay or clay. Gullies 1 to 3 feet deep are rather common. The areas between gullies may still have a part of the original surface soil. The soil has developed under a deciduous forest from materials weathered from slightly clayey dolomitic limestone. Small scattered areas occur throughout the limestone part of the county.

Use suitability.—All of this soil has been cleared and used for crops and pasture. At present much of it is idle land, but the larger part is used for pasture and crops.

The soil is inferior to Dunmore silty clay loam, eroded rolling phase, for crops or pasture because it is lower in organic matter and plant nutrients. It also has a lower water-supplying capacity and greater susceptibility to erosion. It is considered suitable for crops grown in a long rotation, but on most farms it is probably best used for semipermanent hay or pasture. For a discussion of use and management, see group 8.

Dunmore silt loam, hilly phase (12 to 25 percent slopes) (Dsb).—This soil differs from Dunmore silt loam, rolling phase, chiefly because it occupies stronger slopes. It is widely distributed throughout the Great Valley part of the county in close association with the Dewey, Emory, Lindside, Greendale, and Groseclose soils and other soils of its own series.

Profile description:

0 to 8 inches, light yellowish-brown friable silt loam; has thin surface layer stained dark with organic matter.
8 to 26 inches, yellowish-red to reddish-yellow, dense, plastic silty clay; well-developed coarse blocky structure.
26 inches +, yellowish-red, dense, very plastic silty clay to clay, streaked and splotched with yellow; contains small shale fragments in places; bedrock at depths of 3 to 10 feet or more.

This soil is medium to strongly acid, and the supply of organic matter and plant nutrients is high, especially in the surface layer. It is practically free of stones although in places outcrops of bedrock occur. Moisture absorption is slow because of the dense subsoil. The soil allows normal penetration of plant roots, air, and moisture.

Dunmore silt loam, hilly phase, includes small areas of associated soils and also some soils derived from the residuum of clayey limestone. These soils are slightly shallower, heavier, and less permeable than the soil described.

Use suitability.—All of this soil is now in forest. The soil is fairly well suited to crops and well suited to pasture. It is not feasible to clear many of the areas because they are isolated from other tilled land. If cleared, their use suitability would be similar to that of Dunmore silty clay loam, eroded hilly phase. For a discussion of use and management, see group 12.

Dunmore silty clay loam, eroded hilly phase (12 to 25 percent slopes) (Dsf).—This soil differs from Dunmore silt loam, rolling phase, chiefly in being eroded and occupying stronger slopes. A considerable part of the original surface soil is gone, and in a few severely eroded spots the subsoil is exposed.

This soil is widely distributed on short ridge slopes throughout the Great Valley part of the county. The present surface layer consists of subsoil mixed with remnants of the original surface soil. It is finer textured and lower in organic matter and plant nutrients than the original surface soil. It is light yellowish brown to yellowish red and 2 to 7 inches thick. The subsoil is plastic yellowish-red or reddish-yellow silty clay or clay, like that of the other Dunmore soils.

Use suitability.—Practically all of this soil has been cleared. An estimated 15 percent is in corn, 15 percent in small grains, 30 percent in hay crops, and 30 percent in pasture. About 10 percent is in miscellaneous crops or is idle.

The soil is moderately well suited to crops if properly managed. Rotations should be long and should consist chiefly of close-growing crops, preferably grasses and legumes. This soil is probably best used for pasture or semipermanent hay crops on most farms. Good pastures can be easily established and maintained if enough lime and phosphorus are used. For a discussion of use and management, see group 12.

Dunmore silty clay, severely eroded hilly phase (12 to 25 percent slopes) (Dsd).—This soil differs from Dunmore silt loam, rolling phase, chiefly in occupying stronger slopes and in being severely eroded. Most of the original surface layer is gone, and the present surface layer consists largely of the yellowish-brown to yellowish-red subsoil material. Gullies 1 to 3 feet deep are rather common. Some areas between gullies still have a considerable part of the original surface soil. The soil is widely distributed throughout the Great Valley part of the county.

Use suitability.—All of this soil has been cleared. Some is used for pasture, and a small acreage is used for crops, but most of it is idle. Yields of crops are generally very low, and crop failure is rather common.

This soil has been severely damaged by erosion and is now better suited to pasture or semipermanent hay than to crops that require tilling. Lime and phosphorus are essential for establishing and maintaining good pastures. When it is necessary to grow crops, hay should be selected in preference to other crops. Good stands of alfalfa have been obtained where lime, phosphorus, and manure have been applied. It is sometimes difficult to obtain satisfactory stands because tilth is not favorable. The decrease in productivity caused by severe erosion can be overcome to some extent by growing grasses and deep-rooted legumes for a number of years. For a discussion of use and management, see group 16.

Dunmore silty clay loam, eroded steep phase (25 to 50 percent slopes) (Dsg).—This soil differs from Dunmore silt loam, rolling phase, chiefly in having lost a large part of the original surface soil and in having stronger slopes. The present surface soil is somewhat finer textured than that of Dunmore silt loam, rolling phase, and it is lower in organic matter and plant nutrients. In addition the surface soil is considerably more varied in color and thick-

ness. It is light yellowish brown to yellowish red and 2 to 6 inches thick. Some small areas have lost all the original surface soil, and the subsoil is now exposed. A small acreage is uneroded.

This soil is closely associated with the Bolton, Emory, and Lindside soils and with other soils of its own series. It is distributed throughout the Great Valley part of the county.

Use suitability.—All areas of this soil have been cleared and used for crops and pasture. Most of it is now used for pasture or hay, but some is used for crops, and some is idle. The soil is not suitable for crops and is only moderately well suited to pasture. Strong slopes, lack of organic matter and plant nutrients, and extreme erodibility limit its use. Good pastures can be established and maintained by proper management, which includes applying lime and phosphorus and carefully controlling grazing. For a discussion of use and management, see group 17.

Dunmore cherty silt loam, rolling phase (5 to 12 percent slopes) (Dna).—This soil has formed from materials weathered from low-grade limestone or dolomitic limestone. It developed under a forest consisting mostly of hardwoods. The soil occupies rolling ridge crests and the broader smoother areas in which the cherty limestone soils occur. Its profile is slightly lighter colored throughout than that of Dunmore silt loam, rolling phase. It is also shallower to bedrock and somewhat less productive.

The soil is widely distributed throughout the Great Valley part of the county in association with the Groseclose, Greendale, and Pace soils and with other members of its own series. The most extensive areas are near Haws Crossroads and Fall Branch.

Profile description:

0 to 8 inches, light yellowish-brown, moderately cherty, friable silt loam; includes a thin topmost layer stained dark by organic matter.
8 to 12 inches, predominantly reddish-yellow moderately friable silty clay loam, streaked or splotched with light yellowish brown; small angular chert fragments distributed throughout.
12 to 26 inches, yellowish-red to reddish-yellow plastic silty clay of well-developed coarse subangular or blocky structure.
26 inches+, yellowish-red, dense, very plastic silty clay to clay, splotched with yellow; bedrock at depths of 3 to 8 feet or more.

This soil varies from place to place because of variation in the parent rock. As mapped, the soil has a wide range in content of chert. At one extreme are small areas that contain a small amount of fine chert, and at the other extreme are areas cherty enough to make tillage difficult. Very small areas of associated soils are included with this soil.

The soil is medium to strongly acid and moderately low in content of organic matter and plant nutrients. It is permeable to plant roots, air, and moisture. Rainfall is slowly absorbed, and surface runoff is moderately rapid. The chert fragments act as miniature barriers to the flow of surface water and help to make this soil less erodible than Dunmore silt loam, rolling phase.

Use suitability.—Practically all of this soil is in cutover forest. It is well suited to the common crops and pasture, but most of the acreage is in small tracts isolated from other cleared fields. If cleared, this soil would have the same use suitability as Dunmore cherty silty clay loam, eroded rolling phase. See group 9 for a discussion of use and management.

Dunmore cherty silty clay loam, eroded rolling phase (5 to 12 percent slopes) (Dnf).—This well-drained soil differs from Dunmore cherty silt loam, rolling phase, as a result of erosion. The present surface layer varies from light yellowish brown to reddish yellow in color and from silt loam to silty clay loam in texture. Some areas are severely eroded; they have lost most of the surface soil and part of the subsoil. The soil is widely distributed throughout the Great Valley, but it is more extensive in the northern part of the county. Large areas occur near Haws Crossroads and Fall Branch.

The soil is predominantly cherty. Some small areas contain a relatively small amount of finely divided chert; at the other extreme, the soil contains chert in amounts that seriously interfere with tillage. Outcrops of bedrock are common.

Use suitability.—Nearly all of this soil has been cleared and is being used for crops and pasture. It is moderately well suited to the crops that are commonly grown. Grasses and legumes are the best suited crops. This soil is slightly less productive than the closely associated Dunmore silty clay loam, eroded rolling phase, and it needs more fertilizer, but it is easier to keep in good tilth. Both of these soils need a moderately long rotation in which legumes and grasses predominate, and both need lime, phosphorus, and potassium for most crops. See group 9 for a discussion of use and management.

Dunmore cherty silt loam, hilly phase (12 to 25 percent slopes) (Dnb).—This is a hilly, well-drained soil of the uplands. It developed from residuum weathered from moderately cherty dolomitic limestones. It formed under deciduous forest.

The soil occurs on ridge slopes in irregularly shaped bodies and is distributed throughout the area underlain by limestone. It is closely associated with the Greendale, Pace, and Groseclose soils, the stony land types, and other soils of its own series.

Profile description:

0 to 7 inches, light yellowish-brown, moderately cherty, friable silt loam; wooded areas have 2-inch surface layer stained dark with organic matter.
7 to 12 inches, predominantly reddish-yellow, moderately friable silty clay loam, streaked with light yellowish brown; moderately well developed fine to medium nut structure.
12 to 26 inches, reddish-yellow to yellowish-red plastic silty clay; well-developed coarse blocky structure.
26 inches +, reddish-yellow or yellowish-red very plastic silty clay or clay, streaked and splotched with yellow; cherty in many places; bedrock at depths of 3 to 8 feet or more.

This soil is medium to strongly acid throughout the profile and only moderately well supplied with organic matter and plant nutrients. It is permeable enough to allow penetration of plant roots and circulation of air and moisture. Water is absorbed rather slowly and surface runoff is rapid because the subsoil is heavy and slopes are strong. The capacity to retain absorbed water is moderately high. The content of chert varies because of the variable nature of the parent rock. In only a few places does chert occur in quantities large enough to interfere seriously with tillage. The chert fragments are generally small and are scattered over the

surface and throughout the soil mass. Outcrops of bedrock occur in many areas.

The boundaries between this soil and the associated soils are indistinct in many places; consequently, this separation includes very small areas of the associated soils.

Use suitability.—All of this soil is in forest. If cleared, its suitability would be the same as that of Dunmore cherty silty clay loam, eroded hilly phase. For a discussion of use and management see group 16.

Dunmore cherty silty clay loam, eroded hilly phase (12 to 25 percent slopes) (Dng).—This soil differs from Dunmore cherty silt loam, hilly phase, chiefly because it it has been eroded. A large part of its original surface soil is gone. In many places the upper part of the subsoil has been mixed with the remainder of the original surface soil. As a result, the present surface layer is a light yellowish-brown to reddish-yellow moderately friable silt loam or silty clay loam, slightly heavier than the original surface soil, and having a reddish-yellow cast imparted by the subsoil material. The subsoil is a reddish-yellow to yellowish-red plastic silty clay or clay.

This soil is distributed throughout that part of the Great Valley section of the county that is underlain by limestone. It is associated with the Greendale, Groseclose, and Pace soils, the stony land types, and other members of its own series.

Use suitability.—All of this soil has been cleared. The greater part is now used for crops, but a large acreage is in pasture and some is lying idle. An estimated 15 percent is now in corn, 10 percent in small grains, 30 percent in hay, 30 percent in pasture, and 5 percent in miscellaneous crops. About 10 percent is idle land.

This soil is steep and erodible, but not to such a degree that tillage is precluded. However, continued use of this soil for crops will require careful management. For a discussion of use and management, see group 16.

Dunmore cherty silty clay, severely eroded hilly phase (12 to 25 percent slopes) (Dnd).—This soil differs from Dunmore cherty silt loam, hilly phase, chiefly in being severely eroded. The erosion losses are not uniform. Although most of the original surface soil is gone, in some places several inches of it remains. In many areas the upper part of the original subsoil has also been lost. Some areas where the yellowish-red to reddish-yellow subsoil is exposed adjoin areas that still have several inches of the original surface soil. Gullies, some more than 2 feet deep, are fairly common.

This soil is well distributed throughout the area that is underlain by limestone and is closely associated with the Groseclose, Greendale, and Pace soils, the stony land types, and other soils of its own series.

Mapped with this soil are areas of the associated soils, and some areas that are more sandy or more cherty.

Use suitability.—Some areas of this soil are still used for field crops, but yields are generally very low. Some of it is in pasture, and a large part is lying idle or is abandoned and covered sparsely with weeds and brush.

This soil has been severely damaged by erosion. It is low in organic matter, plant nutrients, and water-holding capacity. It is poor for field crops but is somewhat better suited to pasture. New pastures may be hard to establish. For a discussion of use and management, see group 16.

Dunmore cherty silt loam, steep phase (25 to 50 percent slopes) (Dnc).—This soil differs from Dunmore cherty silt loam, hilly phase, mainly in occupying stronger slopes. Like the hilly phase, it has a light yellowish-brown, moderately cherty, friable silt loam surface soil and a plastic reddish-yellow to yellowish-red silty clay to clay subsoil. The soil layers, however, are more variable in thickness, color, and consistence, and probably are somewhat thinner than those of the hilly phase.

This steep soil occurs in irregular tracts throughout most of the area that is underlain by limestone. It is closely associated with the Groseclose, Greendale, and Pace soils, and with other members of its own series.

Use suitability.—This soil is almost all in forest. Even if cleared, it is too steep to be suitable for field crops. Its natural fertility is only moderate and is easily depleted. It is highly erodible. This soil is suited to pastures, but it is not especially productive unless lime and phosphorus are added. On many farms its best use is forestry. Unless there is an urgent need for additional pasture, the clearing of the forest is not recommended. For a discussion of use and management, see group 17.

Dunmore cherty silty clay loam, eroded steep phase (25 to 50 percent slopes) (Dnh).—This soil differs from Dunmore cherty silt loam, hilly phase, chiefly in having lost a large part of the original surface soil by erosion and in occupying stronger slopes.

The surface soil consists of a light yellowish-brown, moderately cherty, silty clay loam or heavy silt loam. Where the soil has been tilled, the surface soil now has a light reddish-yellow cast because the upper part of the subsoil has been mixed with it. The subsoil is reddish-yellow to yellowish-red plastic silty clay to clay. Small areas have lost most of the surface soil and part of the subsoil.

This soil is distributed throughout the Great Valley part of the county and is associated with the Groseclose, Greendale, and Pace soils, and other members of its own series.

Use suitability.—All of this soil has been cleared. Most of it is now used for pasture, but some of it is used for crops, and some is idle. The yields of crops and pastures are fairly low under the management ordinarily practiced.

Dunmore cherty silty clay loam, eroded steep phase, is very poorly suited to crops and only moderately suited to permanent pasture. Because of the strong slopes, the soil is difficult to till and is highly erodible. It is moderately low in most plant nutrients, but fairly good pastures can be established and maintained by proper management. See group 17 for a discussion of use and management.

Dunmore cherty silty clay, severely eroded steep phase (25 to 50 percent slopes) (Dne).—This soil differs from Dunmore cherty silt loam, hilly phase, chiefly in occupying stronger slopes and in being severely eroded. Most of the original surface soil is gone, and in many places the upper part of the subsoil has also been lost. The erosion losses were not uniform; consequently, areas where the yellowish-red to reddish-yellow subsoil is exposed adjoin small areas that still have a considerable part of the original surface soil. This soil occurs in small

but conspicuous areas scattered throughout the area underlain by cherty dolomitic limestone.

Use suitability.—A large part of this soil is temporarily idle or has been abandoned. It is poorly suited to pasture or crops and can best be used for forestry. Pines are establishing themselves on many of the abandoned fields. There is evidence that pastures can be established and maintained, but at considerable expense and risk of failure. For a discussion of use and management, see group 18.

Dunmore loam, rolling phase (5 to 12 percent slopes) (Dnk).—This well-drained sandy soil of the limestone uplands has developed from materials weathered from dolomitic limestone and thinly interbedded fine-grained sandstone, or interbedded dolomitic limestone and sandy limestone. The soil differs from Dunmore silt loam, rolling phase, in having a coarser surface soil, in occupying higher elevations, and in being somewhat less productive. It occurs on hill crests and on the broader, smoother, uneroded areas within the region occupied by the coarser textured Dunmore soils. The forest consists chiefly of oaks, hickories, and poplars. This soil is closely associated with the Bolton, Greendale, and Pace soils, the stony land types, and other soils of its own series.

Profile description:

0 to 8 inches, light yellowish-brown to very pale brown, very friable loam; has a thin surface layer stained dark with organic matter; contains a few small sandstone fragments.
8 to 28 inches, yellowish-red to reddish-yellow plastic fine sandy clay to silty clay; well-developed medium blocky structure.
28 inches +, yellowish-red plastic silty clay to clay, splotched with pale yellow and light yellowish brown; splotchings increase with depth; bedrock at depths of 5 to 10 feet or more.

The soil is medium to strongly acid throughout the profile and moderate in content of plant nutrients and organic matter. It is permeable enough to allow normal growth of plant roots and medium circulation of air and moisture. It absorbs rainfall moderately well, and its water-holding capacity is fairly high. Internal drainage is good. Small soft sandstone fragments are scattered thinly over the surface and throughout the soil mass. In some places they are numerous enough to interfere with tillage and to affect the productivity of the soil.

The surface texture of this soil differs from place to place because of the variation in amount of sandstone in the parent rock. The extreme range is from fine sandy loam to heavy silt loam.

Use suitability.—Practically all of this soil is still under a cover of cutover forest. If cleared, its use suitability would be the same as that of Dunmore loam, eroded rolling phase. For a discussion of use and management, see group 8.

Dunmore loam, eroded rolling phase (5 to 12 percent slopes) (Dnl).—This soil occurs on rolling ridge crests and on the broader, smoother, eroded areas in the region occupied by the coarser textured Dunmore soils. It differs from Dunmore silty clay loam, eroded rolling phase, chiefly in having a coarser surface texture, in being a little less productive, and in occurring at higher elevations. It differs from the Dunmore loam, rolling phase, in being eroded.

Erosion has removed a large part of the original surface soil. In a few small severely eroded areas, all of the original surface layer is gone and the yellowish-red or reddish-yellow subsoil is exposed. Practically all areas have a few stones, and in places they are numerous enough to interfere with tillage. The soil has formed under a deciduous forest consisting chiefly of oaks, hickories, chestnuts, and poplars.

Use suitability.—All of this soil has been cleared and now is used for crops and pasture. An estimated 20 percent is in corn, 20 percent in small grains, 35 percent in hay, 25 percent in pasture, and 5 percent in tobacco, market vegetables, and miscellaneous crops.

This soil is suited to most of the crops commonly grown in the county, especially grasses and alfalfa and other legumes. Erodibility restricts its use for cultivated crops. Crop rotations and fertilizers are needed to maintain or to increase crop yields and to conserve the soil. A suitable rotation could include a row crop every 3 or 4 years. For a discussion of use and management, see group 8.

Dunmore loam, hilly phase (12 to 25 percent slopes) (Dnm).—This soil differs from Dunmore loam, rolling phase, chiefly in having stronger slopes. The native vegetation consists mainly of deciduous trees.

The soil occurs chiefly on ridge slopes. Areas of it are scattered throughout the Great Valley part of the county. It is closely associated with the Bolton, Groseclose, Greendale, and Pace soils, and with other members of its own series.

Profile description:

0 to 8 inches, light yellowish-brown to very pale brown, very friable, gritty loam; wooded areas have a 1-inch to 2-inch surface layer that is stained dark by organic matter.
8 to 26 inches, reddish-yellow to yellowish-red plastic fine sandy clay or silty clay; well-developed medium blocky structure.
26 inches+, yellowish-red to reddish-yellow plastic silty clay to clay, splotched or streaked with yellow; frequency of light yellowish-brown splotchings increases with depth; well-developed medium blocky structure.

The soil is medium to strongly acid throughout the profile. Its supply of organic matter and plant nutrients is moderate. A few small soft sandstone fragments are scattered over the surface and through the profile. In places these fragments interfere with tillage. Surface runoff is medium high, but internal drainage is moderate. The soil is sufficiently permeable to allow penetration of plant roots and normal circulation of air and moisture. Water is fairly well absorbed, and the water-holding capacity is moderately high.

Use suitability.—All of this soil is in partly cutover forest. It is moderately well suited to crops if well managed. The steeper areas on many farms, however, are probably best suited to pasture. Some areas cannot be used for either crops or pasture because of inaccessibility. Permanent pasture yields fairly well without fertilizer, but it can be improved by using lime and phosphorus. Suitable crops are the same as for Dunmore loam, eroded hilly phase. For a discussion of use and management, see group 12.

Dunmore loam, eroded hilly phase (12 to 25 percent slopes) (Dnn).—This soil is like Dunmore loam, hilly phase, except for the effects of erosion. A large part of the original surface soil, including the thin surface layer highest in organic matter, is gone. Where the land has been tilled, the subsoil is mixed with the surface layer. The present surface layer is light yellowish brown to

brownish yellow or yellowish red. Small severely eroded areas are common and conspicuous because the subsoil is exposed. The present surface layer is somewhat heavier and less friable where erosion has been most severe. The subsoil, like that of Dunmore loam, hilly phase, is a yellowish-red to reddish-yellow plastic silty clay to clay. A few stones occur in most areas, and in some places they are numerous enough to interfere with tillage.

This soil occupies small areas widely distributed in the region underlain by limestone. It is closely associated with the Bolton, Groseclose, Greendale, and Pace soils, and with other members of its own series.

Use suitability.—All of this soil has been cleared and used for crops and pasture. An estimated 15 percent of it is now in corn, 5 percent in wheat, 5 percent in other small grains such as oats and barley, and 35 percent in hay. About 35 percent is used for pasture, and about 5 percent is idle (fig. 5).

***Figure 5.*—Unimproved pasture and idle land on Dunmore loam, eroded hilly phase.**

This soil is moderately well suited to the crops commonly grown in the area. As a result of erosion, it is less suitable for crops than the hilly phase of Dunmore loam. Losses of part of its original surface soil, and the consequent loss of organic matter and plant nutrients, has reduced its productivity and made it even more subject to erosion. The steeper slopes and more severely eroded areas probably can best be used for pasture on most farms. Moderate to liberal applications of lime and phosphorus are required to develop good pastures. See group 12 for a discussion of use and management.

Dunmore loam, steep phase (25 to 50 percent slopes) (Dno).—This soil differs from Dunmore loam, hilly phase, chiefly in occupying stronger slopes. In addition, it is more variable in depth to bedrock and in distinctness of surface soil and subsoil layers. Outcrops of bedrock and loose stones are also more common.

This soil is confined to the part of the Great Valley section that is underlain by sandy dolomitic limestone. It is closely associated with the Bolton, Greendale, Groseclose, and Pace soils, and other soils of its own series. Small areas of associated soils may be included in the mapping unit because the boundaries of this soil are not distinct.

Use suitability.—All of this soil has a cutover forest. Because of strong slopes and isolation from areas of tilled land, it is not feasible to clear many areas. If cleared, the soil would have use suitability similar to that of Dunmore loam, eroded steep phase. For a discussion of use and management, see group 17.

Dunmore loam, eroded steep phase (25 to 50 percent slopes) (Dnp).—This well-drained to excessively drained soil is more variable in depth to bedrock and in distinctness of surface and subsoil layers than Dunmore loam, eroded hilly phase. Outcrops of bedrock and loose stones are also more common.

This soil is confined to that part of the Great Valley underlain by sandy dolomitic limestone. It is closely associated with the Bolton, Greendale, Groseclose, and Pace soils, and with other soils of its own series. Some areas of associated soils may be included.

Use suitability.—All of this soil has been cleared. Much of it is now in pasture, some is in crops, and a small amount is idle.

The soil is not considered suitable for crops, because of the steep slopes, danger of erosion, and presence of stones in some areas. Under good management most areas are suitable for permanent pastures. Lime and phosphorus are generally required to establish and maintain good pastures. Grazing needs to be carefully controlled, so as to maintain a good sod at all times. The steeper and less accessible areas on many farms are probably best used for forestry. For a discussion of use and management, see group 17.

Emory silt loam (2 to 7 percent slopes) (Ea).—This is a brown, well-drained soil of the colluvial lands. It consists of recent colluvial or alluvial material transported from the Dewey, Bolton, Cumberland, Waynesboro, and Dunmore soils.

The soil occurs as narrow elongated areas at the bases of slopes, along narrow intermittent drainageways, and in small well-drained depressions. It is fairly well distributed in the area underlain by relatively high-grade limestones.

Profile description:

0 to 20 inches, dark-brown to brown friable silt loam.
20 to 40 inches, reddish-brown to yellowish-brown moderately friable silt loam to silty clay loam; lower part has a few splotches.
40 to 60 inches, yellowish-brown moderately plastic silty clay loam to silty clay; extends to depths of 3 to 10 feet or more.

The soil varies from place to place, depending on the kind of soil from which the parent material was washed. The color, in most places, is similar to that of the adjacent upland soil.

This mapping unit includes a few areas formed from accumulations in shallow, well-drained sinks or in narrow, bottomlike areas along intermittent drainageways. These included areas contrast with the gentle foot slopes on which this soil normally occurs.

This soil is medium acid and is apparently well supplied with organic matter and plant nutrients. It is easily permeable to plant roots, air, and moisture. Water is readily absorbed, and the water-holding capacity is high. Both internal and external drainage are moderate. The soil is relatively free of stones. Tilth is naturally good and is easy to maintain.

Use suitability.—All of this soil has been cleared and cultivated. Most of it is now used for the common field crops. An estimated 30 percent is now in corn, 25 percent in small grains, 30 percent in hay and pasture, and 15 percent in miscellaneous crops.

Emory silt loam is well suited to intensive use for all the common crops of the county. Its management requirements are simple. Yields of many crops are good without fertilization or rotation; yields can be improved by fertilizing and rotating crops. The rotation can be short; corn, legumes, and hay are one suitable rotation. Lime and phosphorus are needed for maximum yields of many crops. Nitrogen and potassium are less likely to be deficient; the need for these depends largely on the cropping system. In general, protection against erosion or flooding is not necessary, but excessive deposition of material washed from the slopes above must be prevented. A light deposit of material, however, ordinarily benefits the soil. For a discussion of use and management, see group 2.

Greendale silt loam (2 to 7 percent slopes) (Ga).—This moderately well drained to well drained soil of the colluvial lands has formed from alluvium or colluvium washed largely from Dunmore and Groseclose soils. It occurs in small areas on gentle slopes at the bases of the hills from which its soil material has washed. It is widely distributed in that part of the county underlain by limestone. The native vegetation consisted chiefly of deciduous trees.

Profile description:

0 to 15 inches, light yellowish-brown to pale-brown very friable silt loam.
15 to 36 inches, light yellowish-brown to brownish-yellow, friable silt loam or silty clay loam, lightly splotched with yellow in lower part.
36 inches+, brownish-yellow silty clay loam splotched with yellow and gray; accumulation 2 to 10 feet in depth.

This soil is medium acid and moderately well supplied with organic matter and plant nutrients. Most areas are nearly free of stones and chert. Some areas have a few small chert fragments on the surface and through the soil mass, but not enough to interfere with tillage. The soil allows easy penetration of plant roots and normal circulation of air and moisture. Water is readily absorbed and well retained. Surface runoff is moderate to moderately slow.

This soil varies from place to place in depth, texture, drainage, and kind of parent material. It includes soils that occur at the bases of slopes, on narrow bottoms of intermittent drainageways, and on small alluvial fans formed by small streams on the flood plains of the larger streams.

Use suitability.—Practically all areas of this soil have been cleared and cultivated. An estimated 25 percent is now in corn, 20 percent in small grains, 40 percent in hay and pasture, and 15 percent in tobacco and other crops.

Greendale silt loam is well suited to intensive use for tilled crops. The soil is moderately fertile, has a high water-holding capacity, and produces high yields of most crops. It is only slightly susceptible to erosion. Control of runoff is a minor problem. The soil is slightly deficient in lime, phosphorus, and nitrogen. Increased yields can be expected in response to the addition of these elements. If properly fertilized, this soil will give high yields even though continuously cropped for a long time. On most farms, a short rotation that includes a legume should be used.

This soil is fairly well suited to most crops commonly grown and is one of the best for tobacco. It is, however, not so well suited to alfalfa as the Dewey, Dunmore, and some of the other upland soils. For a discussion of use and management, see group 2.

Groseclose cherty silt loam, rolling phase (5 to 12 percent slopes) (Gb).—This is a light-colored, heavy, well-drained cherty soil of the uplands. It was derived from the residuum of interbedded clayey dolomitic limestone and shaly limestone. Ordinarily, it occurs on the top of long narrow ridges that cross the county in a southwest-northeast direction. The soil has developed under a forest consisting chiefly of oaks and hickories. Its distinctive features are heavy consistence, clayey and shaly parent material, and shallow depth to bedrock. Bands of shale are common in the areas this soil occupies. Massive dark-colored chert fragments are scattered over the surface and throughout the soil mass.

Profile description:

0 to 8 inches, light yellowish-brown to dark yellowish-brown, moderately friable, crumbly cherty silt loam; has thin surface layer stained dark with organic matter.
8 to 12 inches, pale-yellow plastic silty clay to clay, streaked with light yellowish brown.
12 to 20 inches, yellowish-brown to olive-yellow, dense, very plastic silty clay or clay; well-developed coarse blocky structure.
20 inches+, variegated yellow, pale-yellow, and olive-yellow, dense, plastic silty clay or clay; underlying bedrock at depths of 2 to 8 feet.

This soil is slightly to medium acid and is moderately low in plant nutrients and organic matter. Water is absorbed rather slowly because of the dense subsoil; surface runoff is moderately rapid. The subsoil restricts penetration of plant roots and circulation of air and moisture. Dark-colored chert fragments scattered over the surface and throughout the soil mass interfere with but do not prevent tillage. Outcrops of bedrock are common. The soil varies from place to place because of the changing nature of the parent material. The degree of variation from the profile described depends chiefly on the composition of the bedrock. The boundaries between this soil and the associated soils are not distinct; consequently, very small areas of the associated soils may be included in the mapping unit.

Use suitability.—Practically all of this soil is covered by cutover forest. On many farms it is not practical to clear this soil because the areas are hard to reach. If cleared, the soil would be suitable for about the same uses as Groseclose cherty silty clay loam, eroded rolling phase. See group 9 for a discussion of use and management.

Groseclose cherty silty clay loam, eroded rolling phase (5 to 12 percent slopes) (Gg).—This soil is similar to Groseclose cherty silt loam, rolling phase, except for the effects of erosion. A large part of the original surface layer, including the thin layer of high organic-matter content, has been lost through erosion. A few very small severely eroded areas are conspicuous because the heavy, yellowish subsoil is exposed.

The present surface layer—predominantly a light yellowish-brown to yellowish-brown, moderately friable cherty silty clay loam—is about 2 to 7 inches thick. The subsoil is yellowish-brown to olive-yellow or reddish-yellow, dense, very plastic silty clay to clay. The lower part of the subsoil is streaked or splotched with yellow

and pale yellow. The underlying bedrock is at depths of 2 to 8 feet.

The soil is largely confined to the tops of long narrow ridges and is closely associated with the Dunmore and Greendale soils and with other soils of its own series.

This soil is medium to slightly acid throughout the profile; its content of organic matter and plant nutrients is relatively low. Surface runoff is moderately rapid because the dense subsoil slows absorption and percolation of water. The water-supplying capacity is moderate to moderately low. Penetration by plant roots is restricted, and soil aeration is rather poor. Dark-colored chert fragments are scattered over the surface and throughout the profile in quantities that interfere with cultivation but do not prevent it. Shaly limestone outcrops are common.

Use suitability.—All of this soil has been cleared and cultivated. An estimated 20 percent is now in cultivated crops, and about 65 percent in pasture. About 15 percent is idle, temporarily abandoned, or in unimproved pasture.

This soil is only fair for cultivated crops. It is low in plant nutrients and organic matter. The slow permeability of the subsoil makes the surface soil extremely wet or extremely dry. The moisture range for safe tillage is very narrow, and good tilth is difficult to maintain. This soil is suited to intertilled crops only if they are grown with close-growing crops in a long rotation. It is deficient in phosphorus and nitrogen. Some areas may also need lime and potassium. On most farms, the best use of this soil is for permanent pasture. For a discussion of use and management, see group 9.

Groseclose cherty silt loam, hilly phase (12 to 25 percent slopes) (Gc).—This well-drained, plastic soil is slightly shallower to bedrock than Groseclose cherty silt loam, rolling phase, and its soil layers are less distinct. The surface layer is about 7 inches of a light yellowish-brown to dark yellowish-brown, moderately friable, heavy silt loam. A thin top layer is stained dark with organic matter. The subsoil is a yellowish-brown to olive-yellow or brownish-yellow, dense, very plastic silty clay or clay that has a well-developed coarse blocky structure. The lower part is splotched with yellow and pale yellow. Bedrock is generally at depths of 2 to 7 feet, but in many places it is near the surface. Outcrops of bedrock are common.

This soil occurs as scattered small areas throughout that part of the county underlain by clayey dolomitic limestone and shaly limestone. It is closely associated with the Dunmore, Greendale, and Lindside soils and with other members of its own series.

The soil is slightly to medium acid and moderately low in organic matter and plant nutrients. Surface runoff is rapid because the subsoil is slowly permeable and slopes are strong. Internal drainage is moderately slow, and the water-holding capacity is moderate to low. The impervious subsoil restricts penetration by plant roots and circulation of air. Dark-colored chert fragments on the surface and in the plow layer interfere with cultivation.

Use suitability.—All of this soil has a cover of cutover forest. It is not suited to production of crops. On many farms, use for crops or pasture is not practical because the soil is isolated from other tilled land. Unless additional pasture is needed, all areas of this soil should remain in forest. If cleared, the use suitability of this soil would be similar to that of Groseclose cherty silt loam, eroded hilly phase. For a discussion of use and management, see group 16.

Groseclose cherty silt loam, eroded hilly phase (12 to 25 percent slopes) (Gd).—As a result of stronger slopes and erosion, this soil is shallower than Groseclose cherty silt loam, rolling phase, and has less distinct soil layers. Part of the original surface layer has been removed by erosion. The nature of the surface soil depends largely on the degree to which it has been eroded. The present surface soil is 2 to 6 inches of light yellowish-brown to yellowish-brown heavy cherty silt loam, but in places it may be olive yellow or pale yellow. The subsoil is a yellowish-brown to olive-yellow or brownish-yellow, dense, very plastic silty clay or clay of well-developed coarse blocky structure. The lower part of the subsoil is splotched with yellow and pale yellow. Bedrock is usually at depths of 2 to 7 feet, but in some places it is near the surface. In many other places outcroppings of bedrock are common.

This soil is widely distributed over that part of the county underlain by shaly limestone. Normally it is on long narrow ridge slopes above the Dunmore soils, with which it is closely associated.

The soil is slightly to medium acid throughout and moderately low to low in plant nutrients and organic matter. Water absorption is slow and surface runoff is rapid, because of the heavy subsoil and strong slopes. Penetration by plant roots and circulation of air are slowed by the heavy subsoil. The water-supplying capacity is moderate to low, and internal drainage is moderate. Numerous chert fragments scattered over the surface and throughout the soil mass make tillage difficult.

Use suitability.—All of this soil has been cleared and used for crops and pasture. An estimated 30 percent is now used for cultivated crops, and 55 percent for pasture and hay. About 15 percent is idle, temporarily abandoned, or in unimproved pasture.

This soil is not suited to cultivated crops because it is steep, cherty, and highly erodible. Surface runoff is rapid, and erosion is very difficult to control in clean-cultivated fields. Workability is poor, and the soil is difficult to conserve. Nevertheless, very good pastures can be established and maintained by good management. Phosphorus is needed and, in some places, lime. For a discussion of use and management, see group 16.

Groseclose cherty silt loam, steep phase (25 to 50 percent slopes) (Ge).—This excessively drained soil is shallower than Groseclose cherty silt loam, rolling phase. The soil layers are thinner and less distinct, and outcrops of bedrock are more common. This soil occurs on steep ridge slopes rather than on rolling ridge crests.

The surface soil is a light yellowish-brown or yellowish-brown cherty heavy silt loam. The subsoil is a yellowish-brown to olive-yellow, dense, very plastic cherty silty clay or clay. Dark-colored massive chert fragments are scattered over the surface and throughout the soil mass in amounts large enough to interfere with tillage. Outcrops of shaly limestone bedrock are common in many areas.

Use suitability.—All of this soil is now in forest. This is the use to which it is best suited. It is very poorly

suited to crops and only moderately well suited to permanent pasture. The soil is very difficult to till because it is steep and cherty and has a very plastic subsoil. Good tilth is difficult to maintain. Erosion is a major problem unless the soil is protected by well-established vegetation. If cleared, a pasture sod should be established before cropping and erosion deplete the plant nutrients and lower the water-supplying capacity. If fertilized and seeded with suitable pasture plants, this soil could be expected to produce fair to good pastures. For a discussion of use and management, see group 17.

Groseclose cherty silt loam, eroded steep phase (25 to 50 percent slopes) (Gf).—This excessively drained soil occupies eroded slopes of narrow ridges on the steep limestone uplands. It lies above the Dunmore soils with which it is associated. As a result of erosion, it is shallower than Groseclose cherty silt loam, rolling phase, and the soil layers are less distinct.

This soil has lost, through erosion, much of its original surface layer, including all of the upper part that contains most of the organic matter.

The present surface layer is quite variable, chiefly because of erosion. It is generally a light yellowish-brown to yellowish-brown heavy cherty silt loam about 2 to 5 inches thick. The subsoil is a yellowish-brown to olive-yellow or brownish-yellow, dense, very plastic silty clay or clay that has a well-developed coarse blocky structure. The lower part of the subsoil is splotched or mottled with yellow and pale yellow. The depths to bedrock range from a very few inches up to 5 feet, and outcrops of bedrock are common.

Shallow gullies are common in this soil. About 30 acres is severely eroded.

Use suitability.—All of this soil has been cleared. Most of it is now used for pasture, some is used for crops, and some is idle. Crop and pasture yields are fairly low under prevailing management.

This soil is very poorly suited to crops and only moderately well suited to permanent pasture. It is probably best suited to forestry. The soil is difficult to till because of the steep slopes, chert, and plastic subsoil. In addition, it is very susceptible to erosion and low in most plant nutrients. Nevertheless, good pastures can be established and maintained by proper management. Phosphorus is needed and, in some places, lime. Grazing must be carefully controlled to maintain a good pasture sod. For a discussion of use and management, see group 17.

Groseclose silty clay loam, eroded rolling phase (5 to 12 percent slopes) (Gh).—This light-colored, heavy, well-drained soil of the uplands was derived from residuum that weathered from clayey dolomitic limestone. The native vegetation was largely deciduous forest. The soil occurs chiefly as small, narrow, elongated areas on the crests of long, narrow ridges. It is closely associated with the Dunmore, Greendale, and Lindside soils.

Profile description:

0 to 7 inches, light yellowish-brown to yellowish-brown friable silty clay loam.
7 to 24 inches, reddish-yellow to brownish-yellow very plastic silty clay; well-developed medium to coarse blocky structure.
24 inches+, brownish-yellow to reddish-yellow very plastic silty clay or silty clay loam, streaked and splotched with yellow; bedrock at depths of 5 to 10 feet.

A considerable part of the original surface layer has been removed from most of the areas by erosion. The plow layer consists of subsoil mixed with remnants of the original surface soil; it ranges from gray to brownish yellow and from silt loam to silty clay loam.

The entire profile is medium to strongly acid, the supply of organic matter is relatively low, and the content of plant nutrients is moderately low. In places a few small angular chert fragments are scattered over the surface and through the profile, but they do not interfere with tillage. Small outcrops of bedrock occur here and there. Thin flakes and thin bands of partly disintegrated shale fragments are common in the lower layers. This soil is permeable enough for penetration by plant roots and normal circulation of air and moisture. Water absorption is slightly restricted, and the water-holding capacity is moderately low.

Boundaries between this soil and the associated Dunmore soils are not always distinct; consequently some small areas of Dunmore soils are included in the mapping unit.

Most of this soil is moderately eroded, but small areas are included that are either not eroded or are severely eroded.

Use suitability.—Most of this soil has been cleared, but about 20 percent of it is still in cutover forest. An estimated 20 percent of the cleared area is now in corn, 15 percent in small grains, 45 percent in hay and pasture, and 10 percent in miscellaneous crops. About 10 percent is idle.

This soil is suited to crops but is moderately low in plant nutrients and in water-holding capacity. It is, therefore, a poor producer for many crops. Crop yields can be increased by using moderately long rotations that include close-growing crops, preferably the deep-rooted legumes, and by applying adequate amounts of fertilizer. The soil is deficient in lime, phosphorus, nitrogen, and possibly potassium. Contour tillage is desirable because the soil is susceptible to erosion. For a discussion of use and management, see group 8.

Groseclose silty clay loam, eroded hilly phase (12 to 25 percent slopes) (Gk).—This soil is distributed throughout the part of the county underlain by shaly limestone. It is closely associated with the Dunmore, Greendale, and Lindside soils. It differs from Groseclose silty clay loam, eroded rolling phase, chiefly in having stronger slopes.

A large part of the original surface soil has been removed by erosion. The present surface layer ranges from light yellowish brown to yellowish brown in color and from silt loam to silty clay loam in texture. Small severely eroded areas are common, and they are conspicuous because the yellowish-brown subsoil is exposed.

The soil is medium to strongly acid throughout the profile and is moderately low in organic matter and plant nutrients. A few small angular chert fragments may be on the surface and in the profile, but they do not interfere with cultivation. There are a few bedrock outcrops. This soil is only slightly permeable, and penetration by plant roots and circulation of air and moisture are somewhat restricted. Surface runoff is high, internal drainage is moderately slow, and the water-holding capacity is moderate to low.

Boundaries of the Groseclose soils are not always distinct, and small areas of the associated Dunmore

soils are included. Most areas of this soil are moderately eroded but some are uneroded.

Use suitability.—Most of this soil has been cleared and used for crops and pasture. An estimated 20 percent of the cleared area is now in corn, 15 percent in small grains, 50 percent in hay and pasture, and 5 percent in miscellaneous crops. About 10 percent is idle land.

Although this soil is commonly used for field crops, it is better suited to permanent pasture or semipermanent hay crops. Conservation is a greater problem on this soil than on Groseclose silty clay loam, eroded rolling phase, because the slopes are stronger. Surface runoff is high, and erosion is difficult to control on clean-cultivated fields. Good pastures can be established and maintained if lime and phosphate are applied and other good management is practiced. For a discussion of use and management, see group 12.

Gullied land, Dunmore soil material (7 to 40 percent slopes) (Gl).—This land type consists of badly gullied areas originally covered by one of the soils developed from limestone residuum, such as the Dunmore. Erosion has reduced it to an intricate pattern of gullies. Little of the original soil layers remains. The silty clay parent material of the soils is exposed nearly everywhere. Outcrops of limestone are common in some places, but the soil material is generally several feet thick.

Most of this land type occurs as small conspicuous areas widely distributed over that part of the county underlain by limestone. It is associated with the Dunmore, Dewey, Groseclose, and Bolton soils.

Practically all of this land has been abandoned, and much of it is reverting to forest. On most farms reforestation is the most practical means of reclaiming this soil. Tree species suited for reforesting this land are shortleaf pine and black locust. Shortleaf pine establishes itself naturally from seed, but the black locust has to be planted. For a discussion of use and management, see group 18.

Hamblen silt loam (0 to 3 percent slopes) (Hb).—This is an imperfectly drained soil of the bottom lands. It consists of mixed general alluvium washed from uplands underlain by calcareous shale, slate, quartzite, and sandstones. It differs from Staser loam chiefly in being finer textured and less well drained. The largest and most typical areas occur along Horse Creek. Small areas occur along the Watauga River in association with the Staser, Prader, Monongahela, and Tyler soils. The soil occurs on nearly level flood plains, and much of it is subject to overflow. It is virtually free of stones or gravel.

Profile description:

0 to 14 inches, grayish-brown to dark yellowish-brown friable silt loam.
14 inches +, yellowish-brown moderately friable silt loam to silty clay loam, mottled with olive gray and yellow; mottlings increase with depth; alluvial deposit is 3 to 10 feet or more deep.

The soil is medium to slightly acid and moderately well supplied with organic matter and plant nutrients. It is permeable and when not saturated is easily penetrated by plant roots and allows good circulation of air and moisture. Rainfall is readily absorbed and retained, and the water-supplying capacity is very high. External and internal drainage are both slow.

Most of this soil is imperfectly drained, but a few very small areas are poorly drained. The texture of these included areas ranges from silt loam to silty clay loam.

Use suitability.—All of this soil has been cleared. It is now used chiefly for corn, but also, to some extent, for truck crops, hay, and pasture. The yields of crops are quite variable, but those of corn and of many hay and forage crops are fairly high. This soil is not so well suited to crops as the Staser soil. Corn frequently has to be planted later in the spring and is more likely to be injured by excessive moisture. Hay crops and pasture plants that are moderately tolerant of wet conditions are about equally well suited to either soil.

Hamblen silt loam is especially valuable for pasture in some areas because it stays moist and productive through extended dry periods when the pastures on the uplands produce little feed. Drainage is generally not adequate for alfalfa. The soil is not well suited to small grains. Artificial drainage would broaden the use suitability of this soil to some extent. Ordinarily lime is not needed, but phosphorus and nitrogen generally are required. For a discussion of use and management, see group 1.

Hamblen loam (0 to 3 percent slopes) (Ha).—This is an imperfectly drained soil of the bottom lands. It consists of mixed general alluvium washed from uplands underlain by calcareous shale, slate, quartzite, and sandstone. It differs from Staser loam chiefly in having inferior drainage.

This soil occurs most extensively in small narrow areas along Dry Creek and Sinking Creek. It is closely associated with the Prader, Sequatchie, and Staser soils. Much of it is on nearly level flood plains, where it is subject to overflow. It is relatively free of stones and gravel.

Profile description:

0 to 14 inches, brown to grayish-brown very friable loam.
14 to 30 inches, grayish-brown to dark yellowish-brown friable loam to clay loam, splotched and mottled with olive gray and yellow.
30 inches+, friable sandy clay loam highly mottled with rust brown, yellow, and olive gray; alluvial deposit is 3 to 10 feet or more deep.

This soil is medium to slightly acid and moderately well supplied with organic matter and plant nutrients. It is permeable and when not saturated is easily penetrated by plant roots and allows good circulation of air. Rainfall is readily absorbed and well retained. The water-holding capacity is relatively high. Both external and internal drainage are slow.

Most of this soil is imperfectly drained, but very small areas that are either poorly drained or well drained are included. A few areas contain considerable amounts of cobblestones and gravel, but generally the texture ranges from silt loam to fine sandy loam. Some areas of strongly acid soils are also included.

Use suitability.—Nearly all of this soil has been cleared. It is now used chiefly for corn, but also, to some extent, for hay and pasture. Yields are variable, but those of corn and of many hay and forage crops are normally rather high.

Because of inferior drainage this soil is not so well suited to crops as Staser loam. Corn frequently is planted later in the spring on this soil, and it is more likely to be injured by excessive moisture. Hay crops

and pasture are moderately tolerant of wet conditions and are about equally well suited to either soil.

Hamblen loam is especially valuable for pasture in some areas. It stays moist and productive through extended dry periods when pasture on the uplands is sparse. The soil is not well suited to small grains and it is too wet for alfalfa. Artificial drainage would broaden the use suitability of this soil to some extent. Lime is ordinarily not needed, except on the strongly acid inclusions. Phosphorus and nitrogen are likely to be needed. For a discussion of use and management, see group 1.

Hayter loam, eroded rolling phase (5 to 12 percent slopes) (Hd).—This is a well-drained brown soil of the colluvial lands. It has formed from local alluvium or colluvium washed from uplands underlain largely by quartzite or sandstone, with which some material from limestone has been mixed. The material is chiefly from the Ramsey soils, but in most places it includes some materials from the Dunmore soils. The soil lies below and in some places adjacent to outcrops of limestone and is very likely influenced by lime-bearing water.

This soil occurs in small areas closely associated with the Dunmore, Ramsey, Barbourville, Sequatchie, Jefferson, and Allen soils. It occupies an intermediate position between the Sequatchie soils of the lake terraces and the Jefferson and Allen soils of the old colluvial lands.

Profile description:

0 to 11 inches, brown to grayish-brown very friable loam.
11 to 19 inches, yellowish-brown or strong-brown to reddish-brown friable clay loam; weak medium blocky structure.
19 to 30 inches+, yellowish-red friable fine sandy clay; colluvial deposit ranges from 3 to 10 feet or more in depth.

This soil is medium acid, relatively high in plant nutrients, and moderately well supplied with organic matter. Some areas have a few small sandstone rock fragments on the surface and throughout the soil, but not enough to interfere with tillage. The lower soil layers are stony or gravelly in many places. The soil is very permeable and allows easy penetration by plant roots and circulation of air and moisture. Water is readily absorbed, and the water-holding capacity is high.

Mapped with this soil are small areas of Barbourville loam, Sequatchie loam, and other Hayter soils, and also a small acreage that has enough stones in the plow layer to interfere with tillage.

Use suitability.—Practically all areas of this soil have been cleared and cultivated. An estimated 25 percent is now in corn, 20 percent in small grains, 40 percent in hay and pasture, and 15 percent in miscellaneous crops and tobacco. Very little is idle land.

This soil is well suited to pasture and to practically all crops, including tobacco, alfalfa, and market vegetables. It is naturally fertile, but crops respond well to fertilizers and lime. Large yields can be consistently produced if the supply of plant nutrients, lime, and organic matter is kept at high level. The soil is slightly erodible but can be conserved by tilling on the contour and using crop rotations of moderate length. For a discussion of use and management, see group 6.

Hayter loam, undulating phase (2 to 5 percent slopes) (Hc).—This soil occurs on terracelike formations between small streams, at the bases of long steep slopes. It is closely associated with Dunmore, Ramsey, Barbourville, Sequatchie, Jefferson, and Allen soils. It is slightly darker colored than Hayter loam, eroded rolling phase, somewhat higher in organic matter and plant nutrients, slightly deeper, and less susceptible to erosion.

The soil has a brown or grayish-brown very friable loam surface soil and a yellowish-brown or strong-brown to reddish-brown friable clay loam or fine sandy clay subsoil.

Use suitability.—Practically all areas have been cleared and cultivated. An estimated 30 percent is in corn, 20 percent in small grains, 35 percent in hay and pasture, and 15 percent in miscellaneous crops. Very little land is idle.

This soil is productive, easy to work, and well suited to intensive use for crops. Practically all crops, including tobacco, alfalfa, and market vegetables, grow well. The soil and its fertility are easily conserved against losses from erosion and leaching. Crop rotations can be short. Good yields ordinarily can be obtained without amendments, but some fertilizer and lime are needed to maintain high yields. See group 3 for discussion of use and management.

Hayter stony loam, undulating phase (2 to 5 percent slopes) (He).—This soil resembles Hayter loam, eroded rolling phase, except that it has milder slopes and contains stones that interfere with cultivation. The colluvial deposit is deeper, and the surface soil is less eroded. The soil occurs in irregularly shaped areas on the colluvial foot slopes at the base of the mountains. Normally, it is immediately below the associated Jefferson and Allen soils.

The surface layer is brown or grayish-brown very friable stony loam. The subsoil is yellowish-brown or strong-brown to reddish-brown friable stony clay loam or fine sandy clay.

The soil is medium acid and moderately high in plant nutrients and organic matter. It is very permeable and allows easy penetration by plant roots and circulation of air and moisture. Water is readily absorbed, and the water-holding capacity is moderate. Sandstone and quartzite fragments scattered over the surface and throughout the soil interfere with but do not prevent tillage.

Use suitability.—Practically all of this soil has been cleared and is used for crops and pasture. It is now used in short irregular rotations, in which row crops are grown at frequent intervals.

This soil is well suited for intensive use. It is relatively fertile and is good for most of the crops commonly grown. It is especially well suited to vegetable crops. Lime, phosphorus, and potassium are generally required for good yields of deep-rooted legumes such as alfalfa. The soil is slightly deficient in lime, phosphorus, nitrogen, and possibly potassium for maximum production of many crops. The soil and its fertility are fairly easy to conserve against losses from erosion and leaching. Good tilth is easily maintained, but the soil is difficult to cultivate because there are many stones in the plow layer. See group 4 for a discussion of use and management.

Hermitage silt loam, undulating phase (2 to 5 percent slopes) (Hf).—This is a well-drained brown soil of the colluvial lands. It developed from local alluvium or colluvium that washed from uplands underlain largely by limestone. The material came chiefly from the Cumberland, Waynesboro, Bolton, and Dewey soils, and to a

lesser extent from the Dunmore soils. The soil usually occupies small and irregular areas on foot slopes, colluvial fans, or benches. It lies immediately below the soil from which the parent material washed (fig. 6).

Figure 6.—**Hermitage silt loam, undulating phase, in a typical footslope position below Bolton loam, eroded hilly phase. Weaver silt loam on first bottom in foreground.**

Profile description:

0 to 9 inches, brown or dark-brown friable silt loam; wooded areas have a thin surface layer stained dark with organic matter.
9 to 25 inches, reddish-brown to yellowish-red moderately friable silty clay loam; weak coarse blocky structure.
25 inches+, yellowish-red, firm, moderately plastic silty clay loam or silty clay; moderate medium blocky structure; colluvial deposit 3 to 10 feet or more in depth.

This soil is medium to strongly acid, high in plant nutrients and organic matter, and permeable to plant roots, air, and moisture. Surface runoff is slow, water is readily absorbed, the water-holding capacity is high, and internal drainage is moderate. This soil is almost free of stones. Some areas have a few small chert fragments, and others may have a few cobblestones. The degree of stoniness depends on the source of the colluvial materials.

Use suitability.—Nearly all of this soil has been cleared and cultivated. An estimated 60 percent is now in crops, and 40 percent is in hay and pasture.

This soil is well suited to pasture and to practically all the crops commonly grown, including tobacco, alfalfa, and truck crops. The soil is naturally fertile, but crops are improved if fertilizer and lime are used. High yields can be produced consistently if supplies of plant nutrients, lime, and organic matter are maintained. The soil is somewhat deficient in lime, phosphorus, and possibly potassium, for continued high yields of most crops. It is only slightly susceptible to erosion. Under good management, the soil can be conserved by using rotations of short or moderate length. For a discussion of use and management, see group 3.

Hermitage silt loam, eroded rolling phase (5 to 12 percent slopes) (Hg).—This soil differs from Hermitage silt loam, undulating phase, in having stronger slopes and in being more eroded. A considerable part of the original surface layer has been lost by erosion. Erosion losses have been uneven, and in most places the plow layer is entirely within the original surface layer. In some places tillage has mixed the remnants of the surface layer with the upper part of the subsoil. A few small severely eroded spots are conspicuous because the reddish subsoil is exposed. The present surface layer ranges from silt loam to silty clay loam and from brown to reddish brown. The subsoil is yellowish-red moderately friable silty clay loam or silty clay.

Use suitability.—All of this soil has been cleared and is used for a wide variety of crops and pasture. It is well suited to practically all crops common to the area, including tobacco, truck crops, and alfalfa. Lime and fertilizer are required to maintain or to increase yields of almost all crops. The soil does not have enough phosphorus, nitrogen, or potassium for continuous high yields of most crops. Nitrogen is not required for legumes or for crops that follow legumes in a rotation. Potassium may be needed for many crops, especially the deep-rooted legumes such as alfalfa.

The soil is moderately susceptible to erosion. Crop rotations should be of medium length and should include grasses and legumes, which protect the soil, improve tilth, and add organic matter. For a discussion of use and management, see group 6.

Holston loam, undulating phase (2 to 5 percent slopes) (Hl).—This is a yellow, well-drained soil on old stream terraces. It has formed under a deciduous forest from mixed materials that were washed mainly from quartzite, sandstone, and shale. Nearly all areas are underlain by shale.

This soil occurs on high terraces along the two major streams of the county. Most of the acreage is on terraces along the Watauga River. A large part of the acreage occurs near Watauga Flats and Austin Springs. The soil is closely associated with the Nolichucky, Monongahela, and Tyler soils of the terrace lands, with the Dandridge and the sandy Litz soils of the uplands, and with the Staser, Hamblen, and Prader soils of the bottom lands.

Profile description:

0 to 10 inches, very pale brown to light yellowish-brown very friable loam; wooded areas have a 1- or 2-inch topmost layer that is stained dark gray by organic matter.
10 to 32 inches, yellow or brownish-yellow firm but moderately friable silty clay loam or clay loam.
32 inches +, pale-yellow or yellow slightly compact silty clay loam, highly mottled with brownish yellow and olive yellow; alluvial deposit is 3 to 15 feet or more thick.

This soil is strongly to very strongly acid, low in organic matter, and moderately low in most plant nutrients. Some areas are cobbly on the surface and throughout the soil mass, but locally there are stone-free areas. Thin beds of gravel or cobblestones may be at various depths but are more likely near the bottom of the deposit. The soil is permeable to plant roots, air, and moisture. Water is readily absorbed by the surface soil and subsoil, but the slightly compact substratum retards the absorption and movement of water. Surface drainage is moderate; internal drainage is moderately slow.

Most of this soil is only slightly eroded, but a few areas are moderately eroded and a few uneroded. The boundaries between this and the associated terrace soils are not distinct in most places; consequently, some of the terrace soils are included with this phase.

Use suitability.—Practically all of this soil has been cleared. It is now used rather intensively for crops and pasture. Many kinds of crops are grown.

This soil is well suited to crops. It is, however, low in plant nutrients and organic matter and medium in water-

supplying capacity. It is moderately responsive to good management. Fertility is hard to maintain, but good tilth is easily retained, and erosion control is not a problem. The soil is well suited to wheat and produces fair to good crops of corn, hay, potatoes, and tobacco. It is not suited to alfalfa. The soil is low in organic matter, lime, phosphorus, potassium, and nitrogen. A complete fertilizer is needed for most crops. If the crops are properly fertilized, productivity can be maintained by using fairly short rotations. For a discussion of use and management, see group 5.

Holston loam, eroded rolling phase (5 to 12 percent slopes) (Hm).—This soil differs from Holston loam, undulating phase, chiefly in having stronger slopes and in being eroded. Most of it lies 50 to 125 feet above the flood plain and occurs near Austin Springs and Watauga Flats. Widely distributed small areas also occur on the terraces along the Nolichucky River. This soil is closely associated with Nolichucky, Monongahela, and Tyler soils, and with other soils of its own series.

Profile description:

0 to 8 inches, very pale brown to light yellowish-brown very friable loam.
8 to 30 inches, yellow to brownish-yellow firm but moderately friable silty clay loam to clay loam.
30 inches +, yellow, slightly compact fine sandy clay or silty clay loam, highly mottled with pale yellow, olive yellow, and brownish yellow; alluvial deposit 3 to 15 feet or more in thickness.

This soil is moderately eroded, and in most places a large part of the original surface layer has been lost. The surface soil and subsoil have been mixed to some extent, but the texture of the plow layer is not much heavier, except in the severely eroded spots. Small severely eroded areas are common, and they are conspicuous because the yellow subsoil is exposed.

The soil is strongly to very strongly acid and low in organic matter and plant nutrients. It usually has stones on the surface and through the profile, but not enough to interfere with cultivation. Thin beds of gravel or cobblestones occur at various depths within the soil mass, mostly near the bottom of the deposit.

The soil is easily penetrated by plant roots and allows normal movement of air and moisture Water easily soaks into the surface and subsurface layers, but the slightly compact substratum retards the absorption and movement of soil water. Surface drainage is moderate; internal drainage is moderately slow.

Included with this soil are some very small uneroded areas and a few severely eroded spots.

Use suitability.—Practically all of this soil has been cleared and is now used for crops or pasture. An estimated 15 percent is idle each year.

This soil is well suited to crops, but it is low in plant nutrients and organic matter, moderately low in water-holding capacity, and only moderately responsive to good management. Good tilth is easily maintained. Erosion control is not a serious problem, but the fertility is somewhat difficult to maintain. This soil appears to be well suited to wheat, truck crops, tobacco, and to hay, except alfalfa. Corn is grown, but yields are generally low.

The soil is low in organic matter, lime, phosphorus, potassium, and most other elements needed by plants. Fertilization is required for good crops. The soil is susceptible to erosion, so rotations of at least moderate length are needed. For a discussion of use and management, see group 10.

Holston cobbly loam, eroded rolling phase (5 to 12 percent slopes) (Hh).—This light-colored, well-drained soil occurs on stream terraces that are 50 to 125 feet above the present flood plains of the Nolichucky and Watauga Rivers. Most of the acreage is along the Watauga River. The soil is more eroded than Holston loam, undulating phase, has thinner layers, and is somewhat shallower. In addition, it contains cobblestones that interfere with tillage.

A large part of the original surface layer has been lost through erosion, but erosion has been uneven. A few small areas have lost all of the surface soil, and the yellow subsoil is exposed. Over most of the acreage, the plow layer still consists of the original surface soil. The present surface layer is a very pale brown to light yellowish-brown very friable cobbly loam. The subsoil is yellow or brownish-yellow firm but moderately friable cobbly clay loam or silty clay loam.

The soil is strongly acid and low in organic matter and plant nutrients. It can be penetrated by plant roots and is permeable to air and moisture. Rainfall is easily absorbed, but the water-holding capacity is moderately low. Cobblestones scattered over the surface and throughout the soil mass interfere with tillage, but they do not prevent it.

Use suitability.—Most of this soil is used for hay or pasture, some is used for crops, and a considerable acreage is idle. Yields of both crops and pasture are low.

This soil is inferior to Holston loam, eroded rolling phase, for crops, chiefly because it contains enough cobblestones to interfere with tilling and harvesting of crops and clipping of pastures. It is moderately low to low in organic matter and in most of the essential plant nutrients. The water-holding capacity is moderately low to low. It is only moderately susceptible to erosion. Excessive soil loss can be prevented by tilling on the contour and using crop rotations of moderate length. Fertilization is essential for most crops. For a discussion of use and management, see group 11.

Holston cobbly loam, eroded hilly phase (12 to 25 percent slopes) (Hk).—This soil is more variable than Holston cobbly loam, eroded rolling phase, in color, texture, depth of alluvial deposit, and content of cobblestones and gravel. This soil has lost much of its original surface layer by erosion. In a few small severely eroded areas all of the surface layer is gone and the yellow subsoil is exposed. Because of the differences in degree of erosion, the surface soil varies greatly from place to place. The plow layer in many places consists of remnants of the original surface layer mixed with the topmost part of the subsoil.

The present surface is a very pale brown, light yellowish-brown, or, in places, a yellow friable cobbly loam. The subsoil is a yellow to brownish-yellow, firm, moderately friable, cobbly silty clay loam or clay loam. The alluvial deposit is 3 to 10 feet deep.

Use suitability.—Most of this soil is now used for pasture, but some is used for crops, and a large part is idle. The soil is difficult to till because it has strong slopes and contains many cobblestones. On most farms it is probably best used for pasture. It is not naturally productive. Moderate to heavy applications of lime and

phosphorus are needed to obtain even fair pasture. Weeds are difficult to control because the cobblestones prevent clipping. For a discussion of use and management, see group 16.

Jefferson stony loam, undulating phase (2 to 5 percent slopes) (Jc).—This is a light-colored, stony, well-drained soil of the colluvial lands. It lies at the base of steep mountain slopes or spreads out a short distance over the adjacent valley floor. The soil has formed from materials washed or rolled from uplands underlain largely by quartzite and sandstone. Most of the material is from the Ramsey soils.

The soil occurs in relatively small areas that are widely scattered along the foot slopes of the Unaka Mountains. It is associated with the Allen, Ramsey, and Sequatchie soils, and with other members of its own series.

Profile description:

0 to 9 inches, light yellowish-brown very friable stony loam; top 1 to 2 inches in wooded areas is stained dark by organic matter.
9 to 28 inches, pale-yellow to yellow and, in places, a brownish-yellow friable stony clay loam.
28 inches+, mixed pale-yellow, yellow, and brownish-yellow stony clay loam to silty clay loam; colluvial deposit has depths of 5 to 15 feet or more.

The soil is strongly acid, low in organic matter and plant nutrients, and very permeable to air, roots, and water. It absorbs moisture readily, but the moisture-holding capacity is moderately low. Rounded and angular stones 3 to 7 inches wide occur on the surface and throughout the soil mass in quantities that interfere with tillage. Some areas have lost a considerable part of the original surface soil.

Use suitability.—Most of this soil has been cleared and is used either for crops or pasture. About 20 percent is now used for corn, 15 percent for small grains, 25 percent for hay crops, and 25 percent for pasture. About 15 percent is used for other crops or lies idle.

This soil is suited to most of the commonly grown crops and to pasture. It is not well suited to alfalfa unless heavily fertilized and limed. Its low productivity and high content of stone limits its usefulness, but it responds well to good management. Surface runoff is slow and easily controlled. The soil does not contain enough lime and essential plant nutrients to produce even fair yields. Moderate to heavy fertilization is needed. For a discussion of use and management, see group 4.

Jefferson stony loam, rolling phase (5 to 12 percent slopes) (Jd).—This soil differs from Jefferson stony loam, undulating phase, chiefly in having stronger slopes. It occurs in small areas, largely on the foot slopes of the Unaka Mountains in association with the Ramsey and Allen soils and other soils of its own series.

Profile description:

0 to 8 inches, light yellowish-brown very friable stony loam; in most places, has 1- to 2-inch top layer stained dark by organic matter.
8 to 26 inches, pale-yellow to yellow or brownish-yellow friable stony clay loam.
26 inches+, brownish-yellow moderately friable stony clay loam to silty clay loam mottled with yellow and pale yellow; colluvial deposit 3 to 15 feet or more in depth.

The soil is strongly acid and low in organic matter and plant nutrients. It absorbs moisture readily, but its moisture-holding capacity is low. It is very permeable to air, roots, and water. Rounded and angular stones, 3 to 7 inches wide, are on the surface and throughout the soil and in numbers sufficient to interfere with cultivation.

Use suitability.—All of this soil is in forest. Its usefulness is limited by low fertility, strong slopes, and stoniness. It is low in plant nutrients and water-holding capacity and occurs in many small and inaccessible areas. The soil is not very productive, but tobacco and red clover could be grown if large quantities of fertilizer were applied. Alfalfa could be grown with fair success but is much better suited to some of the upland soils. For a discussion of use and management, see group 11.

Jefferson stony loam, eroded rolling phase (5 to 12 percent slopes) (Je).—This soil differs from Jefferson stony loam, rolling phase, chiefly in having lost a large part of surface soil because of erosion. The plow layer still consists of the original surface soil over most of the area, but in spots some of the subsoil is mixed with it. The present surface layer is a light yellowish-brown to pale-yellow friable stony loam. The subsoil is a brownish-yellow or yellow friable stony clay loam to silty clay loam.

The soil occurs on rolling areas where alluvial and colluvial materials have accumulated below areas of hilly and steep Ramsey soils. It is closely associated with the Ramsey and Allen soils, and with other soils of its own series.

Use suitability.—All areas of this soil have been cleared and are cultivated. About 20 percent is now used for corn, 15 percent for small grains, 25 percent for hay crops, and 30 percent for pasture. About 10 percent is in other crops or is idle.

The soil is moderately well suited to crops and pasture, but yields are not good. Its usefulness is limited by low fertility, poor water-holding capacity, stoniness, and strong slopes. Fertilizers are necessary for good yields of most crops, and heavy applications of lime and fertilizer are required to maintain stands of legumes. The soil is moderately erodible, and a special effort is required to control surface runoff. For a discussion of use and management, see group 11.

Jefferson stony loam, hilly phase (12 to 25 percent slopes) (Jf).—This soil differs from Jefferson stony loam, rolling phase, chiefly in having stronger slopes. It is more variable in amounts of stones and depths to underlying material. It occurs in small irregularly shaped areas on the foot slopes of the mountains. The Ramsey and Allen soils are closely associated with it.

Profile description:

0 to 8 inches, light yellowish-brown very friable stony loam.
8 to 22 inches, yellow or pale-yellow to brownish-yellow friable stony clay loam.
22 inches+, brownish-yellow stony clay loam to silty clay loam, mottled with yellow and pale yellow; colluvial deposit has depths of 3 to 15 feet or more.

This soil is strongly acid. It absorbs moisture readily but does not retain it well. It is low in organic matter and plant nutrients but is permeable to plant roots, air, and moisture. Numerous rounded and angular stone fragments 2 to 10 inches wide are on the surface and throughout the soil mass. A few stones more than 10 inches wide occur on the surface.

Use suitability.—Nearly all of this soil is forested. It is not suitable for crops and is poor for pasture. It is low in fertility and water-holding capacity and difficult to

till and manage because of the many stones and strong slopes. Moderate to heavy applications of lime and phosphorus are required to establish and maintain good pastures. On many farms, the soil is best used for forestry. For a discussion of use and management, see group 16.

Jefferson stony loam, eroded hilly phase (12 to 25 percent slopes) (Jg).—This soil differs from Jefferson stony loam, rolling phase, chiefly in occupying stronger slopes and in being eroded. A large part of the original surface soil has been lost, and remnants of the surface soil are mixed with the subsoil in the plow layer. The subsoil is exposed in a few places. The present surface soil, slightly finer textured and lower in plant nutrients and organic matter than the original, is a friable stony loam, 2 to 6 inches thick and a light yellowish brown to pale yellow. The subsoil is yellow to brownish-yellow stony clay loam to silty clay loam. This soil is similar to the rolling phase of the Jefferson stony loam in distribution and association.

Use suitability.—All of this soil has been cleared and used for crops or pasture. At present, much of it is in hay or pasture. A large part is idle and some is used for crops. Crop and pasture yields are generally very low.

This soil is not suitable for cultivated crops and is poor for pasture. Nevertheless, fair pastures can be established and maintained under good management. On most farms pasture is probably the best use. Moderate to heavy applications of lime and phosphate are required to establish and maintain good pastures. The stones prevent clipping and make the control of weeds in pastures difficult. For a discussion of use and management, see group 16.

Jefferson loam, undulating phase (2 to 5 percent slopes) (Ja).—This light-colored, sandy, well-drained soil of the colluvial lands occurs at the base of steep mountain slopes or spreads out short distances over the valley floor. The soil has formed from materials washed or rolled from uplands underlain largely by quartzite and sandstone. Most of this material was derived from the Ramsey soils.

The soil ordinarily occurs in small areas widely scattered along the base of the Unaka Mountains in the southern part of the county. It is closely associated with the Ramsey, Sequatchie, and Allen soils, and other soils of its own series.

Profile description:

0 to 9 inches, light yellowish-brown very friable loam; virgin areas have a thin surface layer stained dark by organic matter.
9 to 28 inches, pale-yellow or yellow to brownish-yellow friable clay loam to silty clay loam.
28 inches+, brownish-yellow moderately friable clay loam or fine sandy clay, splotched with yellow, pale yellow, and gray; accumulation is 5 to 20 feet deep.

The soil is strongly acid, low in organic matter and plant nutrients, and permeable to plant roots, air, and moisture. Surface runoff is slow, rainfall is readily absorbed, and the water-holding capacity is moderate. A few small stones are scattered over the surface and throughout the soil mass, but they do not hinder tillage.

The soil is dominantly uneroded or slightly eroded, but it includes small moderately eroded patches. The texture ranges from loam to fine sandy loam.

A few small areas having a reddish-yellow subsoil are included, as well as other associated soils.

Use suitability.—Most of this soil has been cleared and cultivated. It is now used for a wide variety of crops and pasture; only an estimated 10 percent is idle or in nonfarm use. It is well suited to all the commonly grown crops and pasture, except alfalfa, for which the red upland soils are better suited. Low fertility limits the use of this soil, but it responds well to fertilizers and good management. The soil is highly deficient in lime, phosphorus, nitrogen, and potassium. If these deficiencies are corrected, moderately high crop yields are possible. The soil is easy to till and to keep in good tilth. It is not very susceptible to erosion and can be maintained in short rotations if other management practices are good. For a discussion of use and management, see group 5.

Jefferson loam, eroded rolling phase (5 to 12 percent slopes) (Jb).—This well-drained soil differs from Jefferson loam, undulating phase, chiefly in having stronger slopes and in being eroded. It occurs in small irregularly shaped areas in close association with the Allen, Sequatchie, and Ramsey soils and with other soils of its own series.

Profile description:

0 to 7 inches, light yellowish-brown very friable loam.
7 to 28 inches, pale-yellow or yellow to brownish-yellow friable clay loam.
28 inches+, brownish-yellow moderately friable fine sandy clay mottled with yellow, pale yellow, and gray; accumulation is 4 to 15 feet deep.

Most areas of this soil are moderately eroded, and a large part of the original surface soil is gone. In some places remnants of the surface soil have been mixed with the subsoil to form a present surface layer that is highly variable in thickness, color, and texture.

The soil is strongly acid, low in organic matter and plant nutrients, and permeable to plant roots, air, and moisture. Surface runoff is slow to moderate, and internal drainage is moderate. The few stones on the surface and throughout the soil mass do not seriously interfere with cultivation.

A few small areas of associated soils are included with this phase. Some of the included soils are stony.

Use suitability.—Most of this soil has been cleared and cultivated. An estimated 20 percent is now in corn, 15 percent in small grains, 30 percent in hay crops, 15 percent in pasture, and 10 percent in other crops. About 10 percent is in nonfarm uses, or is idle.

This soil is moderately well suited to crops and pasture. The yields of most crops are low because the soil is low in fertility and has moderately low water-holding capacity. The soil is deficient in lime, phosphorus, nitrogen, and potassium for most crops, but it responds well to the applications of these fertilizers. It is not highly susceptible to erosion and can be maintained by the use of moderately short rotations if it is properly fertilized and otherwise well managed. For a discussion of use and management, see group 10.

Leadvale silt loam, undulating phase (2 to 5 percent slopes) (La).—This is a light-colored, moderately well drained soil of the colluvial lands. It occupies alluvial and colluvial foot slopes, benches, and fans below the adjacent Dandridge or Litz soils, and it developed on material washed from those soils.

The soil occurs in narrow, elongated areas of small

acreage in association with the Dandridge, Litz, Hamblen, and Whitesburg soils. The most typical and extensive areas are along Horse Creek and near Johnson City.

Profile description:

0 to 8 inches, yellowish-brown, moderately friable, heavy silt loam; weak medium crumb structure.
8 to 24 inches, pale-yellow to yellow or brownish-yellow firm silty clay loam to silty clay; moderately well developed medium nut or blocky structure.
24 inches+, pale-yellow to yellow, firm, very plastic silty clay, mottled with light gray and yellowish brown; mottling increases with depth; colluvial deposit is 2 to 10 feet deep.

The soil is medium to strongly acid and low in organic matter and plant nutrients. Soil moisture is favorable for most crops except alfalfa and other deep-rooted legumes. Surface runoff is slow to medium, internal drainage is rather slow, and after heavy rains the soil becomes saturated with water. It is virtually stone-free, but in most places numerous weathered shale fragments are on the surface and throughout the soil mass.

The soil varies in texture, drainage, and depth. It grades to the Dandridge of Litz soils in some places and to the Hamblen, Lindside, or Weaver soils in other places. Some areas are slightly influenced by limestone materials.

Use suitability.—All of this soil has been cleared and is used for crops and pasture. An estimated 20 percent is now in corn, 15 percent in small grains, 35 percent in hay and pasture, and 10 percent in other crops. About 20 percent is in nonfarm use or is idle.

Leadvale silt loam, undulating phase, is suited to pasture and to most of the common crops except alfalfa. It can be maintained in short rotations if adequately fertilized and otherwise well managed. Proper applications of lime, phosphorus, nitrogen, and potassium are needed to maintain high crop yields. Slopes are mild and erosion is not a serious problem. For a discussion of use and management, see group 5.

Leadvale silt loam, eroded rolling phase (5 to 12 percent slopes) (Lb).—This soil is similar to Leadvale silt loam, undulating phase, in distribution and in association with other soils. It differs from Leadvale silt loam, undulating phase, chiefly in occupying stronger slopes and in being more eroded. The loss from erosion varies greatly. In severely eroded spots all of the original surface is gone and tillage is entirely in the subsoil. Most of the areas, however, still have enough of the original surface soil to allow tillage within that layer. The present surface soil is dominantly a yellowish-brown moderately friable heavy silt loam. The subsoil is a pale-yellow, yellow, or brownish-yellow, firm, plastic silty clay or silty clay loam. The colluvial deposit has depths of 2 to 10 feet.

Use suitability.—Nearly all of this soil has been cleared and cultivated. It is now being used for a wide variety of crops and pasture. The suitability of this soil for agriculture is similar to that of the undulating phase. Rotations, however, should be longer and less intense, because of the strong slopes and danger from erosion. Moderately short rotations are safe if proper fertilization and other good management are practiced. All of the commonly grown field crops are fairly well suited to the soil, with the exception of the deep-rooted legumes such as alfalfa. The soil is generally deficient in lime, phosphorus, nitrogen, and potassium. For a discussion of use and management, see group 10.

Lindside silt loam (0 to 3 percent slopes) (Lc).—This light-brown imperfectly drained soil occurs in stream bottoms in the limestone valleys. It mainly consists of alluvium washed from uplands underlain by limestone, but small amounts of material from other sources are present in most places. The Dunmore, Dewey, Bolton, and Groseclose soils are the source of most of the material. The surface is nearly level, and all areas are subject to overflow.

Most of this soil occurs in narrow, elongated areas along small streams. It is associated with the Dunmore, Dewey, Bolton, and Groseclose soils of the adjacent uplands, and with the Emory, Greendale, and Pace soils of the colluvial lands.

Profile description:

0 to 15 inches, dark yellowish-brown to brown mellow silt loam.
15 to 30 inches, dark yellowish-brown friable silt loam, mottled with yellow or pale yellow.
30 inches+, heavy silt loam to silty clay loam, mottled with pale yellow, pale olive, and gray; bedrock at depths of 5 to 10 feet or more.

The soil is medium to slightly acid, well supplied with organic matter and plant nutrients, and permeable to air, roots, and water. The lower layers are sometimes saturated with water, and this restricts movement of air, roots, and water. Both internal and external drainage are slow, and the water-holding capacity is very high.

A few small poorly drained areas are included, and also some areas that are better drained.

Use suitability.—Practically all of this soil has been cleared and cultivated. An estimated 35 percent is now used for corn, 10 percent for small grains, 30 percent for hay, 20 percent for rotation pasture, and 5 percent for other crops.

This is a productive soil, but its usefulness is limited by imperfect drainage and susceptibility to overflow. It is well suited to corn and some hay and pasture crops, but not well suited to alfalfa and small grains. The water table is too high for alfalfa, and small grains commonly lodge. Excessive moisture often interferes with tillage and other field operations, but otherwise the soil is normally not difficult to work. It is naturally well supplied with plant nutrients and organic matter, which are periodically replenished by the deposit of sediment from floodwaters. For a discussion of use and management, see group 1.

Litz shaly silt loam, steep phase (25 to 50 percent slopes) (Lm).—This is an excessively drained, shallow, shaly soil of the steep uplands. It has formed under mixed forest from materials that weathered from an acid shale that contains widely spaced beds, or strata, of limestone or calcareous shale. The soil occupies the steep slopes of long narrow ridges that cross the county in a southwest-northeast direction.

The soil consists of a light yellowish-brown to pale-yellow friable silt loam about 8 inches thick. The upper 1 to 2 inches is stained dark with organic matter. Leached acid shale fragments are mixed throughout. Soft, leached shale occurs 4 to 14 inches below the surface and is gradually replaced, with increasing depth, by hard acid shale. The soil is strongly acid throughout.

Use suitability.—This soil has a forest cover that consists mainly of hardwoods, but which in some places includes numerous pines. The soil is very poorly suited to crops because of its steep slopes, high susceptibility to

erosion, low water-supplying capacity, and low fertility. If properly fertilized, the soil would probably produce fair pasture. Lime and phosphorus are the chief requirements. Nitrogen may also be needed to establish a pasture. On most farms, this soil is probably best suited to forestry. It should not be cleared unless there is an urgent need for additional pasture. For a discussion of use and management, see group 17.

Litz shaly silt loam, eroded steep phase (25 to 50 percent slopes) (Ln).—This soil differs from the Litz shaly silt loam, steep phase, chiefly in being eroded. It is also somewhat shallower to bedrock and has shallow gullies in places. The soil consists of a light yellowish-brown to pale-yellow moderately friable shaly silt loam or silty clay loam. Soft, leached, acid shale occurs at depths of 4 to 12 inches in most places.

Use suitability.—All of this soil has been cleared. Most of it is now in pasture; some is idle or in unimproved pasture. Some of the idle acreage is reverting to a forest of Virginia pines. Very little is used for crops.

The soil is not considered suited to crops, because of its extreme susceptibility to erosion, very low water-supplying capacity, and low fertility. It is not naturally productive of pasture plants. Existing pastures are generally of poor quality and of low carrying capacity. Fair pastures can be established and maintained by practicing management that includes use of fertilizers and careful control of grazing. The soil is strongly acid, low in organic matter and essential plant nutrients, and deficient in lime, phosphorus, and nitrogen. For a discussion of use and management, see group 17.

Litz silt loam, hilly phase (12 to 25 percent slopes) (Lr).—This is a well-drained to excessively drained shallow shaly soil of the hilly uplands. It has developed from materials weathered from an acid shale that contains thin bands, or layers, of limestone or limy shale. It has formed under a mixed forest consisting chiefly of hardwoods. It occupies the rather short slopes of long, narrow, widely spaced ridges that cross the county in a southwest-northeast direction.

The soil consists of a light yellowish-brown to pale-yellow friable silt loam, and the top 1 or 2 inches is stained dark by organic matter. Weathered shale occurs 4 to 14 inches below the surface and is gradually replaced by hard acid shale. Fragments of soft shale are numerous throughout the soil mass. The soil is strongly acid throughout.

Use suitability.—All of this soil is in a cutover forest consisting chiefly of oaks, hickories, and scattered pines. It is poorly suited to crops because of its strong slopes, susceptibility to erosion, low water-holding capacity, and low fertility. If properly fertilized, it will produce fair to good pasture, but it is not always feasible to use it for pasture because some of the areas are not accessible. Lime and phosphorus are needed to establish pastures; nitrogen may also be needed. This soil is probably best suited to forestry. If cleared for pasture, it should be promptly seeded to a cover crop or grasses. Otherwise, it will erode and become further depleted. For a discussion of use and management, see group 14.

Litz shaly silt loam, eroded hilly phase (12 to 25 percent slopes) (Ll).—This soil differs from Litz silt loam, hilly phase, chiefly in being eroded. A considerable part of the soil material has been lost through erosion. In small severely eroded spots the acid shale bedrock is exposed. The soil consists of a light yellowish-brown to pale-yellow moderately friable shaly silt loam or silty clay loam. The soil is about 2 to 12 inches deep, is strongly acid throughout, and rests on acid shale bedrock.

Use suitability.—All of this soil has been cleared and cultivated. Most of it is now in pasture, some is in crops, and a small part is idle or temporarily abandoned. It is considered very poor for crops because of its strong slopes, high susceptibility to erosion, low water-holding capacity, low fertility, and shallowness to bedrock. On most farms this soil is best suited for permanent pasture, although it is not naturally productive of pasture. Pastures can be established and maintained with proper management that includes adequate fertilization, proper selection of pasture plants, and carefully controlled grazing. For a discussion of use and management, see group 14.

Litz silt loam, rolling phase (5 to 12 percent slopes) (Lp).—This soil differs from Litz silt loam, hilly phase, chiefly in having milder slopes. It has formed under a mixed forest consisting chiefly of hardwoods and a scattering of pines. It is confined to the very narrow tops of the acid shale ridges.

The soil is a light yellowish-brown to pale-yellow friable silt loam. It rests on acid shale that lies 4 to 16 inches below the surface. The top 1 or 2 inches is stained dark by organic matter, and fragments of soft shale are numerous on the surface and in the soil. The soil and the underlying shale are normally strongly acid.

Use suitability.—All of this soil has a partial forest cover. It is not suited to cultivated crops. Clearing this soil is not feasible because many of the small irregular areas are isolated from other tilled land. If cleared, it is best used for permanent pasture. It is low in natural fertility, shallow to bedrock, low in water-holding capacity, and highly susceptible to erosion. Good pastures could be established and maintained if the soil were fertilized and otherwise properly managed. For a discussion of use and management, see group 14.

Litz shaly silt loam, eroded rolling phase (5 to 12 percent slopes) (Lk).—From the Litz silt loam, rolling phase, this soil differs chiefly in being eroded. A considerable part of its soil material has been lost through erosion, and in small severely eroded spots the acid shale bedrock is now exposed. The soil occurs mainly on tops of long narrow ridges of acid shale that cross the county from southwest to northeast at widely spaced intervals.

The soil is predominantly a light yellowish-brown to pale-yellow, moderately friable shaly silt loam to silty clay loam. It rests on acid shale bedrock, which is 2 to 14 inches below the surface. The soil and the underlying shale are generally strongly acid.

Use suitability.—All of this soil has been cleared and used for crops and pasture. Most of it now is in pasture, some is in crops, and a small acreage is idle or temporarily abandoned. The soil is very poor for cultivated crops because it is shallow, easily eroded, low in water-holding capacity, and low in fertility. It is best suited for permanent pasture. It is not naturally productive, but good pastures can be established and maintained by adding fertilizers, selecting suitable pasture plants, and controlling grazing. The soil is extremely deficient in lime,

phosphorus, nitrogen, and, for some plants, potassium. Shortage of potassium, however, is not likely to limit the growth of most plants. For a discussion of use and management, see group 14.

Litz shaly silt loam, very steep phase (50+ percent slopes) (Lo).—This is a shallow shaly soil of the very steep uplands. It has formed under a mixed forest consisting chiefly of hardwoods and scattered pines. It occurs on the very steep slopes of acid shale ridges.

This soil is a light yellowish-brown to pale-yellow friable shaly silt loam to shaly silty clay loam. In wooded areas the topmost inch is stained dark by organic matter. Soft acid shale generally is 4 to 10 inches below the surface. Fragments of leached shale are numerous in the soil material. The soil is strongly acid throughout.

Use suitability.—Practically all of this soil is still in forest, and that is the use to which it is best suited. It is very poor for pasture because it is steep, shallow, extremely erodible, and broken by outcrops of bedrock. For a discussion of use and management, see group 18.

Litz loam, steep phase (25 to 50 percent slopes) (Lf).—This soil occurs in two major belts, one on the higher part of Bays Mountain, and the other near Austin Springs. It differs from Litz shaly silt loam, steep phase, chiefly in being higher in sand content and slightly deeper over bedrock. It is more acid than Dandridge shaly silt loam, steep phase, and coarser in texture and deeper to bedrock. It is largely confined to the strong slopes of the higher knobs and ridges rising above the closely associated Dandridge soils. The soil has developed under a mixed forest consisting mainly of hardwoods and scattered pines.

Profile description:

0 to 7 inches, yellowish-brown very friable loam; small leached sandstone fragments throughout; upper 1 or 2 inches stained dark with organic matter.

7 to 17 inches, brownish-yellow friable loam or clay loam of medium soft crumb structure; contains many soft sandstone and shale fragments; bedrock about 14 to 18 inches below the surface.

The soil is strongly acid to medium acid throughout and rather low in plant nutrients and organic matter. Because of its shallowness and strong slopes, the soil has rapid surface runoff and low water-holding capacity. Outcrops of bedrock, generally harder and more massive than those in the Dandridge and Litz silt loam soils, are common in many areas. They prevent operation of farm machinery.

Small areas of the associated Dandridge soils may be included with this soil because the boundaries between the two soils are not distinct.

Use suitability.—All of this soil is in cutover forest. The present stand is small and includes many cull trees.

This soil is very poor for crops because it is shallow, steep, and extremely erodible when cleared. It is also poor for pasture unless very well managed. The best use for this soil is forestry. See group 17 for a discussion of use and management.

Litz loam, eroded steep phase (25 to 50 percent slopes) (Lg).—This soil is not extensive; it differs from Litz loam, steep phase, chiefly in being eroded. In most areas, 25 to 75 percent of the soil material has been lost through erosion. Because of erosion, this soil has a slightly heavier surface layer than the steep phase of Litz loam, has more sandstone and shale fragments in the plow layer, is lower in organic matter and plant nutrients, and is more susceptible to further erosion. Erosion and tillage have obliterated the differences between surface soil and subsoil layers that can be seen in uneroded soils of this series. Shallow gullies are common on abandoned areas.

Use suitability.—Nearly all of this soil has been cleared. Most of it is used for unimproved pasture, but some is used for crops, and a considerable part is idle or abandoned.

This soil is very poorly suited to crops because it is steep, low in fertility, low in water-supplying capacity, and extremely susceptible to erosion. Pastures produce low to very low yields in most places. Fair pasture can be established, however, by applying lime and phosphorus and by carefully controlling the grazing. On most farms, this soil is probably best suited for forestry. For a discussion of use and management, see group 17.

Litz loam, rolling phase (5 to 12 percent slopes) (Ld).—This soil is confined mainly to the narrow ridgetops. It is closely associated with the Dandridge soils and with other soils of its own series. It differs from Litz loam, steep phase, chiefly in occupying narrow, winding ridge crests rather than strong ridge slopes. In addition, it is somewhat deeper to bedrock and has fewer outcrops of bedrock.

The surface soil is a yellowish-brown very friable loam, about 8 inches thick. The upper 1 to 2 inches of this layer is stained dark with organic matter. The subsoil is a brownish-yellow friable clay loam of medium soft crumb structure. Soft leached sandstone fragments are common throughout the soil, and it is medium to strongly acid throughout its depth. Bedrock is 18 to 22 inches below the surface.

Included with this soil is an area of about 40 acres that differs in having slopes of 12 to 25 percent.

Use suitability.—Nearly all of this soil is in forest consisting mainly of hardwoods and a few scattered pines. It would be fairly well suited to crops, but it occurs on narrow ridge crests in dissected areas that make cropping impractical. Its use must be the same as that of the adjacent slopes. This soil should be cleared only if additional land for crops or pasture is urgently needed. It could be cropped safely only in long rotations that included close-growing crops. Yields probably would be low. The soil would produce good pasture if properly fertilized. See group 14 for a discussion of use and management.

Litz loam, eroded rolling phase (5 to 12 percent slopes) (Le).—This soil differs from Litz loam, steep phase, chiefly in being eroded and in occupying narrow, rolling ridge crests rather than steep ridge slopes. In addition, it is somewhat deeper to bedrock and has fewer outcrops of bedrock. Shale and sandstone fragments have accumulated on the surface because the finer materials have been removed by erosion. Large fragments on the surface are numerous enough in some places to interfere with tillage.

Use suitability.—Most of this soil has been cleared and used for crops and pasture. The largest part is now in unimproved pasture, a small part is in crops, and a considerable part is idle.

The soil would be suitable for crops, except that it occurs on narrow winding ridge crests and in dissected areas. It has a very low water-supplying capacity but

will produce good pasture if properly fertilized. Pasture management practices are similar to those for the rolling phase of Litz loam. See group 14 for a discussion of use and management.

Litz loam, very steep phase (50+ percent slopes) (Lh).—This soil occurs most extensively on Bays Mountain. Other small areas occur in the vicinity of Austin Springs and Watauga Flats, in association with the Dandridge soils and with other soils of this series. It is shallower than Litz loam, steep phase, has more outcrops of bedrock, and has less distinct soil layers.

The soil material is generally a yellowish-brown to brownish-yellow very friable loam. The upper 1 to 2 inches is stained dark with organic matter. The depth of the soil material to bedrock averages about 12 inches. Leached soft sandstone and shale fragments are common throughout the soil mass. The soil is medium to strongly acid throughout.

Use suitability.—All of this soil is in cutover forest. It is physically unsuitable for crops or pasture because of its very steep slopes and shallow depths. Forestry is its best use. For a discussion of use and management, see group 18.

Masada loam, undulating phase (2 to 5 percent slopes) (Mc).—This is a brown, well-drained soil of the old stream terraces, most of which are 25 to 75 feet above the present flood plains. The parent materials washed chiefly from uplands underlain by granite and gneiss. Some material from sandstone, quartzite, shale, and slate is included.

This soil occupies terraces that are intermediate between the low and high terraces along the Nolichucky River (fig. 7). It is closely associated with Augusta, Congaree, Allen, and Hayter soils, and with other soils of its own series.

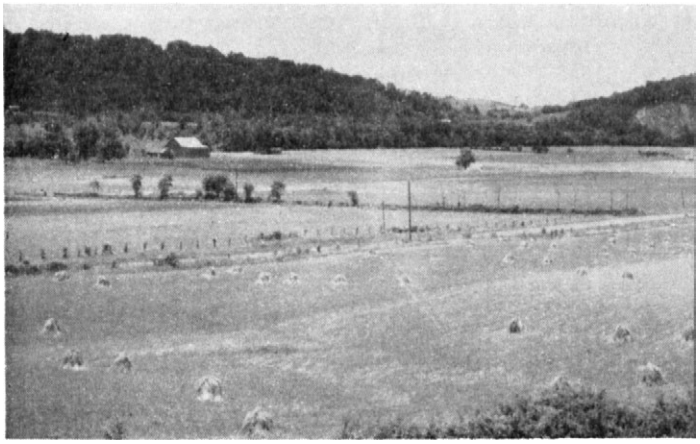

***Figure 7.*—Masada soils, in foreground, on medium high stream terrace above the Congaree and Chewacla soils of the first bottoms.**

Profile description:

0 to 8 inches, brown mellow friable loam.
8 to 15 inches, yellowish-red to reddish-brown friable sandy clay or clay loam; moderately well defined medium blocky structure.
15 inches+, yellowish-red to reddish-yellow moderately friable sandy clay loam or sandy clay, faintly splotched with gray below about 40 inches; limestone at depths of 6 to 20 feet in most places.

The soil is medium to strongly acid and moderately high in organic matter and plant nutrients. In many places there are small amounts of gravel and quartzite cobbles on the surface and throughout the soil. The soil is permeable to air, roots, and water. Surface runoff is slow to moderate, internal drainage is moderate, and the water-holding capacity is relatively high. A large part of the original surface soil has been removed by erosion, but in most areas the plow layer is still within this layer.

Use suitability.—All of this soil has been cleared and cultivated. An estimated 20 percent is now in corn, 15 percent in small grains, 30 percent in hay, 20 percent in pasture, and 10 percent in other crops. About 5 percent is idle.

This soil is well suited to nearly all the common crops of the county. Although moderately productive under the present management, it responds to better management. It does not have enough lime, phosphorus, and nitrogen for high yields of most crops. The supply of potassium is apparently adequate for most crops. The need for potassium depends largely on the crop grown and past management of the soil. In most places lime and phosphorus are essential for the successful growth of alfalfa or red clover. The soil is only slightly susceptible to erosion; special practices for water control are not necessary. For a discussion of use and management, see group 3.

Masada clay loam, eroded rolling phase (5 to 12 percent slopes) (Ma).—This soil is confined to the intermediate terraces along the Nolichucky River. It is closely associated with the Augusta, Allen, Sequatchie, and Congaree soils, and with other soils of its own series. It differs from Masada loam, undulating phase, chiefly in being more eroded and in having steeper slopes. About one-half to two-thirds of the original surface soil has been lost through erosion.

The present surface layer is slightly heavier than that of the undulating phase, but workability of the soil is not significantly affected. The subsoil is exposed in some severely eroded spots.

Use suitability.—All of this soil has been cleared and used for crops and pasture. About 20 percent is now used for corn, 15 percent for small grain, 30 percent for hay, 20 percent for pasture, and 10 percent for other crops. About 5 percent is idle.

This soil is well suited to most of the common field crops and pasture. It is less desirable for crops than the undulating phase, but its use and management needs are somewhat similar. This soil is lower in organic matter and plant nutrients than Masada loam, undulating phase, because of past cropping and erosion. In addition, its water-holding capacity is slightly lower, surface runoff is more rapid, erosion control is more difficult, and susceptibility to erosion is greater.

Crop yields as high as those on the undulating phase will require longer rotations that include more legumes and grasses, and somewhat heavier applications of lime and phosphorus. See group 6 for a discussion of use and management.

Masada clay loam, eroded hilly phase (12 to 25 percent slopes) (Mb).—This soil is confined to intermediate terraces, generally 25 to 75 feet above the present flood plain of the Nolichucky River. It differs from Masada loam, undulating phase, in occupying stronger slopes and in being more eroded. In most places 25 to 75 percent of

the original surface layer has been removed by erosion. In a few small severely eroded spots all of the surface has been lost and the reddish subsoil is exposed.

The present surface soil is generally a brown to reddish-brown, or even yellowish-red, moderately friable clay loam, 2 to 6 inches thick. The subsoil is a yellowish-red to reddish-brown friable sandy clay or clay loam. Cobblestones are common on the surface and are scattered throughout the profile, but they do not seriously interfere with tillage. Layers of soil having high cobble content are common locally. Mica flakes are sparsely scattered throughout the profile and become more numerous with increasing depth.

Use suitability.—Practically all of this soil has been cleared. It is now being used for many kinds of crops and for pasture.

This soil is suited to most of the common field crops and pasture. It is less desirable than Masada clay loam, eroded rolling phase, or Masada loam, undulating phase, because of its stronger slopes. It is more severely eroded, lower in organic matter and plant nutrients, and more susceptible to further erosion. Row crops can be grown safely in long rotations that consist largely of close-growing crops, which protect the soil from erosion. If adequately fertilized, this soil produces good pasture and hay. On most farms it is probably best used for those purposes. For a discussion of use and management, see group 13.

Melvin silt loam (0 to 3 percent slopes) (Md).—This is a gray, poorly drained soil of the bottom lands. It consists of recent alluvium washed largely from upland soils underlain by limestone, chiefly the Dunmore, Dewey, Groseclose, and Bolton soils. The small areas are scattered over the county. It occupies level or nearly level bottom lands that are only slightly higher than the normal level of the streams. Many areas are depressed; these are old stream channels. Practically all of the soil occurs on narrow bottoms of perennial streams and receives considerable seepage from the adjacent upland slopes. Both external and internal drainage are poor. Water stands on the surface most of the year, and the water table is near the surface the rest of the time. The native vegetation was largely water-tolerant oaks, willows, and sweetgums.

Profile description:

0 to 10 inches, brownish-gray to light yellowish-brown or yellowish-brown moderately friable silt loam; mottled with pale yellow and contains strong-brown stains.
10 inches+, light-gray or light olive-gray firm silty clay loam or silty clay; layer extends to the water table, which is at an average depth of 24 inches.

The soil is slightly acid and has a moderate content of plant nutrients and organic matter. When not saturated with water, it is permeable to air, roots, and water. The high water table seriously restricts development of the root system of many crops.

This soil includes a few small areas that are alkaline. These areas are essentially poorly drained variants of the Weaver soil.

Use suitability.—Practically all of this soil has been cleared and used for pasture or crops. Most of the soil is now in pasture, but some is in crops, mainly corn. Average yields of corn are low, and total failures are common. Artificial drainage would broaden the use suitability, but the soil would still be largely limited to summer annual crops such as corn, soybeans, and sorghum. Moderate natural fertility and ability to support vegetation during prolonged dry periods make this soil fairly well suited to pasture. For a discussion of use and management, see group 15.

Monongahela silt loam (1 to 5 percent slopes) (Mf).—This is a light-colored, imperfectly to moderately well drained soil of the stream terraces. It has formed from materials that washed from uplands underlain largely by quartzite, sandstone, shale, and slate. It occurs on nearly level to undulating intermediate stream terraces and is not reached by stream overflows.

The largest part of the acreage occurs along Horse Creek and the Watauga River. Other small areas are widely scattered throughout the county on major stream bottoms. The soil is closely associated with the Holston, Tyler, Hamblen, and Staser soils.

Profile description:

0 to 8 inches, yellowish-brown or dark yellowish-brown moderately friable heavy silt loam of medium crumb structure; in well-established pastures the upper 1 to 2 inches is stained dark with organic matter.
8 to 20 inches, pale-yellow or yellow firm silty clay loam or silty clay; medium blocky or subangular structure.
20 inches+, mottled light-gray, strong-brown, and pale-yellow compact silty clay; coarse blocky structure; depth of the alluvial deposit ranges from about 4 to 15 feet; underlying bedrock normally is calcareous shale.

The soil is strongly acid and low in organic matter and mineral plant nutrients. Surface drainage is adequate, but internal drainage is slow. The upper part of the soil is permeable to air, roots, and water, but the compact lower subsoil is relatively impervious. The soil is virtually stone-free.

A few small areas are included that have slopes of 5 to 12 percent, as well as very small areas of associated soils.

Use suitability.—Most of the soil has been cleared and used for crops and pasture. It is not very well suited to crops, because of low fertility and unfavorable internal moisture conditions. Yields of most crops and of pasture are poor—lower than those from the Holston soils. The soil is easy to work, but it is in great need of fertilizer. The response to amendments is fairly good, but not so good as on the better drained soils.

Most crops common to the area have been grown on this soil, but it is not well suited to alfalfa and is not a good producer of other crops. Satisfactory yields can be obtained, however, if proper fertilization and management are practiced. Liming is essential for success with legumes. The control of erosion usually is not a problem because the slopes are gentle. See group 5 for a discussion of use and management.

Monongahela loam (1 to 5 percent slopes) (Me).—This soil differs from Monongahela silt loam in being coarser textured and slightly darker colored. It has formed from materials transported from uplands underlain chiefly by quartzite, sandstone, shale, and slate. Many areas have also received a small amount of material from limestone soils.

Most of the acreage of this soil occurs along the Nolichucky River; it lies between the present flood plain and the Jefferson and Allen soils of the old colluvial lands. Very small, widely scattered areas occur along the small streams or creeks throughout the county.

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Profile description:

0 to 9 inches, yellowish-brown to dark yellowish-brown friable loam.
9 to 20 inches, yellow firm silty clay loam or fine sandy clay; moderately well developed medium blocky structure.
20 inches+, mottled yellow, strong-brown, and light-gray compact silty clay or fine sandy clay; coarse blocky structure; depth of the alluvial deposit ranges from 5 to 20 feet or more; underlying bedrock is usually limestone.

The soil is medium to strongly acid and low in mineral plant nutrients and organic matter. Surface drainage is adequate, and the upper 20 inches of the soil is permeable to air, roots, and water. Internal drainage is slow because of the compact subsoil. The soil is almost free of stones. In places there are a few cobbles, but they do not interfere with cultivation.

The soil varies slightly from place to place in texture, color, and depth to the compact layer. Included with this soil are small areas having slopes of 5 to 12 percent and, because boundaries are not distinct, small areas of associated soils.

Use suitability.—Nearly all of this soil has been cleared and cultivated. It is now being used for many kinds of crops, including corn, small grains, hay, and pasture. The yields of most crops are low because the soil is not fertile and has unfavorable internal moisture conditions. Although easy to work at the proper moisture content, and moderately responsive to fertilizer, this soil is normally not so productive as better drained soils. It is not suited to alfalfa or most other deep-rooted crops. Other common crops can be grown with fair success if the soil is adequately fertilized. The soil is low in lime, phosphorus, and nitrogen, and possibly potassium for certain crops. Erosion control is not a problem. For a discussion of use and management, see group 5.

Nolichucky loam, rolling phase (5 to 12 percent slopes) (Nc).—This is a well-drained soil on stream terraces that rise 75 to 150 feet above the flood plain of the Nolichucky River. The soil was derived from old alluvium washed largely from uplands underlain by sandstone, quartzite, slate, and shale. The alluvium includes a small admixture of limestone material. In fact, terrace deposits in this county are underlain by limestone at depths of 3 to 15 feet or more.

Waynesboro, Holston, Dunmore, and Allen soils and other soils of the Nolichucky series are associated with this soil.

Profile description:

0 to 8 inches, pale-brown to light yellowish-brown very friable loam; upper 1 or 2 inches stained dark by organic matter.
8 to 14 inches, brownish-yellow, pale-yellow, or light yellowish-brown, friable, light clay loam or silty clay loam.
14 to 30 inches, reddish-yellow or yellowish-red firm silty clay loam; moderate medium blocky structure.
30 inches+, yellowish-red firm silty clay loam to fine sandy clay, streaked and splotched with yellow and gray; beds of coarse gravel and cobblestones are at depths of 3 to 15 feet in most places.

The soil is strongly acid and moderately low in organic matter and plant nutrients. A few pebbles and cobblestones are on the surface and throughout the profile. The soil is permeable to roots, air, and moisture. External and internal drainage are moderate. The water-holding capacity is moderate.

Use suitability.—All of this soil is in forest. The areas are normally small and not easily accessible from other cropland. The soil is well suited to crops and pasture but deficient in lime and in the major plant nutrients. Fertilization is necessary for the successful growth of most of the common crops. If cleared and used for crops and pasture, this soil has use suitability and management requirements similar to those of Nolichucky loam, eroded rolling phase. For a discussion of use and management, see group 10.

Nolichucky loam, eroded rolling phase (5 to 12 percent slopes) (Nd).—All of this soil occurs on terraces of the Nolichucky River in association with the Waynesboro, Holston, Dunmore, and Allen soils, and with other soils of its own series. It developed from alluvium washed chiefly from the Ramsey soils. It differs from Nolichucky loam, rolling phase, chiefly in being eroded. A large part of the original surface layer has been lost. The plow layer consists of subsoil mixed with remnants of the original surface soil. The present surface layer is highly varied in color, texture, and thickness. In some places all the original surface layer is gone and the subsoil is exposed. A few shallow gullies occur in the more severely eroded areas.

The present surface layer is a light yellowish-brown to brownish-yellow friable loam. The subsoil consists of reddish-yellow or yellowish-red firm clay loam or silty clay loam.

Use suitability.—Practically all of this soil has been cleared and cultivated. Many kinds of crops and pasture are grown, including corn, small grains, hay, tobacco, and market vegetables.

The soil is well suited to crops and pasture, but proper crop rotation and fertilization are necessary to obtain satisfactory yields. Rotations of at least moderate length that include a deep-rooted legume crop are desirable. The soil is too low in lime and most of the major plant nutrients for high crop yields. It responds to fertilizers. Lime and phosphorus are essential for success with alfalfa and red clover. The soil is moderately susceptible to erosion. For a discussion of use and management, see group 10.

Nolichucky loam, hilly phase (12 to 25 percent slopes) (Ne).—This soil occurs on high terraces of the Nolichucky River in association with the Holston and Waynesboro soils of the terraces and with the Dunmore soils of the uplands. It differs from the rolling phase of Nolichucky loam chiefly in having stronger slopes.

The surface consists of light yellowish-brown or pale-brown very friable loam. The subsoil is reddish-yellow or yellowish-red firm clay loam or silty clay loam. Depths to underlying bedrock are at least 3 feet and are more variable than for the rolling phase.

Use suitability.—All of this soil is in forest. It is poorly suited to cultivated crops because of its strong slopes, low fertility, and susceptibility to erosion. It is fairly well suited to pasture and close-growing hay crops. It is low in plant nutrients but responds to good management and proper fertilization. Tillage is moderately difficult, and conservation of soil and moisture is a problem. If the soil is cleared and used for crops and pasture, its use suitability will be similar to that of the eroded hilly phase. For a discussion of use and management, see group 13.

Nolichucky loam, eroded hilly phase (12 to 25 percent slopes) (Nf).—Most of this soil occurs on high terraces of

the Nolichucky River. The Allen, Holston, Waynesboro, and Dunmore soils are closely associated with it. It differs from Nolichucky loam, rolling phase, chiefly in being eroded and in having stronger slopes. The surface soil consists of a light yellowish-brown to brownish-yellow loam and is from 4 to 7 inches thick. The subsoil consists of a reddish-yellow or yellowish-red firm clay loam or silty clay loam.

Use suitability.—Practically all of this soil has been cleared and used for crops and pasture. Most of it is now used for hay and pasture, but some for tilled crops. Some of it is idle. Crops and pasture produce moderately low yields.

This soil is not well suited to cultivated crops, but it can be used and maintained for this purpose if properly managed. The crop rotation should be long and should consist mainly of close-growing legumes and grasses. The soil is low in organic matter, lime, phosphorus, and potassium. Fertilization is necessary for good yields of most crops. The soil is rather susceptible to erosion.

This soil is better suited to pasture or semipermanent hay than to cultivated crops. On most farms pasture is probably its best use. For a discussion of use and management, see group 13.

Nolichucky cobbly loam, eroded rolling phase (5 to 12 percent slopes) (Na).—This soil occurs on the high terrace lands of the Nolichucky River. It is associated with the Waynesboro, Allen, Dunmore, and Holston soils, and with other soils of its own series. It differs from Nolichucky loam, rolling phase, chiefly in being cobbly and eroded. A large part of the original surface layer has been removed by erosion. The plow layer consists of subsoil mixed with remnants of the surface layer and is highly varied in color, texture, and thickness. In some places all of the original surface layer is gone and the subsoil is exposed.

The present surface soil is a light yellowish-brown to brownish-yellow friable cobbly loam. The subsoil consists of a yellowish-red or reddish-yellow, firm, cobbly sandy clay or silty clay loam.

The soil is strongly acid, low in organic matter and plant nutrients, and permeable to roots, air, and moisture. External and internal drainage are both moderate. The water-holding capacity is moderately low. Cobblestones are scattered over the surface and throughout the soil mass in quantities that interfere with tillage.

Use suitability.—Most of this soil has been cleared. A large part is now in unimproved pasture, some is in crops, and some is idle.

This soil is only fairly well suited for crops. Cobblestones interfere with cultivation and in some places make it impossible. They also reduce the capacity of the soil to hold water and make it droughty. The soil is probably best suited to early maturing crops such as small grains, crimson clover, red clover, and early vegetables. It is not well suited to corn or other crops that mature late in summer or early in fall. It is too porous and droughty for alfalfa. On many farms this soil is best suited to permanent pasture, but hay crops will give fairly good yields if properly fertilized. The cobblestones interfere with the harvesting of hay. The soil is deficient in lime, phosphorus, and nitrogen, and in potassium for some crops. Fair yields require moderately heavy applications of lime and fertilizer. For a discussion of use and management, see group 11.

Nolichucky cobbly loam, eroded hilly phase (12 to 25 percent slopes) (Nb).—This soil occupies short slopes on high terraces of the Nolichucky River. A small acreage that is uneroded is included. This soil differs from the eroded rolling phase of Nolichucky cobbly loam chiefly in occupying stronger slopes. In addition, it is somewhat shallower to the limestone residuum and more eroded. Erosion has removed a large part of the original surface layer and exposed the yellowish-red subsoil.

The surface soil is a light yellowish-brown or brownish-yellow very friable cobbly loam to cobbly clay loam. The subsoil is a yellowish-red or reddish-yellow firm cobbly sandy clay or clay loam. The underlying material, largely stratified, consists of beds of cobblestones and clayey material, some of which is residual.

Use suitability.—Most of this soil has been cleared. Most of the acreage is now in unimproved pasture, some is in crops, and some is idle.

This soil is poorly suited to cultivated crops because of strong slopes, cobblestones, and low natural fertility. The cobblestones lower its capacity to hold water. The soil is hard to work and water control is difficult. The soil is best suited to permanent pasture and would produce a wide variety of pasture plants if adequately fertilized. It is deficient in lime, phosphorus, nitrogen, and possibly potassium. For a discussion of use and management, see group 16.

Ooltewah silt loam (0 to 3 percent slopes) (Oa).—This imperfectly drained soil occurs in depressions or sinks along narrow intermittent drainageways. Practically all of it is in the Great Valley part of the county. The material from which the soil formed consists of local wash from adjacent upland slopes that are underlain by limestone. The soil is closely associated with and is derived from material that washed from the Dewey, Dunmore, Bolton, and Groseclose soils. Most of the areas are surrounded by Dunmore soils.

Profile description:

0 to 10 inches, yellowish-brown or pale-brown friable silt loam.
10 to 24 inches, yellowish-brown to light brownish-gray friable heavy silt loam or silty clay loam splotched with pale yellow and gray; contains numerous black stains.
24 inches+, highly mottled olive-yellow, light-gray, and brownish-yellow moderately friable silty clay loam or silty clay; depth to bedrock ranges from 3 to 10 feet or more.

The soil is medium to slightly acid, moderate in organic matter, and fairly high in plant nutrients. The soil is permeable throughout, but the subsoil is saturated with water much of the time. This restricts penetration of roots and movement of air. External drainage is very slow, and internal drainage is slow. The soil may be flooded after heavy rains because most of it is in depressions that have no surface outlets.

Use suitability.—Practically all of this soil has been cleared. Because it occurs in small areas, it is usually treated in the same way as surrounding areas of the more extensive soils. Where this soil is cultivated individually, it is used chiefly for corn, hay, and pasture. It normally does not have adequate drainage for alfalfa, small grains, and tobacco. Drainage would broaden the use suitability and productivity for most crops, but it is impractical in most places because outlets are lacking. For a discussion of use and management, see group 1.

Pace silt loam, undulating phase (2 to 5 percent slopes) (Pa).—This is a light-colored, moderately well drained soil of the colluvial lands. The soil has formed from local alluvial or colluvial materials washed from upland soils underlain largely by limestone, chiefly the Dunmore and Groseclose soils. It includes small amounts of materials washed from shales. Normally, the soil occupies foot slopes, fans, or benches immediately below the soil from which it has washed. The areas are fairly small and are widely distributed on the limestone uplands.

Profile description:

0 to 9 inches, light yellowish-brown friable silt loam.
9 to 26 inches, pale-yellow, yellow, or brownish-yellow friable silty clay loam; moderately well developed medium nut structure.
26 inches+, mottled or splotched pale-yellow, yellow, and reddish-yellow slightly compact silty clay loam or silty clay.

The soil is medium to strongly acid, low in organic matter, and moderately low in plant nutrients. It is sufficiently permeable for extensive penetration by plant roots and normal circulation of air and moisture. Water is readily absorbed, and the water-supplying capacity is fairly high. Surface runoff is slow, and internal drainage is moderate. The soil is virtually free of stones. Small angular chert fragments may occur on the surface and in the soil mass, but they do not interfere with tillage or decrease productivity.

This soil varies slightly in color, texture, and drainage. In a few places it consists partly of materials washed from the Litz soils; in such places, the soil is finer in texture and lighter in color. Some areas are also included that have a reddish-yellow or yellowish-red subsoil and are somewhat better drained. In addition, a considerable acreage is included that occupies ridgetops instead of foot slopes.

Use suitability.—Nearly all of this soil has been cleared and farmed. Most of it is now used for the common crops, but some is in permanent pasture. Little of the soil is idle. The crops most commonly grown are tobacco, corn, small grains, vegetables, alfalfa, lespedeza, red clover, timothy, and redtop. Much of the tobacco produced in the county is grown on this soil (fig. 8).

This soil is suited to pasture and to a wide variety of crops, including tobacco, vegetables, corn, and small grains. It is not well suited to alfalfa, because its internal drainage is slow. The soil is easy to work. Good tilth can be fairly easily maintained, and the moisture range over which the soil can be tilled is comparatively wide. Water is easy to control, and erosion is not a problem. The soil can be used rather intensively if adequately fertilized, but it is seriously deficient in lime, phosphorus, nitrogen, and potassium. It is very responsive to fertilizers. Good yields of the adapted crops can be expected if moderately large amounts of fertilizer and lime are applied. For a discussion of use and management, see group 5.

Figure 8.—**Burley tobacco on Pace silt loam, undulating phase. Dunmore soils on slope in background.**

Pace silt loam, rolling phase (5 to 12 percent slopes) (Pb).—This soil occupies terracelike positions below the associated limestone soil from which its materials have been washed. It is closely associated with the Dunmore, Greendale, and Lindside soils. The areas are relatively small and irregular in shape.

The surface soil is a light yellowish-brown very friable silt loam. The 1-inch to 2-inch topmost layer is stained dark with organic matter. The subsoil is a pale-yellow friable silty clay loam.

Use suitability.—All of this soil is in cutover forest consisting chiefly of hardwoods. The soil is suited to all the common crops and pasture plants except possibly alfalfa. Its use suitability is similar to that of Pace silt loam, undulating phase, but this soil is more difficult to conserve. Rotations should be longer and should include more close-growing crops. The soil is moderately susceptible to erosion, but this can be controlled by proper management. The soil has good tilth, is easy to work, and is fairly easy to conserve. It is also low in fertility but responds well to fertilization. See group 10 for a discussion of use and management.

Pace silt loam, eroded rolling phase (5 to 12 percent slopes) (Pc).—This soil occupies benches, fans, foot slopes, and terracelike positions immediately below the associated Dunmore and Groseclose soils. It is widely distributed among the soils of the limestone uplands. Individual areas are usually rather small and irregular in shape. The soil differs from Pace silt loam, undulating phase, chiefly in occupying stronger slopes and in being moderately eroded. Erosion has removed much of the original surface soil. The present surface layer is more variable and generally heavier than the original. It varies from yellow to light yellowish brown and from silt loam to silty clay loam. The subsoil is a yellow to brownish-yellow friable silty clay loam.

Use suitability.—All of this soil has been cleared. It is now used for a wide variety of crops and pasture. Very little of the soil is idle. It is suited to pasture and to nearly all crops except possibly alfalfa. Much of the tobacco produced in the county is grown on it. Alfalfa is grown on this soil but is much better suited to upland soils such as the Dunmore. The soil is susceptible to erosion and is not so well suited to intensive use as Pace silt loam, undulating phase. Rotations should be longer on this soil, and they should include more close-growing crops. The soil is easy to work and conserve. Tilth is good and is easily maintained. The range of moisture content over which the soil can be safely tilled is fairly wide. The soil is medium to strongly acid and moderately low in organic matter and plant nutrients. It responds well to fertilizers. For a discussion of use and management, see group 10.

Prader silt loam (0 to 3 percent slopes) (Pd).—This is a gray, poorly drained soil of the bottom lands. It consists of recent alluvium washed chiefly from soils underlain by shale, slate, and sandstone. It occurs in narrow strips along Horse Creek, Sinking Creek, and the Watauga River. It occupies bottom lands a little higher than the normal level of streams. Many of the areas are in depressions that were once stream channels. The areas on the narrow bottoms along perennial streams in the calcareous shale uplands receive considerable seepage from adjacent slopes. Water stands on the surface much of the year, and the water table is near the surface at all times. External and internal drainage are poor. The native vegetation is largely water-tolerant oaks, willows, and sweetgums.

Profile description:

0 to 7 inches, dark yellowish-brown friable heavy silt loam, mottled with light olive gray and showing strong-brown stains.

7 inches+, olive-gray firm silty clay loam or silty clay showing strong-brown stains; layer extends to water table; thickness of the alluvium varies from 4 to 10 feet or more.

The soil is nearly neutral to slightly acid and has a moderate amount of plant nutrients and organic matter. The high water table seriously restricts the root system of many crops.

Use suitability.—Practically all of Prader silt loam has been cleared, but a large part has grown up in willow and alder thickets. Most of the remaining cleared areas are in pasture, but some are in crops. Corn is the main crop, but average yields are low and total failures are common. Artificial drainage would broaden the use suitability, but the soil would still be limited largely to summer annual crops such as corn, soybeans, and sorghum. Moderate fertility and the ability to support vegetation during long dry periods make this soil fairly well suited to pasture. For a discussion of use and management, see group 15.

Ramsey stony loam, steep phase (25 to 50 percent slopes) (Rb).—This is a light-colored, excessively drained, stony soil on steep mountain slopes. It is widely distributed over the Unaka Mountains. Practically all of the acreage is within the Cherokee National Forest. It is one of the most extensive soils of the Ramsey series. The soil has developed from materials weathered from quartzite, sandstone, shale, and slate. The soil material is highly variable, owing to the variability of the parent rock.

The undisturbed surface soil is covered with a leaf mold about an inch thick. The soil material under the organic layer is a light yellowish-brown to brownish-yellow very friable stony loam. The bedrock is normally 10 to 15 inches below the surface, but the soil material has depths ranging from 1 to 3 feet.

The soil is medium to strongly acid throughout the profile and moderately low in plant nutrients and organic matter. Numerous sandstone and quartzite fragments 2 to 10 inches wide are on the surface and in the soil mass. The soil material is very permeable to air, roots, and water. Surface runoff is very high, and internal drainage is rapid. The water-holding capacity is low.

Use suitability.—Practically all of this soil is in forest. Forestry is its best use because the soil is stony, steep, and shallow (fig. 9). For a discussion of use and management, see group 18.

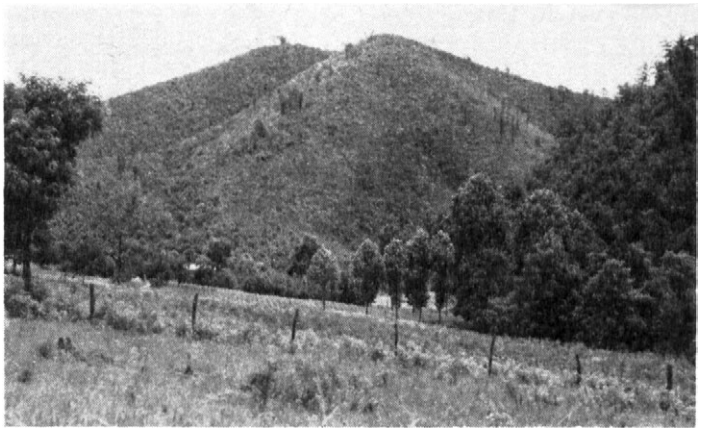

Figure 9.—**Ramsey stony loam, steep and very steep phases, on burned-over slopes in background. Forest is mostly scrubby, second-growth trees. Jefferson soils are on the smoother slopes in the foreground.**

Ramsey stony loam, hilly phase (12 to 25 percent slopes) (Ra).—This soil occurs in widely scattered small areas, mainly on mountain crests. It differs from Ramsey stony loam, steep phase, chiefly in having gentler slopes. In addition, this soil is somewhat deeper and slightly less stony and has fewer outcrops of bedrock.

The surface soil is a light yellowish-brown loose stony loam. The subsoil is a brownish-yellow to pale-yellow very friable stony loam or sandy clay loam. Bedrock is at depths of 1 to 3 feet in most places. A small acreage is included that has lost a considerable part of the original surface layer through accelerated erosion.

Use suitability.—Practically all of this soil is still in forest. Most of the cleared acreage is in unimproved pasture, but some is reverting to forest.

This soil is unsuitable for crops or pasture because it is stony, steep, of low fertility, and, for the most part, inaccessible. Forestry is its best use on most farms. For a discussion of use and management, see group 16.

Ramsey stony loam, very steep phase (50+ percent slopes) (Rc).—This soil is widely distributed around the heads of drainageways throughout the mountains. It differs from Ramsey stony loam, steep phase, chiefly in having stronger slopes. In addition, bedrock is nearer the surface and outcrops are more common.

The soil material is generally a light yellowish-brown to brownish-yellow loose stony loam. Bedrock lies about 12 inches below the surface.

Use suitability.—All of this soil is covered by forest, and a large proportion is in the Cherokee National Forest. Because of very steep slopes, shallowness, stoniness, and low fertility, this soil is unsuited to either crops or pasture. Forestry is its best use. For a discussion of use and management, see group 18.

Riverwash (0 to 3 percent slopes) (Rd).—This miscellaneous land type consists of an accumulation of cobblestones, gravel, sand, and very small amounts of silt and clay. It occurs on very small islands which usually are elevated less than a foot above stream level. It also occurs on the rims or edges of larger islands and in narrow strips, particularly along the banks of the Nolichucky River. All areas are subject to flooding whenever the streams rise only a little from their normal levels.

Most of this land is bare or is sparsely covered with sycamores or other water-tolerant vegetation. It has no agricultural importance. See group 18 for a discussion of use and management.

Sequatchie loam (1 to 5 percent) (Sb).—This is a light-brown, well-drained soil that occurs principally on low terraces along the Nolichucky and Watauga Rivers (fig. 10). Very small areas are scattered along tributary

Figure 10.—**Sequatchie loam, a highly desirable agricultural soil, in foreground. Ramsey soils on mountains in background, and Allen soils on foothills back of the barn.**

streams. The parent material consists of general alluvium washed from uplands that are underlain by quartzite, sandstone, shale and slate. There is a small admixture of materials derived from limestone. The soil is underlain by limestone and calcareous shale at depths of 5 feet or more. It occurs in small irregularly shaped areas and is closely associated with the Staser, Hamblen, Hayter, Allen and Jefferson soils, and with other members of its own series.

Profile description:

0 to 9 inches, light-brown or brown very friable loam.
9 to 13 inches, brown, yellowish-brown, or brownish-yellow, friable light clay loam or loam.
13 inches+, brownish-yellow to yellowish-brown friable clay loam or sandy clay; below 30 inches material is splotched with gray, yellow, and brown; layers of cobblestones are common 2 to 3 feet below the surface.

The soil is medium to strongly acid and moderately high in organic matter and most of the plant nutrients. A few cobblestones occur on the surface and throughout the soil but do not interfere much with cultivation. The soil can be tilled over a wide range of moisture content, and tilth is easy to maintain. The soil is permeable to roots, air, and moisture. Its moisture-holding capacity is rather poor, but its position on the landscape is such that it receives enough moisture for plant growth. External and internal drainage are moderate. Some areas that have slopes of 5 to 12 percent are included with this soil.

Use suitability.—All of this soil has been cleared and used for crops and pasture. About 30 percent is now used for corn, 15 percent for small grains, 30 percent for hay, 10 percent for pasture, and 10 percent for miscellaneous crops, including vegetables and tobacco. About 5 percent is idle land.

This soil is well suited to a wide variety of crops. It can be used intensively for intertilled crops if adequately limed and fertilized. It is somewhat deficient in lime, phosphorus, potassium, and nitrogen for high yields of most crops, but it responds readily if these elements are applied. The soil can be maintained by use of short rotations if deep-rooted legumes to supply the needed nitrogen are included. No special practices for controlling runoff and erosion are necessary if crops are rotated and adequately fertilized. For a discussion of use and management, see group 3.

Sequatchie cobbly fine sandy loam (1 to 10 percent slopes) (Sa).—This soil occurs mainly on low terraces situated along the Nolichucky and Watauga Rivers. It is closely associated with the Staser, Hamblen, Allen, Jefferson, and Hayter soils, and with other members of its own series. It differs from Sequatchie loam chiefly in having cobblestones and gravel on the surface and in the profile in amounts that interfere with tillage.

The surface soil is a brown or light-brown cobbly fine sandy loam. The subsoil is a yellowish-brown or brownish-yellow gravelly light clay loam.

Use suitability.—All of this soil has been cleared and cultivated. About 20 percent is now used for corn, 10 percent for small grains, 20 percent for hay, and 35 percent for unimproved pasture. About 15 percent is used for other crops or is idle.

The stone content of this soil restricts its use for crops. Besides interfering with tillage, the stones reduce the water-holding capacity of the soil. The soil is fairly well suited to practically all the commonly grown crops, with the possible exception of alfalfa. On many farms, however, it is best used for permanent pasture because of the difficulties of tilling and harvesting. The soil is a little deficient in lime, phosphorus, and nitrogen for high yields of most crops, but it responds readily to applications of these elements. The use suitability could be widened and yields could be greatly improved by removing stones wherever feasible. For a discussion of use and management, see group 4.

Staser loam (0 to 3 percent slopes) (Sc).—This is a grayish-brown, well-drained sandy soil that occurs on nearly level flood plains along the Watauga River. It is closely associated with the Hamblen and Sequatchie soils. The parent material consists of mixed general alluvium washed chiefly from the Dandridge and Ramsey soils. It includes weathered quartzite, sandstone, shale, slate, and, occasionally, limestone. The soil differs from Hamblen loam chiefly in being better drained and therefore free of mottlings to a greater depth.

Profile description:

0 to 12 inches, grayish-brown or dark grayish-brown very friable mellow loam.
12 to 36 inches, grayish-brown or brown friable loam or very fine sandy loam.
36 inches+, grayish-brown to light yellowish-brown fine sandy loan or loam mottled with gray and yellow.

The soil is slightly acid in most places and moderately high in organic matter and most plant nutrients. Plant roots penetrate the soil easily, and air and water move freely through it. Water is readily absorbed and fairly well retained. Surface runoff is slow, and internal drainage is moderate. Most of the soil is subject to overflow. Some gravel and cobblestones are on the surface and

throughout the profile but do not interfere much with tillage.

Use suitability.—All of this soil has been cleared. It is now used chiefly, and in some places continuously, for corn. Hay, small grains, and market vegetables are grown to some extent. The soil is well suited to intensive cropping. The susceptibility to flooding limits its use suitability. Overflows, however, help to maintain fertility by depositing material that is high in organic matter and plant nutrients. Small grains tend to lodge and mature late. They are also susceptible to disease. Productivity is fairly high, but yields could be increased by applying phosphorus and by using short rotations of crops. See group 1 for a discussion of use and management.

Stony colluvium, Jefferson soil material (2 to 25 percent slopes) (Sd).—This extremely stony land type occurs on small colluvial or alluvial fans, on slopes at the base of steep mountains, and along short intermittent drainageways. It is widely distributed in the mountains and is closely associated with the Ramsey, Jefferson, Allen, and Sequatchie soils. The soil material has washed from Ramsey soils of the mountain uplands. It is similar to the material from which the Allen and Jefferson soils have formed. Stones or cobblestones on the surface and in the profile prohibit tillage. The stones are of various sizes and may range up to several feet across. Some are rounded; others are more or less angular.

Use suitability.—A large part of this land type has been cleared and used for crops or pasture. Some is still in forest, and some is reverting to forest. The cleared areas are now used chiefly for unimproved pasture.

This land type is unsuited to crops and poorly suited to pasture. Fair pasture can be produced, but the control of weeds is difficult. Pastures are improved by applying lime and phosphorus in adequate amounts. For a discussion of use and management, see group 18.

Stony rolling land, Dunmore soil material (5 to 12 percent slopes) (Sf).—This is locally known as rock land, limestone rock land, or glady land. Outcroppings and ledges of limestone rock occupy from 10 percent to 50 percent or more of the surface. Some of the areas included are too stony for any use except forestry. Most of the land type, however, is suitable for grass and produces good pasture. The soil material between the ledges and outcroppings resembles that of the Dunmore soils. The material varies in depth and is normally deepest farthest from the rock outcrops. The range in depth is from a few inches to several feet.

The texture varies from silt loam to silty clay. The color varies from yellow to reddish brown.

This land type is widely distributed throughout that part of the county underlain by limestone. It is closely associated with the Dunmore, Dewey, and Groseclose soils and with other stony land types.

Use suitability.—An estimated 65 percent of this land has been cleared and is now used largely for pasture.

Stones prevent the use of this land type for cultivated crops, but it is suitable for pasture. It produces some of the earliest spring pasture in the county. Bluegrass does well early in spring and late in fall when moisture supplies are favorable. Lime and phosphorus are needed nearly everywhere for good pasture. Weed control in pastures is difficult because stones prevent the use of mowing machines. For a discussion of use and management, see group 16.

Stony hilly land, Dunmore soil material (12 to 25 percent slopes) (Se).—This land type is commonly referred to as rock land or limestone rock land. It occurs throughout that part of the county underlain by limestone. In most places, outcroppings and ledges of limestone bedrock occupy from 10 to 60 percent of the surface.

The soil material between the rocks is similar to that of the Dunmore soils. Its texture varies from silt loam to silty clay. It ranges from a few inches to several feet in depth. The color ranges from brownish yellow to reddish brown.

Use suitability.—About 50 percent of this land is cleared and used for pasture. The rest is in forest that consists mainly of redcedar. The steeper and stonier areas should be left in forest. Stones prevent using this land for cultivated crops, but it produces good early spring pasture (fig. 11).

***Figure 11.*—Bluegrass pasture on Stony hilly land, Dunmore soil material.**

Bluegrass does well and is at its best in spring, early in summer, and in fall. Lime and phosphorus are needed almost everywhere for good pasture. Weed control on pastures is difficult because the rocky surface does not allow the use of mowing machines. For a discussion of use and management, see group 16.

Stony steep land, Dunmore soil material (25 to 60 percent slopes) (Sg).—This mapping unit is locally known as limestone land. Numerous ledges and outcroppings of limestone rock occupy from 20 to 70 percent of the surface. The soil material covering the rocks and between the ledges and outcroppings is thin; it ranges from a few inches to about 3 feet in depth. It is brownish yellow to yellowish red.

Use suitability.—More than 80 percent of this land type is covered by a sparse growth of drought-resistant trees, mostly redcedar.

Forestry is the best use for this land under prevailing conditions. For a discussion of use and management, see group 18.

Stony very steep land, Ramsey soil material (50+ percent slopes) (Sh).—This land type occurs on the very steep rocky slopes in the mountainous part of the county. Numerous outcrops of bedrock and loose boulders occupy 20 to 70 percent of the surface and prevent tillage.

The rocks consist of quartzite, fine-grained sandstone, sandy and clayey shale, and slate. Ramsey soil material, normally between 2 and 3 feet deep, occupies the spaces among the rocks and boulders. It is highly variable in texture and color.

The land is almost all in forest that consists mainly of hardwoods and scattered areas of hemlock and pine. This land is best suited to forestry. A large part of it lies within the Cherokee National Forest. For a discussion of use and management, see group 18.

Tyler silt loam (0 to 3 percent slopes) (Ta).—This is a gray poorly drained soil of the stream terraces. It consists of alluvium washed chiefly from soils underlain by shale, slate, sandstone, and quartzite. The small scattered areas are on nearly level or depressed parts of the low terraces along the Nolichucky and Watauga Rivers. The soil is closely associated with the Monongahela soils and differs from them chiefly in being more poorly drained. Surface runoff is low or very low, and internal drainage is very slow. The native vegetation consisted of water-tolerant trees.

Profile description:

0 to 7 inches, light brownish-gray friable silt loam, mottled with yellow.
7 to 16 inches, grayish-yellow or pale-yellow firm silty clay loam, mottled with gray and yellow.
16 to 48 inches+, compact silty clay or clay, highly mottled with pale yellow, yellow, and light gray; the material below about 40 inches is less compact; below 30 inches the color is predominantly light gray.

Tyler silt loam is strongly to very strongly acid and low in organic matter and natural fertility. The compact claypan layer tends to be impermeable to air, roots, and water. The layers above the claypan are saturated with water a large part of the year. The soil has a low water-holding capacity, and crops are damaged by long periods of either wet or dry weather. Most areas of this soil are poorly drained, but a few areas resembling the Purdy soils are very poorly drained. Purdy soils are not mapped as a separate unit in this county.

Use suitability.—Most of Tyler silt loam is used for permanent pasture or is in forest. Corn, hay, and sorghum are grown on a few areas, but the yields are low. Pastures consist mainly of water-tolerant plants. Artificial drainage has been attempted in places by bedding and by open ditches.

In its present condition, this soil is probably best suited to pasture and hay crops. Several summer annuals such as corn, sorghum, and soybeans are grown with varying degrees of success. Artificial drainage would broaden the use suitability and increase the yields of crops now grown, but it is difficult to drain this soil adequately. Tile drainage would not be effective because the compact layer in the subsoil interferes with the movement of water. Open ditches, bedding, and row direction would be effective in removing surface water in many places. Diversion ditches or terraces on the adjacent soils would also help.

Lime and fertilizer requirements are high. The response to amendments is not as good as that of the associated Holston soils, because of the poor drainage and nearly impermeable claypan. Nevertheless, the yield of pasture and hay crops can be improved by the use of lime, phosphorus, and possibly potassium. For a discussion of use and management, see group 15.

Waynesboro loam, undulating phase (2 to 5 percent slopes) (Wc).—This soil occurs on high terraces along the Nolichucky River and the Watauga River. Most of the acreage is along the Nolichucky. It is a red, well-drained, friable soil. Like the Nolichucky soils, it consists of old alluvium washed mainly from sandstone, quartzite, slate, and shale, and some material from limestone. This soil is somewhat coarser textured, more friable, and generally lighter colored than the Cumberland soils. The native vegetation consisted of oaks, hickories, maples, and yellow-poplars.

Profile description:

0 to 10 inches, brown to light-brown very friable loam; in wooded areas the upper 2 inches is stained dark with organic matter.
10 to 16 inches, brown or light-brown to yellowish-brown friable light clay loam; soft coarse crumb structure.
16 to 30 inches, yellowish-red firm but friable silty clay loam.
30 inches+, yellowish-red to light-red firm silty clay loam or sandy clay with frequent yellow and olive-yellow splotches; underlain by limestone bedrock or material weathered from limestone; alluvial deposit generally from 3 to 10 feet in depth.

Nearly all of this soil is slightly eroded. Most of it has lost some of the original surface layer, including the topmost part high in organic matter. A few areas are included that have lost a considerable part of the surface layer. In some areas the soil is shallow over limestone residuum, and the lower layers are generally heavier in texture and less friable than in the profile described.

This soil is medium to strongly acid and has a moderate supply of plant nutrients and organic matter. It is permeable to air, roots, and water. The soil has a medium water-supplying capacity, but moisture moves freely through it. Some cobblestones and gravel occur on the surface and throughout the profile but do not seriously interfere with tillage. External and internal drainage are good.

Use suitability.—Most areas have been cleared and are used for crops and pasture. Corn, small grains, lespedeza, alfalfa, red clover, tobacco, and vegetables are the most commonly grown crops.

This soil is well suited to all the common crops, including alfalfa and red clover. It is suited to moderately intensive use. It probably could be maintained by use of rotations in which row crops are grown half the time. Row crops should not be planted more than 2 years in succession. Lime and phosphorus are needed for good yields of deep-rooted legumes such as alfalfa and red clover. Practically all crops respond favorably when phosphorus is applied. All crops, except legumes and the crops immediately following legumes, respond to applications of nitrogen. For a discussion of use and management, see group 3.

Waynesboro loam, eroded rolling phase (5 to 12 percent slopes) (Wd).—This soil occurs mainly on high terraces situated along the Nolichucky and Watauga Rivers. It differs from Waynesboro loam, undulating phase, in being somewhat more eroded and in having stronger slopes. A large part of the original surface soil has been removed by erosion. The present surface layer often is mixed with subsoil, so it varies a great deal in depth, color, and texture.

The surface soil is a light-brown or brown to yellowish-red loam to silty clay loam. The subsoil consists of light-red to yellowish-red firm but friable clay loam or

silty clay loam. Small severely eroded areas are conspicuous because the subsoil is exposed. Shallow gullies are common in eroded areas. A small area that is still in forest is not eroded.

Use suitability.—Practically all of this soil has been cleared and cultivated. Very little of the acreage is abandoned or idle. Less than 15 percent of the soil is in permanent pasture, and the rest is used for corn, small grains, hay, and miscellaneous crops. A wide variety of crops are grown, but systematic rotations are generally not used.

The soil is well suited to all the common crops, including alfalfa. It requires better management than the undulating phase, chiefly because of its stronger slopes. Crop rotations should be longer and should include a row crop no more than once every 3 or 4 years. Fertilizer and lime requirements are similar to those for the undulating phase. The soil is susceptible to erosion when not covered with vegetation. For a discussion of use and management, see group 6.

Waynesboro loam, eroded hilly phase (12 to 25 percent slopes) (We).—This soil is largely confined to high terraces situated along the Nolichucky and Watauga Rivers. It differs from Waynesboro loam, undulating phase, mainly in having stronger slopes and in being more eroded.

Part of the original surface soil has been removed by erosion. The present surface layer is a brown or light-brown to yellowish-red friable loam or silty clay loam. The subsoil is light-red to yellowish-red firm but friable clay loam or silty clay loam. The alluvial material from which the soil was derived is 2 feet to 10 feet or more deep.

The soil is associated mainly with other members of its own series and with the Cumberland, Nolichucky, and Dunmore soils.

Use suitability.—Practically all of this soil has been cleared and is used for crops and pasture. Its use and management are similar to those of Waynesboro loam, eroded rolling phase, but more of this soil is now idle or is in unimproved pasture and less is used for crops.

This soil is not well suited to cultivated crops but is well suited to pasture. The strong slopes and susceptibility to erosion make it hard to cultivate and conserve. This soil is moderately fertile and has a moderate water-supplying capacity. It is also fairly productive of close-growing crops and pasture if adequately fertilized. For a discussion of use and management, see group 13.

Waynesboro cobbly loam, eroded rolling phase (5 to 12 percent slopes) (Wa).—This soil occurs in small scattered areas along the Watauga and Nolichucky Rivers. It is closely associated with Cumberland, Nolichucky, and Dunmore soils, and other members of its own series. It is not extensive in this county. It differs from Waynesboro loam, undulating phase, chiefly in being cobbly, in occupying stronger slopes, and in being more eroded. A large part of the original surface layer has been removed by erosion, and the properties of the present surface soil vary with the degree of erosion.

This soil is friable cobbly loam or light clay loam, generally brown or light brown to yellowish brown, and in places yellowish red. The subsoil is a yellowish-red firm but moderately friable cobbly silty clay loam to sandy clay. The alluvial accumulation from which this soil has formed ranges from less than 2 feet to more than 10 feet in thickness. The alluvium is underlain by limestone. About 10 acres of this soil that is still in forest is not eroded.

Use suitability.—Practically all of this soil has been cleared and is used for crops or pasture. It is now used for corn, small grains, hay, and pasture. It is only moderately well suited to cultivated crops because it is cobbly and droughty. Cobblestones interfere with tillage, and in places make it impossible. They also make the soil more porous and reduce its ability to hold moisture.

This soil is well suited to crimson and red clovers, small grains, and early vegetables. It is not well suited to the late-maturing crops such as corn or alfalfa. It contains a moderate supply of plant nutrients and organic matter and is medium to strongly acid. Moderate to heavy applications of lime, phosphorus, and potassium are essential for high crop yields. See group 7 for a discussion of use and management.

Waynesboro cobbly loam, eroded hilly phase (12 to 25 percent slopes) (Wb).—This soil occurs in small areas sparsely distributed on the high terraces situated along the Nolichucky and Watauga Rivers. It differs from Waynesboro cobbly loam, eroded rolling phase, primarily in occupying stronger slopes. It developed from an old alluvial deposit consisting chiefly of material that was washed from uplands underlain by sandstone, quartzite, slate, shale, and limestone. A large part of the surface soil has been removed by erosion. In small severely eroded spots all of the original surface layer is gone and the reddish-colored subsoil is exposed.

The present surface soil is predominantly a light-brown or brown to yellowish-brown friable cobbly loam or light clay loam. The subsoil is a yellowish-red firm but moderately friable cobbly silty clay loam or sandy clay. The alluvial deposit from which the soil was formed ranges from about 2 feet to 10 feet in thickness.

Use suitability.—All of this soil has been cleared and used for crops and pasture. A large part of the acreage is now in pasture. Some of it is being used for crops, and some is idle or abandoned.

This soil is poorly suited to intertilled crops. It is difficult to work and conserve because it has strong slopes and a high content of cobblestones and gravel. It is also somewhat droughty and highly susceptible to erosion. On most farms this soil is probably best suited to permanent pasture. It has a moderate supply of organic matter and plant nutrients. High-quality pastures can be established and maintained if enough lime and phosphorus are applied. For a discussion of use and management, see group 16.

Weaver silt loam (0 to 3 percent slopes) (Wf).—This is a brown, alkaline, imperfectly drained soil situated along stream bottoms. It consists of general alluvium washed from uplands underlain by limestone. Small amounts of material from other sources also are present. Dunmore, Dewey, and Groseclose soils have been the source of most of the alluvial materials. The surface of this soil is nearly level, and all areas are subject to overflow. The outstanding characteristic of the Weaver soil is the large amount of limestone concretions or marl incorporated with the soil mass.

The soil occurs in narrow strips along small streams that are fed by springs or subterranean flow. It is associated with the Dunmore, Dewey, and Groseclose soils of the

uplands, and with the Emory, Greendale, Pace, and Hermitage soils of the colluvial lands. The most extensive areas occur along Big Limestone Creek.

Profile description:

0 to 14 inches, dark yellowish-brown or brown friable silt loam mixed with small limestone nodules or marl.
14 to 24 inches, yellowish-brown or dark yellowish-brown heavy silt loam, mottled with light olive gray and pale yellow; layer is about 20 percent marl.
24 inches+, light olive-gray silty clay loam containing an admixture of marl; alluvial deposit is usually more than 5 feet deep.

The soil is neutral to strongly alkaline. It is moderately well supplied with organic matter and plant nutrients. It is permeable, but the lower layers are saturated with water part of the time; consequently movement of air and water and growth of plant roots are restricted. Internal and external drainage are slow; the water-supplying capacity is high. Small limestone nodules or marl are scattered over the surface and become larger and more numerous with increasing depth. In many places, almost pure marl occurs at a depth of 4 feet (fig. 12).

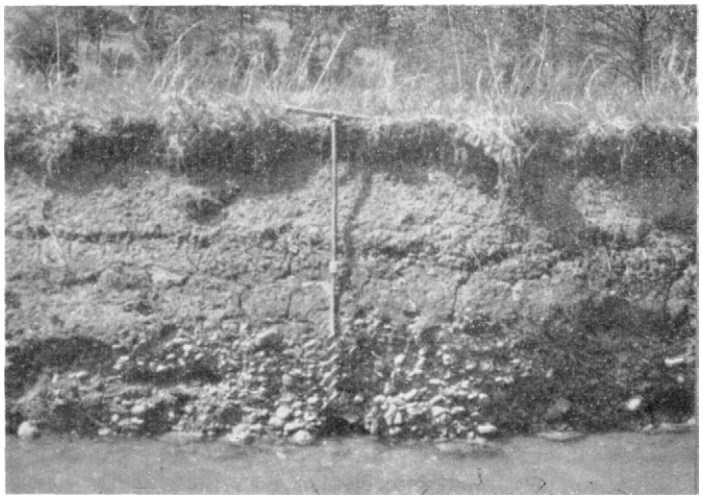

Figure 12.—**Marl bed (at bit of auger) underlying the imperfectly drained Weaver soil of the first bottoms.**

This marl is used in place of limestone by many farmers for liming the soil.

The soil varies a little in content of marl and in drainage. A few small included areas are more poorly drained than the soil described.

Use suitability.—Practically all of this soil has been cleared and cultivated. It is now being used mainly for hay, corn, and pasture. A small acreage is idle.

The use suitability of this soil is limited by slow drainage, high lime content, and susceptibility to flooding. The soil is well suited to corn and certain hay and pasture crops. It is not well suited to alfalfa because it has a high water table. Small grains tend to lodge, mature late, and are susceptible to disease. Crops that are sensitive to lime are also unsuitable. Excessive moisture frequently interferes with tillage and other field operations. Otherwise, the soil is not difficult to work. Supplies of plant nutrients and organic matter are moderate and are periodically replenished by sediments from floodwaters. Drainage would probably increase the productivity of the soil. It would not, however, greatly broaden the use suitability unless the soil were also protected from flooding and the marl were removed. Neither of these improvements is feasible. See group 1 for a discussion of use and management.

Wehadkee silt loam (0 to 3 percent slopes) (Wg).—This is a gray, poorly drained soil that occurs on river lowlands or first bottoms. It consists of general alluvium washed chiefly from uplands underlain by granite or gneiss. In most places the alluvium is mixed with small amounts of material from other sources. This soil is closely associated with the Chewacla, Congaree, and Augusta soils. All of it is on the present flood plains of the Nolichucky River. It is not an extensive soil.

Profile description:

0 to 9 inches, light brownish-gray to grayish-brown moderately friable silt loam, mottled with pale yellow and gray.
9 inches+, gray or dark-gray heavy silty clay loam or silty clay, mottled with yellowish brown; layer extends to water table; alluvial deposit is several feet thick.

This soil is medium to strongly acid and is moderately low in organic matter and plant nutrients. Gravel or cobblestones are on the surface and throughout the soil in some places, but not in amounts that seriously interfere with tillage. Variable amounts of mica flakes are in the soil mass. The high water table limits penetration of roots and movement of air. The soil layers are moderately permeable to air, roots, and water when the water table is sufficiently lowered. Crayfish are active on this soil, and their chimneys are common. The soil is flooded frequently by the streams along which it occurs, and the water table is permanently high. Seepage from the adjacent uplands also keeps the soil wet in places.

Use suitability.—Nearly all of this soil has been cleared, and most of it now is in poor-quality pasture. A large part is idle and is reverting to forest. Because of its poor drainage, this soil is best suited to pasture. Water-tolerant hay crops and short-season summer annual legumes do fairly well.

Artificial drainage would make this soil more suitable for hay and pasture and would broaden its use suitability to include corn and other crops. The soil, however, would be difficult to drain. In its natural poorly drained condition, it would not respond well to fertilization. For a discussion of use and management, see group 15.

Whitesburg silt loam (2 to 7 percent slopes) (Wh).—This is an imperfectly drained brown soil. It consists of recent local alluvium washed from calcareous shale uplands. The colluvium and local alluvium are from Dandridge and Litz soils. The soil is at the base of slopes, on small alluvial-colluvial fans, and along narrow intermittent drainageways. External drainage is good. Internal drainage is only fair but is adequate for most of the common crops. The native vegetation is oaks, hickories, maples, and yellow-poplars.

Most of this soil occurs in the vicinities of Horse Creek and Austin Springs. Individual areas are small; a few are fan-shaped, but most are narrow strips along intermittent drains. The soil is associated mainly with the Dandridge, Litz, Leadvale, and Hamblen soils.

Profile description:

0 to 11 inches, yellowish-brown to grayish-brown friable silt loam.
11 to 20 inches, light yellowish-brown to yellowish-brown firm heavy silt loam or silty clay loam faintly mottled with olive gray and pale yellow.

20 inches+, light yellowish-brown to brownish-yellow firm dense silty clay or silty clay loam, profusely mottled with olive gray, pale yellow, and brown; in some places calcareous shale is at a depth of 24 inches but in most places it is deeper.

The soil varies in color and in depth of the surface layer. In some places the soil has a uniform color and texture to a depth of 2 feet.

Whitesburg silt loam is slightly acid and fairly well supplied with organic matter and mineral plant nutrients. It is permeable to air, roots, and moisture, but water saturates the subsoil in the rainy seasons. It has a high water-supplying capacity.

Use suitability.—Nearly all this soil has been cleared. It is now used for corn, market vegetables, small grains, hay, and tobacco (fig. 13). Permanent pastures occupy many areas. A few areas that are isolated from other soils suitable for crops or pasture are idle.

***Figure 13.*—Burley tobacco and corn on Whitesburg silt loam. Dandridge soils on steep slopes in background.**

The soil is not hard to manage. It can be used rather intensively for adapted crops if adequate organic matter and fertility levels are maintained by the use of crop residues, green manure, barnyard manure, and commercial fertilizers. In addition, short rotations—for example, corn, legumes, and hay—should be followed on most farms. Tobacco and alfalfa are not well suited to this wet soil. Small grains can be grown, but they tend to lodge. The soil is not subject to erosion but may be damaged by excessive deposition of material washed from higher slopes. For a discussion of use and management, see group 2.

Interpretation and Use

Interpretative groupings help in evaluating the suitability of individual soils for agriculture, forestry, or other uses. Three such groupings have been made of the soils of Washington County, one based on use and management, one on land capability, and one on geographic associations of soils. These groupings are discussed in the following sections.

Use and management of soils

Good soil management makes consistently good yields possible and at the same time keeps the soil in good condition. Crop selection, crop rotation, fertilization, suitable methods of cultivation, and control of weeds, diseases, and insects are basic management practices applicable to all soils. Individual soils, however, differ widely in use suitability and specific management needs. To simplify the discussion of management, the 133 soils mapped in Washington County have been combined into 18 groups, each group consisting of soils that have similar management needs.

In the following pages, two levels of management are discussed for each group: (A) the prevailing level, and (B) a higher level, equivalent to the practices used by the farmers of the county who get better yields, and which are feasible under present economic conditions. For each management group, there is a table showing the yields that can be expected under each of the two levels of management. These are average yields, each based on at least a 5-year period. Higher yields are possible in favorable seasons, especially with more liberal use of fertilizer. To raise yields from those in the "A" columns to those in the "B" columns will generally require at least two complete rotation cycles under the high level of management. New crop varieties, improved tillage methods, or better methods of controlling plant diseases and insects may make still higher yields possible in the future.

MANAGEMENT GROUP 1

Management group 1 consists of soils good to excellent for crops and pasture. The soils are well suited to intensive cropping. Their use suitability is limited by periodic flooding and imperfect drainage. All, except the Buncombe soil, are fairly fertile and produce comparatively high yields of the adapted crops without amendments. Most of the soils are well supplied with lime, organic matter, and plant nutrients, which are replenished periodically by flood sediments. Moisture conditions are favorable for plant growth most of the time. Practically all soils have favorable tilth that is easily maintained. Table 7 shows yields of adapted crops to be expected on these soils under two levels of management.

These soils are well suited to corn, summer annual hay, many kinds of vegetables, and red clover. They are poorly suited to alfalfa and tobacco. Small grains are more susceptible to lodging and disease and generally mature later on these soils than on soils of the uplands.

Present use and management.—All these soils have been cleared of forest and are rather intensively used for farming. Corn, tobacco, small grains, and hay are the main crops. Red clover, alone or mixed with timothy or orchardgrass, is the chief hay crop. Little alfalfa is grown, but a considerable acreage of lespedeza is sown with small grains and used for hay or pasture. Tobacco is the chief cash crop, although more of it is grown on the associated terrace and colluvial soils than on the soils of this group.

Planned rotation of crops is not ordinarily practiced, although a few farmers follow a system consisting of corn, small grains, and hay. In common practice the sequence of row crops is broken every few years with a hay crop. A few farmers follow each row crop with a winter cover crop, which is used for winter pasture.

TABLE 7.—*Soils of management group 1 and average expected acre yields of adapted crops under two levels of management*

[Yields in columns A are those to be expected under prevailing management, as defined for management group 1 under the subheading, Present Use and Management; yields in columns B are those to be expected under improved management as defined in the subheading, Management Requirements; absence of yield figure indicates crop is not commonly grown and soil is not physically suitable for it under the management specified]

Soil	Corn		Wheat		Oats		Lespedeza		Alfalfa		Tobacco		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Lbs.*	*Lbs.*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Buncombe loamy fine sand	15	25	5	10	9	23	0. 4	0. 7	------	------	------	------	15	35
Chewacla loam	35	55	------	(2)	------	(2)	1. 1	1. 6	------	------	------	------	85	120
Congaree loam	45	70	14	20	35	50	1. 2	1. 7	------	------	1, 500	1, 900	110	135
Congaree fine sandy loam	40	60	12	18	30	45	1. 1	1. 6	------	------	1, 350	1, 700	95	120
Hamblen silt loam	40	60	------	(2)	------	(2)	1. 1	1. 6	------	------	------	(2)	110	135
Hamblen loam	35	55	------	(2)	------	(2)	1. 1	1. 6	------	------	------	(2)	105	130
Lindside silt loam	45	63	------	(2)	------	(2)	1. 2	1. 6	------	------	------	(2)	115	140
Ooltewah silt loam	40	60	------	(2)	------	(2)	1. 2	1. 6	------	------	------	------	110	135
Staser loam	45	70	14	18	35	50	1. 2	1. 7	------	------	1, 300	1, 800	110	135
Weaver silt loam	40	55	------	(2)	------	(2)	. 9	1. 5	------	------	------	------	105	130

[1] Number of days 1 acre will graze a mature cow without injury to the pasture.

[2] Crop seldom grown on soil.

Most farmers fertilize tobacco with 700 to 1,400 pounds per acre of a complete fertilizer, such as 3–12–12, or 4–8–12, if no manure is used. Many farmers also lightly fertilize corn and small grains. Lime is commonly applied preceding the legume crop. The amounts and frequencies for applying lime and fertilizer vary greatly from farm to farm. Some of the farmers apply as much as 2 or 3 tons of lime per acre every 3 years.

Tillage is accomplished with reasonable promptness and care. Tile drainage is not common on the imperfectly drained soils, but open ditches have been used on many areas. Insect and disease controls are practiced, but not enough to assure complete protection.

Management requirements.—Selection of adapted crops is very important. Although the adapted crops can be successfully grown almost continuously, a short rotation is desirable on most farms. A rotation of corn and hay is well suited to the imperfectly drained soils. A corn, wheat, and red clover rotation is successfully used on the well-drained soils. Winter legumes such as crimson clover, grown and plowed under as green manure in spring, are beneficial to soils on which corn is grown every summer. Vegetable crops such as cabbages or green beans, or tobacco, can be substituted for the corn in the suggested rotations.

Some fertilization is required to maintain high yields under intensive use. Needs should be checked by soil test. Most of the soils respond well to fertilizer. Lime and a complete fertilizer are required to establish and maintain red clover. Practically all crops respond well to liberal applications of phosphorus. Moderate applications of potassium may be needed for some crops, but this will depend on the crop to be grown and the previous cropping system. Nitrogen is needed if continuous row cropping is practiced, but a legume in the rotation generally supplies some of this element.

Special tillage or cropping practices for the maintenance of tilth or water control are not generally necessary. Good tilth is easily maintained, and the soils can be tilled over a wide range of moisture content without serious damage. The soils are not susceptible to erosion, but it may be necessary to build up streambanks in some places to prevent scouring. The range of use suitability and the general productivity of the imperfectly drained members probably could be increased by artificial drainage. The advisability of installing artificial drainage depends on engineering feasibility and cost, and the kinds and amounts of other soils on the farm.

MANAGEMENT GROUP 2

Soils of management group 2 are well suited to intensive farming. They are also valuable for pasture because they stay moist and productive during the hot, dry weather. When used for pasture, these soils require the application of lime and phosphorus, use of adapted pasture plants, and control of grazing. Weed control is not a serious problem on properly managed pastures, but mowing may be necessary to remove excess herbage and undesirable plants. Table 8 shows yields of adapted crops to be expected on these soils under two levels of management.

This group consists of soils good to excellent for crops and pasture. They are well suited to intensive use for practically all the common crops. Ordinarily, they are not susceptible to flooding and therefore they have wider adaptations than soils of group 1. All are deep, permeable, well-drained soils. Moisture conditions are favorable for plant growth. The supplies of organic matter and plant nutrients and the water-holding capacity are high. Although not susceptible to flooding, these soils receive sediments washed from adjacent slopes, which tend to replenish the supply of plant nutrients and organic matter. Good tilth is easily maintained, and the soils can be tilled over a fairly wide range of moisture conditions without serious damage.

These soils are well suited to corn, hay, and tobacco. They are not suited to small grains, which tend to lodge and mature late on these soils. Alfalfa grows well in

TABLE 8.—*Soils of management group 2 and average expected acre yields of adapted crops under two levels of management*

[Yields in columns A are those to be expected under prevailing management, as defined for management group 2 under the subheading, Present Use and Management; yields in columns B are those to be expected under improved management as defined in the subheading, Management Requirements; absence of yield figure indicates crop is not commonly grown and soil is not physically suitable for it under the management specified]

Soil	Corn		Wheat		Oats		Lespedeza		Alfalfa		Tobacco		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Lbs.*	*Lbs.*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Barbourville loam	35	60	13	20	23	38	1.0	1.6	------	------	1,300	1,800	85	130
Barbourville stony loam	25	45	12	18	20	35	.8	1.3	------	------	950	1,400	60	110
Emory silt loam	45	70	20	29	40	55	1.3	1.8	2.0	3.0	1,700	2,200	110	140
Greendale silt loam	40	60	17	23	33	43	1.1	1.6	1.8	2.8	1,600	2,100	95	130
Whitesburg silt loam	40	55	14	20	30	38	1.1	1.6	------	------	1,100	1,600	90	125

[1] Number of days 1 acre will graze a mature cow without injury to the pasture.

places but it is better suited to upland soils such as the Dunmore.

Present use and management.—All the soils of group 2 have been cleared, and most of the acreage is used intensively for corn, small grains, tobacco, vegetables, or hay. Little alfalfa is grown, but a considerable amount of lespedeza is sown with small grains and is either cut for hay or pastured. Many areas are used exclusively for tobacco, which is the chief cash crop. Cover crops are commonly sown following the tobacco harvest; they are used either for green manure or for winter pasture.

A planned crop rotation is not ordinarily practiced, but a few farmers use a system consisting of corn or tobacco, a small grain, and hay. In common practice the sequence of row crops is broken by a hay crop every few years. Some farmers follow each row crop with a winter cover crop. Many areas of these soils are small and irregular in shape, and their use, in many cases, depends on the use of the adjacent areas; consequently, a substantial acreage is used for permanent pasture.

Most farmers fertilize tobacco and vegetable crops heavily with a complete fertilizer such as 3–12–12 or 4–8–12. Vegetables generally receive 250 to 800 pounds of fertilizer per acre, and tobacco 800 to 1,400 pounds. In addition, these two crops receive most of the available barnyard manure. Many farmers lightly fertilize corn and small grains. Some farmers apply 2 to 3 tons of lime per acre at 3-year intervals. The use of lime and fertilizer varies greatly from farm to farm both in amount and in frequency of application.

Tillage operations are carried out with reasonable promptness and care. Some measures are taken for insect and disease control, but not enough to provide complete protection.

Management requirements.—The soils of group 2 are suited to intensive cultivation. Good yields are obtained even when the soils are used almost continuously for row crops, but a short rotation is desirable on most farms. A rotation well suited to this soil consists of corn, wheat, red clover, and tobacco. Almost any of the vegetable crops can be substituted for the corn or tobacco, and oats or barley may be used in place of wheat. Alfalfa appears to be better suited to certain upland soils such as the Dunmore. Some farmers use these soils almost continuously for row crops. However, a rotation in which crimson clover is alternated with tobacco, vegetables, or some other row crop is advisable.

Although these soils have high fertility in comparison with other soils of the county, they show excellent response to fertilizer. Fertilizer needs should be checked by soil tests. Nitrogen is generally needed, though some of it is supplied by legumes. Phosphorus is also required for high yields of most crops. Potassium is less likely to be deficient, but it may be needed for some crops. Although none of the soils are especially low in lime, a light application would generally be beneficial, and this is necessary in most places for the successful growth of red clover and alfalfa.

Control of runoff usually is not a problem except in a few places where the soils receive excess water from higher slopes. Such places may be damaged by erosion and also by heavy deposits of material, if the higher slopes are eroding rapidly. Diversion of the runoff from such slopes is desirable. Good tilth is easily maintained, and tillage can be carried on over a wide range of moisture content without harming the physical properties of the soils. All cultivation should be on the contour.

These soils are highly productive of pasture because they stay moist and productive during hot, dry weather. If used for pasture, the soils require chiefly phosphorus. Greendale and Barbourville soils need lime also. Other desirable management practices are control of grazing, scattering of droppings, and occasional mowing to remove excess herbage and undesirable plants.

MANAGEMENT GROUP 3

The soils of management group 3, all good to excellent for crops and pasture, are listed in table 9. They are relatively high in fertility and easy to work and conserve. They have mild slopes, are not seriously eroded, and are not very susceptible to erosion. Compared to the soils of the uplands, their content of organic matter and plant nutrients is moderate to high, and their moisture conditions are favorable for plants. The soils are not stony, and tilth is very good to excellent. Table 9 shows the expected yields of adapted crops under two levels of management.

TABLE 9.—*Soils of management group 3 and average expected acre yields of adapted crops under two levels of management*

[Yields in columns A are those to be expected under prevailing management, as defined for management group 3 under the subheading, Present Use and Management; yields in columns B are those to be expected under improved management as defined in the subheading, Management Requirements]

Soil	Corn		Wheat		Oats		Lespedeza		Alfalfa		Tobacco		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Lbs.*	*Lbs.*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Cumberland silt loam, undulating phase	35	60	18	28	40	60	1. 2	1. 6	3. 0	4. 0	1, 500	2, 000	70	125
Hayter loam, undulating phase	35	55	16	23	25	40	1. 0	1. 6	2. 2	3. 2	1, 450	1, 850	70	120
Hermitage silt loam, undulating phase	38	60	17	25	35	55	1. 2	1. 6	3. 0	3. 8	1, 650	2, 200	80	130
Masada loam, undulating phase	35	55	17	25	32	48	1. 1	1. 5	2. 8	3. 6	1, 450	1, 850	70	120
Sequatchie loam	38	55	18	25	28	45	1. 1	1. 6	1. 8	2. 8	1, 500	1, 950	70	120
Waynesboro loam, undulating phase	35	53	17	25	30	48	1. 1	1. 5	2. 8	3. 7	1, 500	1, 950	70	125

[1] Number of days 1 acre will graze a mature cow without injury to the pasture.

These soils are well suited to practically all of the crops commonly grown in the area. With proper fertilization and liming, alfalfa and red clover are grown successfully. These soils are not so good for corn as those of groups 1 and 2 but are better than the soils of the uplands.

Present use and management.—Nearly all the acreage of these soils has been cleared and is now used intensively for crops. Corn, small grains, hay, and tobacco are the chief crops. Tobacco is the main cash crop. A considerable acreage of alfalfa is grown. Red clover is grown alone or mixed with timothy or orchardgrass. Lespedeza is commonly grown with small grains and used for hay or pasture. Wheat is the most common small grain harvested. Oats, rye, and barley are generally used for green manure or for winter pastures. Crops are not rotated systematically, but the farmers getting better yields use 3-year and 4-year rotations consisting of corn, wheat, hay, and pasture.

Small grains and corn are lightly fertilized with phosphorus on many farms. Tobacco and vegetable crops receive moderate to heavy applications of a complete fertilizer, plus a heavy application of barnyard manure. Most crops need lime also, as the soils are usually deficient in this element. Many farmers give alfalfa moderate applications of 3–12–12 fertilizer at planting, and superphosphate and boron. The amounts of amendments used and the frequency of application vary widely.

Tillage is carried out with reasonable promptness and care. Special practices for controlling runoff are not needed if crops are rotated and adequately fertilized. Some measures for the control of insects and disease are followed, but protection against them is not adequate.

Management requirements.—The soils of this group are suited to intensive use for crops. Winter cover crops and green-manure crops are useful for conserving soil moisture, improving tilth, and providing nitrogen and humus.

A rotation of corn, a small grain, and red clover and grass is well suited. Any row crop can be substituted for the corn in this rotation. If a longer rotation is desired, alfalfa can be substituted for the red clover. Another well-suited cropping system consists of an intertilled crop followed by a small grain and lespedeza.

For high yields of most of the common crops, the soils of this group are slightly to moderately deficient in lime, phosphorus, nitrogen, and possibly potassium. Crops show excellent response to fertilizer on most of these soils. Soil tests should be used to check the amount of lime and fertilizer needed. Moderate applications of lime and a complete fertilizer are needed for good yields of the deep-rooted legumes such as alfalfa and red clover. Alfalfa should receive 20 pounds of borax per year, applied before spring growth or just after spring planting. These elements also greatly increase the yield of other legumes, especially lespedeza. Nitrogen is required for high yields of all crops except legumes, though less may be needed for the crops that immediately follow legumes. Practically all crops respond well to phosphorus.

The Sequatchie soil is likely to be deficient in potassium, especially for the deep-rooted legumes. The amount of potassium in the other soils may be enough for most crops but should be determined by soil tests. Heavy applications of a complete high-grade fertilizer are desirable on vegetables, tobacco, and potatoes. Properly stored manure is an excellent source of both nitrogen and potassium, but it should be supplemented with phosphorus to obtain a balance of plant nutrients.

Good tilth is easily maintained, and the soils can be tilled over a wide range of moisture content without seriously impairing the tilth. Some gravel and cobblestones are on most areas, but they do not interfere with tillage. Controlling erosion and conserving soil moisture are not serious problems when crops are properly chosen and adequately fertilized. Engineering devices for controlling erosion are not generally needed, but contour tillage is desirable wherever feasible.

These soils are well suited to pasture. Good pastures can sometimes be established without any special preparation other than seeding, but an application of 800 to 1,000 pounds of 3–12–12 is desirable. Exact amounts and rates should be determined by soil tests. Fertilization and regulation of grazing are usually effective in controlling weeds, but mowing may be necessary.

MANAGEMENT GROUP 4

Soils of management group 4 are suited to rather intensive use for crops, although the large quantities of stones, gravel, and cobblestones on the surface and throughout the profile interfere with tillage. The soils are deep, very permeable, and moderate in water-holding capacity. They are medium to strongly acid and moderately high to low in organic matter and plant nutrients. Slopes are mild, and the soils are only slightly susceptible to erosion. Table 10 lists the soils of this group and the yields to be expected under two levels of management.

These stony soils are more difficult to till and less fertile than those of group 3, and they have moisture conditions less favorable for plant growth. They are fairly well suited to most of the common crops, such as crimson clover, red clover, and small grains, but their suitability is limited by stoniness and droughtiness. They are well suited to early vegetables, but not to crops that mature late in summer or early in fall.

Present use and management.—Practically all the acreage of these soils is used for crops and pasture. The crops most commonly grown are corn, small grains, hay, tobacco, and market vegetables. Tobacco and peppers are the chief cash crops. Other vegetables are grown primarily for home use. A smaller proportion of these soils is used for tobacco and peppers than of the stone-free terrace and colluvial soils. Much of the acreage of group 4 is used for pastures, and a substantial acreage is idle each year. Lespedeza, alone or mixed with grasses, is the chief hay and pasture plant. Very little alfalfa is grown.

Crop rotation and fertilization are not systematically practiced. Short irregular rotations that include frequent row crops are common. A few farmers use a rotation of corn, a small grain, and hay, or they substitute a row crop such as tobacco for the corn. Some operators plant winter cover after a row crop.

Tobacco and truck crops are heavily fertilized, but other crops receive little or no fertilizer. Tobacco is given about 700 to 1,400 pounds, or more, of a complete fertilizer per acre. Much of the acreage has been given adequate amounts of lime, but a large area still needs it. Some farmers apply 2 to 3 tons of ground limestone at 3-year intervals; others apply larger amounts at longer intervals. Most farmers have used superphosphate, but not enough.

Erosion is not a serious problem on the mildly sloping soils of this group, so special erosion controls are not used. Some measures are taken to control insects and disease, but they are not adequate for complete protection.

Management requirements.—These soils are suited to intensive cropping. Crop rotation and fertilization are required to maintain or increase yields. A rotation consisting of corn, wheat, and red clover is suitable. In this rotation any row crop can be substituted for the corn, any of the small grains for the wheat, and grass with red clover for the red clover alone.

These soils are generally not as strongly leached as the associated soils of the uplands, but they are moderately deficient in lime, phosphorus, nitrogen, and possibly potassium. Applications of lime and complete fertilizer are essential for good growth of alfalfa or red clover and are beneficial to practically all crops. Alfalfa should receive 20 pounds of borax per acre each year before spring growth or after first cutting. Nitrogen is also deficient, except for legumes and the crops that immediately follow legumes. The Hayter soil probably has enough potassium for any crops except alfalfa and potatoes, though this should be checked by soil tests. The Jefferson and Sequatchie soils ordinarily are deficient in potassium for other crops. Barnyard manure is an excellent source of nitrogen, potassium, and organic matter.

The large amount of stones, gravel, or cobblestones in these soils interferes with tillage. In some places it may be practical to improve workability by removing the large loose stones. These soils are only very slightly susceptible to erosion, but they should be tilled on the contour wherever feasible.

The soils of this group are fair to good for pasture. They produce very good pasture early in the season, but not late in summer and early in fall. A good pasture mixture consists of bluegrass, orchardgrass, redtop, white clover or Ladino clover, red clover, hop clover, and lespedeza. Lime and a complete fertilizer should be applied to properly selected pasture mixtures. It is necessary to control grazing, scatter droppings, and mow to remove excess herbage and eradicate weeds.

TABLE 10.—*Soils of management group 4 and average expected acre yields of adapted crops under two levels of management*

[Yields in columns A are those to be expected under the prevailing management, as defined for management group 4 under the subheading Present Use and Management; yields in columns B are those to be expected under improved management as defined in the subheading, Management Requirements; absence of yield figure indicates crop is not commonly grown and soil is not physically suitable for it under the management specified]

Soil	Corn		Wheat		Oats		Lespedeza		Alfalfa		Tobacco		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Lbs.*	*Lbs.*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Hayter stony loam, undulating phase	30	45	12	19	23	38	1.0	1.4	1.5	2.4	1,050	1,500	60	100
Jefferson stony loam, undulating phase	18	35	8	15	15	30	.7	1.1	------	------	750	1,125	45	90
Sequatchie cobbly fine sandy loam	30	45	15	19	23	38	.9	1.3	------	------	1,150	1,500	55	95

[1] Number of days 1 acre will graze a mature cow without injury to the pasture.

MANAGEMENT GROUP 5

The soils of management group 5 are poor to good for crops and fair to very good for pasture. They are easy to work and conserve and are moderately productive of most crops. Table 11 shows the soils of this group and the yields to be expected from them under two levels of management.

The Holston, Jefferson, and Pace soils are deep, friable, and well drained, and they have slopes of about 2 to 5 percent. They are very permeable to air, roots, and water. The Monongahela, Leadvale, and Augusta soils are imperfectly drained to moderately well drained and are less permeable and slightly lower in water-supplying capacity than the others.

Rainfall is readily absorbed and fairly well retained. The water-supplying capacity is medium, and the supply of plant nutrients is low to medium. None of the soils have enough stones in the plow layer to interfere with tillage, although cobblestones, gravel, or chert are present in all of them.

These soils are suited to corn, wheat, oats, barley, tobacco, and many vegetables. If properly fertilized, red clover grows successfully. The use suitability of the Monongahela, Augusta, and Leadvale soils is more limited than that of the well-drained members because of inferior drainage.

Present use and management.—An estimated 98 percent of the acreage in this group has been cleared and is now cultivated. Corn, wheat, tobacco, and hay are the chief crops. Lespedeza, alone or mixed with grasses, is the chief hay crop. Timothy, orchardgrass, and redtop are also important hay crops. Much of the tobacco in this county is grown on the soils of this group, particularly the Pace soil. Some alfalfa is grown.

Although a wide variety of crops is grown, very few farmers use a systematic rotation. A rotation of corn, a small grain, and hay is perhaps the most common one. Some farmers plant winter cover after each row crop.

Tobacco and truck crops are usually fertilized heavily, but only a few farmers fertilize other crops. Tobacco is treated with 800 to 1,400 pounds of complete fertilizer per acre, such as 3–12–12 or 4–8–12, and truck crops with 300 to 600 pounds. Wheat is usually fertilized lightly.

Most farmers use lime, but not enough to correct fully the acidity of the soil. Phosphorus also has been applied at various intervals and rates, but usually not enough to get high yields. Artificial drainage is normally not needed. Erosion control is not a problem, because the slopes are mild.

Management requirements.—Although they occur on similar slopes, the soils of group 5 have more severe management requirements than those of group 3. Rotations should be longer and fertilization heavier. If other management practices are good, the soils can be maintained in a 3-year to 4-year rotation. A rotation of corn, small grains, clover and orchardgrass which is seeded in the grain and allowed to remain for 2 or 3 years, and then tobacco followed by crimson clover, is suitable. The clover is plowed under in spring before planting corn again. Other row crops can be substituted for the corn or tobacco in this rotation. It is important that a cover crop follow all intertilled crops.

These soils vary widely in requirements for lime, phosphorus, and nitrogen. They tend to be seriously deficient in potassium. Legumes, especially red clover and alfalfa, require lime and phosphorus, but if inoculated need only small amounts of nitrogen. Borax should be applied at the rate of 20 pounds per acre annually before spring growth or after the first cutting. Potassium is needed for the deep-rooted legumes. On most soils of this group, inoculated legume crops, especially if plowed under, will supply some nitrogen for other crops in a rotation. Tobacco and truck crops need a complete fertilizer. Properly conserved manure is a good source of nitrogen and potassium, but it should be supplemented with phosphorus to obtain a balance of plant nutrients.

Good tilth is fairly easily maintained, and the soils can be worked over a fairly wide range of moisture content. The soils are somewhat susceptible to erosion, but the control of runoff and erosion is not a serious problem. Contour tillage should be practiced wherever feasible, but terraces or other engineering devices are usually not necessary.

TABLE 11.—*Soils of management group 5 and average expected acre yields of adapted crops under two levels of management*

Yields in columns A are those to be expected under prevailing management, as defined for management group 5 under the subheading, Present Use and Management; yields in columns B are those to be expected under improved management as defined in the subheading, Management Requirements; absence of yield figure indicates crop is not commonly grown and soil is not physically suitable for it under the management specified]

Soil	Corn		Wheat		Oats		Lespedeza		Alfalfa		Tobacco		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Lbs.*	*Lbs.*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Augusta loam	25	40	11	17	17	28	1.0	1.4	------	------	------	------	70	110
Holston loam, undulating phase	23	43	10	18	20	35	.8	1.2	1.3	2.2	1,000	1,750	50	100
Jefferson loam, undulating phase	25	45	10	18	23	38	.8	1.2	1.3	2.2	1,000	1,750	50	100
Leadvale silt loam, undulating phase	20	40	10	18	20	32	.8	1.2	------	------	850	1,425	50	95
Monongahela loam	20	40	9	18	18	30	.7	1.1	------	------	800	1,425	50	95
Monongahela silt loam	18	38	9	16	17	28	.7	1.1	------	------	800	1,400	50	95
Pace silt loam, undulating phase	35	50	14	20	30	43	1.1	1.4	1.6	2.5	1,450	1,900	70	105

[1] Number of days 1 acre will graze a mature cow without injury to the pasture.

These soils are suited to pasture but are not productive unless fertilized. Lime and phosphorus are the chief requirements; potassium may also be needed. Adapted pasture plants should be seeded, and grazing should be regulated. Occasional mowing may be required.

MANAGEMENT GROUP 6

Management group 6 consists of soils good to very good for crops and good to excellent for pasture. They are moderately easy to work and conserve but vary considerably in productivity. All are deep, friable, and well drained and have slopes ranging from 5 to 12 percent. They are very permeable to air, roots, and water. Rainfall is readily absorbed and well retained. The water-supplying capacity is medium, and the inherent supply of plant nutrients is medium to high. No soil in the group has enough stones in the plow layer to interfere with tillage, but all have some cobblestones, gravel, or chert. Table 12 lists the soils of this group and gives yields to be expected from them under two levels of management.

These soils are suited to corn, wheat, oats, barley, tobacco, and many kinds of vegetables. If properly fertilized, red clover and alfalfa can also be grown.

Present use and management.—These soils are very important to the agriculture of the county. They are used for all crops common to the area. Corn, small grains (mostly wheat), alfalfa, and burley tobacco are the main crops. Some of the acreage is used for pasture consisting of a mixture that includes whiteclover, bluegrass, lespedeza, orchardgrass, and redtop. Alfalfa is an important hay crop; other plants used for hay are red clover or lespedeza, alone or mixed with orchardgrass, redtop, and timothy. Tobacco is the most important cash crop, although some vegetables are grown commercially on the Allen, Hayter, and Waynesboro soils.

Crop rotation is not generally practiced on soils of this group, but a rotation consisting of corn, a small grain, and hay or pasture is fairly common. Tobacco or any other row crop can be substituted for corn.

Practically all the farmers fertilize tobacco heavily. It is common practice to use 700 to 1,400 pounds of 3–12–12 or 4–8–12 per acre. A few farmers use larger applications. Normally, tobacco also receives most of the barnyard manure. Corn and small grains are lightly fertilized.

Lime is commonly applied before red clover or alfalfa is planted. The amounts of lime applied and the frequency of application vary from farm to farm. Some farmers apply 2 to 3 tons of lime per acre every 3 years.

Special devices for erosion control are not commonly used. Measures for disease and insect control give only partial protection.

Management requirements.—The soils of group 6 need more careful management than those of group 1 to 5. They require longer rotations, heavier fertilization, and better water control. If other management is good, the soils can be maintained in a 4-year to 6-year rotation. A suitable rotation consists of 1 year of corn, 1 year of a small grain, 3 years of clover and orchardgrass, 1 year of tobacco, followed by crimson clover. Alfalfa can replace the red clover. It is important that a cover crop follow every intertilled crop.

These soils require varying amounts of lime, phosphorus, and nitrogen for high yields of most crops. The Allen soils are much more deficient in these elements than the other members of this group, and they are also apt to be lacking in potassium. Legumes, especially alfalfa and red clover, require lime and phosphorus, but if inoculated, they do not need much nitrogen. Borax should be applied at the rate of 20 pounds annually, either before spring growth or after the first cutting. Potassium will be required for the deep-rooted legumes on most of these soils. An inoculated legume crop will generally supply, especially if turned under, some nitrogen for other crops in a rotation. All crops respond well to applications of

TABLE 12.—*Soils of management group 6 and average expected acre yields of adapted crops under two levels of management*

[Yields in columns A are those to be expected under the prevailing management, as defined for management group 6 under the subheading, Present Use and Management; yields in columns B are those to be expected under improved management as defined in the subheading, Management Requirements.]

Soil	Corn		Wheat		Oats		Lespedeza		Alfalfa		Tobacco		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Lbs.*	*Lbs.*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Allen loam:														
Rolling phase	(2)	45	(2)	18	(2)	35	(2)	1.2	(2)	2.8	(2)	1,450	(2)	95
Eroded rolling phase	28	43	9	17	20	32	0.8	1.1	1.8	2.8	950	1,450	55	95
Bolton loam, eroded rolling phase	30	50	14	22	30	50	1.0	1.4	2.2	3.2	1,200	1,600	60	105
Cumberland silty clay loam, eroded rolling phase	32	50	16	26	35	55	1.1	1.5	2.7	3.6	1,350	1,800	65	115
Hayter loam, eroded rolling phase	30	55	13	20	25	40	.8	1.4	2.0	2.9	1,250	1,675	60	110
Hermitage silt loam, eroded rolling phase	35	53	16	23	25	40	1.0	1.5	2.7	3.6	1,500	1,950	75	115
Masada clay loam, eroded rolling phase	30	50	15	22	30	43	1.0	1.4	2.6	3.3	1,225	1,625	65	110
Waynesboro loam, eroded rolling phase	33	48	15	23	28	45	1.0	1.4	2.3	3.5	1,200	1,650	60	115

[1] Number of days 1 acre will graze a mature cow without injury to the pasture.

[2] Crop seldom grown on soil.

phosphorus. A complete fertilizer is needed for truck crops and tobacco. Properly conserved manure is a good source of nitrogen and potassium, but it should be supplemented with phosphorus to obtain a balance of plant nutrients.

Good tilth is fairly easily maintained, and tillage can be carried on over a fairly wide range of moisture content. All of the soils are practically stone-free, although a few cobblestones, pebbles, or chert fragments may occur on all of them.

These soils are moderately susceptible to erosion, but runoff and erosion control should not be a serious problem if other management practices are good. Contour tillage should be practiced wherever feasible, and contour strip-cropping may be advisable on the long slopes. Terraces or other structures for controlling runoff usually should not be necessary unless shorter rotations than those suggested are used. The soils are deep and permeable, generally have regular slopes, and should be well suited to terracing if suitable outlets are available.

These soils are well suited to pasture. The principal management requirement is to supply lime and phosphorus to adapted pasture plants. Nitrogen should also be applied to long-term pastures not containing legumes. Other good management practices are control of grazing and scattering of droppings. Occasional mowing may be necessary.

MANAGEMENT GROUP 7

The soils of management group 7 are poor to fair for crops and good to very good for pasture. Stones or cobblestones on the surface and in the profile interfere with tillage and make the soils poor for crops. The soils are deep, friable, well-drained, and medium to strongly acid. They are medium in plant-nutrient and organic-matter content and are very permeable to air, roots, and water. Table 13 shows the soils of this group and the yields to be expected under two levels of management.

These soils are suited to most of the crops of the county, but their use is limited by stoniness and droughtiness. They are fairly well suited to crimson clover, red clover, and small grains and less well suited to crops that mature late in summer or early in fall.

Present use and management.—An estimated 85 percent of the acreage has been cleared and cultivated. The remaining 15 percent has a cover of cutover forest. An estimated 30 percent of the cleared land is in row crops, 55 percent is in hay or pasture, and the rest is in miscellaneous crops or lies idle. Corn is the most common row crop, and lespedeza is the most common hay and pasture crop. Tobacco is the chief cash crop. Vegetables are grown by some farmers as a cash crop, but fewer are grown on soils of this group than on those of groups 3 and 6. Little alfalfa or red clover is grown.

A four-year rotation consisting of corn, a small grain, and hay or pasture is commonly used by the better farmers. A large acreage, however, is farmed without systematic crop rotation. Most farmers follow row crops with a small grain or a cover crop. A few let the land lie fallow for a short time before another crop is sown.

The most common fertilizers are 3–12–12 and 4–12–8. Tobacco ordinarily receives from 700 to 1,000 pounds per acre of commercial fertilizer; truck crops such as peppers, 300 to 600 pounds; and corn and small grains about 300 pounds of fertilizer or 16 percent superphosphate. Most farmers have applied lime, but the amount and frequency of application vary greatly from farm to farm. Only a small acreage of these soils has received lime in amounts that would correct their strong acidity.

Because tillage is difficult, it is not done so promptly as on the nonstony soils. Special measures for control of erosion are not generally applied. A few farmers keep erosion to a minimum by properly rotating and fertilizing their crops.

Management requirements.—These soils are suited to crops, but, because they are difficult to till, it may be best to use them largely for pasture. Because of the tillage problems, many farmers favor a long rotation such as 1 year of corn, 1 year of wheat, and 3 to 5 years of pasture. If a more intensive use of the land is necessary, a rotation consisting of 1 year of corn, 1 year of small grain, and 3 years of red clover and grass is suitable. Any of the commonly grown row crops can be substituted for corn in this rotation.

Practically none of these soils supply enough lime, phosphorus, and nitrogen for high yields of most crops. The Allen soils also are likely to be deficient in potassium. Additions of lime, phosphorus, and potassium are essential for good growth of legumes. Also, 20 pounds of borax

TABLE 13.—*Soils of management group 7 and average expected acre yields of adapted crops under two levels of management*

[Yields in columns A are those to be expected under prevailing management, as defined for management group 7 under the subheading, Present Use and Management; yields in columns B are those to be expected under improved management as defined in the subheading, Management Requirements; absence of yield indicates crop is not commonly grown and soil is not physically suitable for it under the management specified]

Soil	Corn		Wheat		Oats		Lespedeza		Alfalfa		Tobacco		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Lbs.*	*Lbs.*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Allen stony loam, eroded rolling phase	20	35	9	14	17	30	0.8	1.1	------	------	700	1,100	55	95
Waynesboro cobbly loam, eroded rolling phase	26	37	12	19	22	35	.8	1.2	1.8	2.8	1,000	1,250	55	100

[1] Number of days 1 acre will graze a mature cow without injury to the pasture.

should be applied to legumes annually. Nearly all crops make a good response to phosphorus. Nitrogen is also needed for high yields of all crops, except possibly the legumes. Barnyard manure is an excellent source of nitrogen, potassium, and organic matter.

These soils are susceptible to erosion and should be tilled on the contour where feasible. Water-control structures should not be necessary if crops are properly fertilized and rotated. Stripcropping may be advisable on the long slopes. The workability of the soils can be improved by removing the loose stones or cobblestones, but normally this is practical only on very small areas.

The soils of this group are good to very good for pasture. Moderate to heavy applications of lime, phosphorus, and potassium are generally required to establish and maintain high-yielding pastures of good quality. Nitrogen should also be applied to long-term pastures not containing legumes. A pasture mixture consisting of bluegrass, orchardgrass, redtop, whiteclover, and lespedeza is well suited. Other good management practices are control of grazing, mowing excess herbage, and control of weeds.

MANAGEMENT GROUP 8

Management group 8 is made up of heavy, red to reddish-yellow soils of the uplands that developed from residuum weathered from dolomitic limestone. All are well drained, are medium to strongly acid, and have firm plastic subsoils. They are generally 5 or more feet deep over bedrock. They are all susceptible to erosion and, in most areas, have lost part of their surface soil. Compared with other cropped soils of the uplands, they have fairly good supplies of organic matter and plant nutrients and a medium water-supplying capacity. The content of organic matter and plant nutrients, especially nitrogen, depends largely on the past cropping system and the extent of erosion. The severely eroded Dunmore soil, included with this group because of its small acreage, is lower in organic matter, plant nutrients, and water-supplying capacity than the average for the group. It is also more vulnerable to additional erosion.

Table 14 shows the soils of this group and the yields to be expected at two levels of management.

These soils are well suited to practically all of the crops commonly grown. They are very well suited to most hay crops, especially alfalfa, and are as well suited to corn, tobacco, and truck crops as are the soils of group 2.

Present use and management.—The greater part of acreage in group 8 has been cleared and is now used for crops and pasture. Corn, small grains (usually wheat), and hay are the most common crops. Alfalfa is one of the more important hay crops, but lespedeza and red clover, alone or mixed with redtop, timothy, and orchardgrass, are also grown for hay. Ryegrass is also common in many pastures. Burley tobacco is the main cash crop, but less of it, in proportion, is grown on these soils than on those of the terraces and colluvial slopes. A substantial acreage of the soils in group 8 is used for pastures, and a small acreage is idle each year.

Crop rotations are generally irregular and variable. The most common rotation is corn, wheat, and hay or pasture. Other small grains are often substituted for wheat. In normal practice, a row crop is grown about every 3 to 5 years.

Most farmers fertilize tobacco rather heavily and small grains lightly. Applications of fertilizer to corn range from moderately heavy to none. Lime and phosphorus are usually applied preceding a legume crop. A few farmers have applied these elements in adequate amounts, but much of the acreage is still deficient in them.

Special measures for erosion control are not commonly used. Measures are taken for control of insects, but they are not adequate to give complete disease protection.

Management requirements.—The members of this group have a wide range of suitability for various crops, except where severely eroded. To maintain or increase the pro-

TABLE 14.—*Soils of management group 8 and average expected acre yields of adapted crops under two levels of management*

[Yields in columns A are those to be expected under prevailing management, as defined for management group 8 under the subheading, Present Use and Management; yields in columns B are those to be expected under improved management as defined in the subheading, Management Requirements; absence of yield indicates crop is not commonly grown and soil is not physically suitable for it under the management specified]

Soil	Corn		Wheat		Oats		Lespedeza		Alfalfa		Tobacco		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B.
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Lbs.*	*Lbs.*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Dewey silty clay loam, eroded rolling phase	32	52	14	23	30	48	1.0	1.4	2.9	3.9	1,200	1,700	60	115
Dunmore silt loam, rolling phase	(2)	50	(2)	21	(2)	45	(2)	1.4	(2)	3.9	(2)	1,600	(2)	110
Dunmore silty clay loam, eroded rolling phase	30	48	13	19	24	42	.9	1.3	2.8	3.8	1,000	1,500	50	105
Dunmore silty clay, severely eroded rolling phase	10	28	6	13	15	30	.5	1.1	1.4	2.8	------	------	35	85
Dunmore loam:														
Rolling phase	(2)	48	(2)	20	(2)	43	(2)	1.3	(2)	3.7	(2)	1,500	(2)	110
Eroded rolling phase	28	45	12	18	23	40	.9	1.3	2.6	3.6	1,000	1,450	50	105
Groseclose silty clay loam, eroded rolling phase	27	42	11	17	23	36	.9	1.3	2.6	3.6	900	1,350	50	100

[1] Number of days 1 acre will graze a mature cow without injury to the pasture.

[2] Crop seldom grown on soil.

ductivity of the soils, adapted crops must be grown in a suitable rotation. Row crops should be alternated with close-growing crops, and an occasional deep-rooted crop is beneficial. The rotation, however, can be of moderate length. A row crop may be safely grown once every 4 years if the soil is fertilized and otherwise well managed.

A rotation consisting of corn, a small grain, and alfalfa for 4 years appears to be well suited. A winter cover crop should follow each clean-cultivated crop. Grass or a green-manure crop should be included in the rotation to help maintain the supply of organic matter.

Lime and fertilizer are needed, especially for legumes and grasses. Soil tests should be used to determine the amount needed in the rotation. Nitrogen is generally required, though some is supplied by the legumes. Some potassium is usually needed for the deep-rooted legumes. Borax should be applied to alfalfa at the rate of 20 pounds per year before spring growth or just after the first cutting.

Good tilth is easy to maintain on the uneroded soils, but the eroded soils can be tilled only within a limited range of moisture content. Grasses and green-manure crops help improve tilth. Fall plowing improves tilth and is a good practice if a cover can be established to prevent excessive runoff and loss of soil. Contour tillage also conserves soil moisture and soil material.

Stripcropping is advisable on the longer slopes.

These soils are well suited to pasture but, because of their less favorable moisture supply, are not so good as those in groups 1 or 2. Though good pastures can sometimes be established without amendments, the best results are obtained from the use of lime and complete fertilizers. Soil tests should be made to help determine rate and amount. Pastures are fairly difficult to start on the severely eroded spots. Barnyard manure and nitrogen fertilizer help to establish the stand. After a stand is established, the legumes in the pasture mixture should supply most of the nitrogen needed for high yields. Other good pasture management practices are the scattering of droppings, clipping to control undesirable plant growth, and control of grazing.

MANAGEMENT GROUP 9

The soils of management group 9 are fair to good for crops and pasture. They generally are somewhat lower in natural fertility than the soils of group 8 but are slightly lighter textured, more friable, and less susceptible to erosion. They are low in lime, plant nutrients, and organic matter. They have 5 to 12 percent slopes and are uneroded to moderately eroded. They absorb and retain moisture only moderately well but are permeable to air and moisture. Because the water-supplying capacity of the Groseclose soils is lower than that of the Dunmore soils, crops on Groseclose soils are damaged more by drought. All of these soils have some chert on the surface and in the plow layer that interferes with tillage in some places.

Table 15 lists the soils of this group and the yields to be expected at two levels of management.

These soils are fairly well suited to all the crops commonly grown. Yields are moderate to low because of the deficiency of plant nutrients and somewhat unfavorable moisture relations. Nevertheless, the soils respond to good management. If adequately limed and fertilized, alfalfa and red clover can be grown, but not nearly so well as on the soils of group 7.

Present use and management.—Most of the acreage of these soils has been cleared and cultivated. An estimated 10 to 15 percent of the acreage is in cutover forest. These soils now are used mostly for pasture and a wide variety of crops, chiefly corn, small grains, and hay. Proportionately, less tobacco is grown on these soils than on the associated colluvial soils; nevertheless, it is probably the chief cash crop. Lespedeza, red clover, timothy, and redtop are the most important hay crops. Alfalfa is not extensively grown. A large acreage is used for pasture. Pastures are usually mixtures of orchardgrass, redtop, bluegrass, whiteclover, and lespedeza. Many pastures consist only of lespedeza mixed with wild or volunteer grasses.

A 4-year or 5-year crop rotation of corn, a small grain, and hay or pasture is most common. Some farmers,

TABLE 15.—*Soils of management group 9 and average expected acre yields of adapted crops under two levels of management*

[Yields in columns A are those to be expected under the prevailing management, as defined for management group 9 under the subheading, Present Use and Management; yields in columns B are those to be expected under improved management, as defined under the subheading Management Requirements]

Soil	Corn		Wheat		Oats		Lespedeza		Alfalfa		Tobacco		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Lbs.*	*Lbs.*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Dunmore cherty silt loam, rolling phase	(2)	47	(2)	19	(2)	42	(2)	1.3	(2)	3.4	(2)	1,500	(2)	110
Dunmore cherty silty clay loam, eroded rolling phase	28	43	12	18	23	38	0.8	1.3	2.0	3.2	950	1,400	50	105
Groseclose cherty silt loam, rolling phase	(2)	35	(2)	17	(2)	33	(2)	1.3	(2)	2.0	(2)	1,175	(2)	95
Groseclose cherty silty clay loam, eroded rolling phase	25	32	10	15	18	30	.8	1.2	1.0	1.7	600	1,050	50	90

[1] Number of days 1 acre will graze a mature cow without injury to the pasture.

[2] Crop seldom grown on soil.

however, do not follow a regular rotation. Many substitute tobacco or truck crops for the corn. Mixtures of redtop, timothy, red clover, orchardgrass, and lespedeza are used for the hay and pasture.

Heavy applications of a complete fertilizer and barnyard manure are commonly used on tobacco and truck crops. Small grains and hay are usually given light applications of phosphorus alone. The use of superphosphate on permanent pastures is becoming common. Lime has been applied to most farmlands, but its use, and that of fertilizers, varies greatly from farm to farm.

Tillage is more or less on the contour. Stripcropping is not practiced, and terraces and other devices for erosion control are not common. The measures that have been taken to control insects and diseases provide only partial protection to crops.

Management requirements.—This group of soils is moderately low in natural fertility but is suitable for moderately intensive use. Fertilization and crop rotation are required to maintain or increase yields. The rotation can include a row crop once every 4 years. A good rotation consists of a row crop seeded to a small grain and followed for 3 years by a legume or legume-and-grass mixture. Legumes and green-manure crops should be included in the rotation to help maintain or increase supplies of organic matter and nitrogen, conserve moisture, and help control erosion.

For high yields of most crops, these soils do not supply enough lime, nitrogen, phosphorus, and potassium. Barnyard manure, if available, should be applied in liberal amounts because it is a source of nitrogen, potassium, and humus. It will improve soil tilth and increase the moisture-holding capacity. Some phosphorus fertilizer should be used with manure to give the right balance of plant nutrients. If manure is not available, complete commercial fertilizers can be applied to corn, small grains, tobacco, vegetables, and grasses. Legumes and legume-grass mixtures need complete fertilizers as determined by soil tests. Borax at the rate of 20 pounds per acre should be applied annually to alfalfa, either before spring growth or after the first cutting. Lime is necessary for good growth of legumes, especially alfalfa and red clover. It should be applied to the soil in small amounts at frequent intervals. Fertilizers should be applied as needed for each particular crop, rather than in large amounts at infrequent intervals.

Good tilth is moderately easy to maintain, and the soil can be tilled without damage over a wide range of moisture content. By proper selection, rotation, and fertilization of crops, runoff and erosion can be reduced, and special practices for water control are not needed. However, tillage should be on the contour, if possible, and stripcropping on the longer slopes will help conserve moisture and prevent erosion. Terraces may be useful in some places, but to be effective, they must be carefully planned, constructed, and maintained.

The soils of this group are well suited to pasture. Good pasture mixtures include bluegrass, orchardgrass, redtop, white clover, Ladino clover, red clover, and lespedeza. Fertilizer and lime are needed in moderate amounts at frequent intervals to maintain highly productive pasture. Pastures with legumes probably will not need nitrogen. Control of grazing is important, especially during the dry summer and early fall months when overgrazing might injure the stand. Pastures may need occasional mowing to remove excess herbage and to control weeds.

MANAGEMENT GROUP 10

All of the soils in this group are acid, low in fertility, and moderate in productivity. Table 16 shows yields of adapted crops to be expected from these soils at two levels of management.

Except for the Leadvale, the soils of this group are deep and friable and have medium to low water-supplying capacity. Stones, cobblestones, or chert are on the surface and throughout the profile but do not interfere

TABLE 16.—*Soils of management group 10 and average expected acre yields of adapted crops under two levels of management*

[Yields in columns A are those to be expected under prevailing management, as defined for management group 10 under the subheading, Present Use and Management; yields in columns B are those to be expected under improved management as defined in the subheading, Management Requirements; absence of yield figure indicates crop is not commonly grown and soil is not physically suitable for it under the management specified]

Soil	Corn		Wheat		Oats		Lespedeza		Alfalfa		Tobacco		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Lbs.*	*Lbs.*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Holston loam, eroded rolling phase	20	38	9	16	18	30	0.7	1.1	1.2	2.0	900	1,600	45	90
Jefferson loam, eroded rolling phase	21	38	9	16	18	30	.7	1.1	1.2	2.0	850	1,500	45	95
Leadville silt loam, eroded rolling phase	18	33	8	16	17	28	.7	1.1	------	------	700	1,200	45	90
Nolichucky loam:														
Rolling phase	(2)	43	(2)	18	(2)	37	(2)	1.2	(2)	2.8	(2)	1,700	(2)	105
Eroded rolling phase	28	40	11	17	19	33	.8	1.1	1.7	2.6	1,000	1,550	50	100
Pace silt loam:														
Rolling phase	32	45	13	18	27	38	.9	1.3	1.5	2.4	1,300	1,700	65	100
Eroded rolling phase	30	42	12	17	24	35	.8	1.2	1.4	2.3	1,150	1,575	60	95

[1] Number of days 1 acre will graze a mature cow without injury to the pasture.

[2] Crop seldom grown on soil.

with tillage. Slopes range from 5 to 12 percent. Accelerated erosion has removed part of the surface soil in cultivated areas, and the heavier textured subsurface layers are exposed. The range of moisture content that will allow tillage has been narrowed by erosion. The rolling phases of the Nolichucky and Pace soils usually are not eroded.

All the soils in this group are adequately drained, both internally and externally, for most crops. Corn, wheat, oats, barley, tobacco, and many kinds of vegetables are suited. Small grains are better suited than corn. If properly fertilized, such crops as alfalfa or red clover can be grown successfully. Alfalfa, however, is not a very good crop for these soils.

Present use and management.—An estimated 90 to 95 percent of the acreage in this group has been cleared and cultivated. The most common crops are tobacco, corn, wheat, and hay. Tobacco is the chief cash crop and is grown on large acreages. Vegetables are grown to a small extent for market. The most common hay and pasture plant is lespedeza. Many pastures contain wild grasses mixed with lespedeza.

Systematic crop rotation is not commonly practiced. Where these soils are used intensively for crops, it is usual to break the sequence of row crops every few years by growing a hay crop. Many farmers use a rotation consisting of corn, small grain, hay, and pasture. Tobacco or any other row crop may be substituted for the corn. Some farmers follow the row crop with a winter cover crop such as crimson clover, ryegrass, or a small grain.

Tobacco and truck crops are usually given 700 to 1,400 pounds per acre of 3–12–12 or 4–8–12 fertilizer. Wheat and corn are lightly fertilized, if at all. Lime and superphosphate have been applied, but not in quantities that meet the needs of most crops. The application of lime and fertilizer varies greatly from farm to farm.

The soils usually are tilled approximately on the contour and with reasonable promptness and care. Many farmers use no special erosion control measures. The insect and disease controls that are used do not provide complete protection for crops.

Management requirements.—These soils require more careful management than those of management group 5, chiefly because they have stronger slopes and have lost more soil through erosion. They require more attention to prevent excessive runoff and erosion. Rotations should be 4 to 6 years long and include close-growing crops. Such rotations, with other good management, will maintain the soils. A rotation well suited to this soil consists of corn, a small grain, clover and orchardgrass for 3 years, tobacco, and crimson clover. To maintain a very high level of fertility, a good rotation is corn, a small grain, and alfalfa for 4 years. Cover crops should follow all intertilled crops.

These soils are similar to those of group 5 in fertilizer requirements, but generally they need heavier applications for comparable crop yields. They all need lime, phosphorus, potassium, and nitrogen, in varying amounts, for high yields of most crops. Legumes, especially deep-rooted ones, require lime, phosphorus, and potassium, as well as nitrogen when they are established. Borax should be applied to alfalfa at the rate of 20 pounds annually, either before spring growth or just after the first cutting. Legumes generally will supply some nitrogen for the other crops in the rotation. All crops respond well to applications of phosphorus fertilizers. Heavy applications of complete fertilizers are needed for truck crops and tobacco.

Good tilth is easily maintained, and the soils can be tilled over a fairly wide range of moisture content. These soils are erodible but runoff and erosion can be controlled if crops are rotated and fertilized. All tillage should be on the contour, and stripcropping may be advisable on the long slopes. Terraces or other devices for the control of surface runoff should not be necessary unless rotations of shorter length than those described are used. The soils are deep and permeable. They have regular slopes and are well suited to terraces if suitable outlets are available.

These soils are suited to pasture. High yields of forage require large applications of lime and complete fertilizer and use of adapted pasture plants. In addition, maintenance applications of fertilizer should be applied as a topdressing. When the pasture is mostly legumes, nitrogen will probably not be needed in the maintenance application. Other requirements are proper control of grazing and occasional mowing for weed control.

MANAGEMENT GROUP 11

Soils of management group 11 have enough stones, gravel, or cobblestones on the surface and throughout the profile to interfere with tillage. The soils are suited to pasture and to a wide variety of crops but are difficult to work and conserve. All are deep, permeable, and well drained and have a low water-holding capacity. They are medium to strongly acid. The supply of plant nutrients and organic matter varies but is moderate to low for most of the soils. Table 17 lists the soils of this group and the yields to be expected at two levels of management.

Present use and management.—The largest part of the acreage of these soils has been cleared and is used for crops and pasture. Corn, small grains, and hay are among the more important crops. Part of the acreage is used for unimproved permanent pasture, and some is idle. Small acreages of tobacco and truck crops are also grown. Vegetables usually are grown in small gardens for home use. A small acreage of peppers is grown for the market. Lespedeza, alone or mixed with grasses, is the chief hay crop. Very little alfalfa or red clover is grown. Pastures consist chiefly of lespedeza and wild or volunteer grasses, but some of the better pastures include orchardgrass and redtop.

Moderately long rotations of corn, small grains, hay, and pasture are commonly used by the better farmers, but many operators do not systematically rotate crops. Many farmers do not plant cover crops after small grains or row crops but, instead, sow lespedeza in the spring and use it for hay or pasture along with volunteer plants.

Corn usually is not fertilized. Small grains get about 200 pounds per acre if fertilized at all. Tobacco and truck crops receive 400 to 1,400 pounds per acre of 3–12–12 or 4–8–12 fertilizer. Lime has been applied to most of the cleared areas, but not enough to counteract the strong soil acidity. The application of superphosphate on pastures is becoming a common practice. Phosphorus is used also to some extent on corn and small grains, but the amounts that have been applied are insignificant compared with the need.

On some farms, the soil is tilled approximately on the contour, but this is not a general practice. Tillage is not carried out as promptly nor with as much care as on

TABLE 17.—*Soils of management group 11 and average expected acre yields of adapted crops under two levels of management*

[Yields in columns A are those to be expected under prevailing management, as defined for management group 11 under the subheading, Present Use and Management; yields in columns B are those to be expected under improved management as defined in the subheading, Management Requirements; absence of yield figure indicates crop is not commonly grown and soil is not physically suitable for it under the management specified]

Soil	Corn		Wheat		Oats		Lespedeza		Alfalfa		Tobacco		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Lbs.*	*Lbs.*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Holston cobbly loam, eroded rolling phase	16	30	7	14	14	26	0. 6	1. 0	------	------	600	1, 050	40	85
Jefferson stony loam:														
Rolling phase	(2)	33	(2)	15	(2)	30	(2)	1. 0	------	------	(2)	1, 100	45	85
Eroded rolling phase	16	32	7	14	14	28	. 6	1. 0	------	------	600	1, 050	45	85
Nolichucky cobbly loam, eroded rolling phase	20	35	9	16	18	30	. 7	1. 1	1. 8	2. 6	650	1, 100	50	90

[1] Number of days 1 acre will graze a mature cow without injury to the pasture.

[2] Crop seldom grown on soil.

the more productive soils. Poor pastures, unadapted crops, irregular rotations, and idle land show that, on the whole, little attention is given to erosion control. Engineering devices for erosion control are not commonly used. Insect and disease controls do not completely protect crops.

Management requirements.—The soils of management group 11 are suited to crops, but, because they are difficult to till, it may be best on most farms to use them for pasture. Farmers who grow cultivated crops favor a long rotation that consists of corn, wheat, and pasture for 3 to 5 years. If more intensive use is necessary, a suitable rotation is corn, a small grain, and red clover and grass for 3 years. Any adapted row crop can be substituted for the corn in these rotations.

Practically all of these soils need lime, phosphorus, potassium, and nitrogen for high yields of most crops. The amount should be determined by soil tests. Applications of lime, phosphorus, and potassium are essential for good growth of legumes, and nitrogen is needed at the time of establishment. Before spring growth or just after the first cutting, alfalfa should receive an application of 20 pounds of borax per acre. Barnyard manure is an excellent source of nitrogen, potassium, and organic matter.

The soils of this group should be tilled on the contour because they are susceptible to erosion. Engineering devices for water control should not be needed on the shorter slopes if the suggested crop rotations are followed and the crops are adequately fertilized. Removing loose stones will improve the workability of the soils, but this is practical only for small areas. Stripcropping may be advisable on the long slopes.

The soils of this group are fair to good for pasture. To establish and maintain high-yielding pastures of good quality, moderate to heavy applications of lime and complete fertilizer are needed. Pastures containing mostly legumes will not need nitrogen in the maintenance topdressing. A pasture mixture of bluegrass, orchardgrass, redtop, whiteclover, hop clover, and lespedeza is well suited. Other suggested management practices are controlling grazing, spreading droppings, and mowing to remove excess herbage and weeds.

MANAGEMENT GROUP 12

In management group 12 are heavy, light-red to reddish-yellow soils of the uplands. They have developed from residuum weathered from relatively high-grade dolomitic limestone. They differ from the soils of group 8 chiefly in having stronger slopes that range from 12 to 25 percent. All soils are well drained and medium to strongly acid. Generally they are 5 or more feet in depth. They have firm, plastic subsoils. They are moderately high in organic matter and plant nutrients and have moderate water-holding capacity. Table 18 shows the soils in this group and yields to be expected under two levels of management.

These soils are well suited to pasture and to alfalfa and most of the other hay crops. They are not so well suited to corn, tobacco, and truck crops. The careful management required to farm these soils limits the choice of crops and the frequency with which they can be grown.

Present use and management.—Most of the soils in group 12 have been cleared and cultivated. An estimated 5 to 10 percent of the area is in a cutover forest. Practically all of the common crops are grown. Much of the acreage is in permanent pasture. Proportionately, less alfalfa is grown on these soils than on the soils of group 7. Some corn is grown, but the total acreage is small. Hay is a very important crop. The most common kinds are alfalfa; red clover alone or mixed with timothy, redtop, and orchardgrass; and lespedeza alone or mixed with grasses. These same plants also are used in the pastures along with white clover, Ladino clover, bluegrass, and ryegrass. Each year an estimated 10 percent of the soils is idle or in unimproved, low-yielding pasture. Tobacco and truck crops are grown to some extent. The acreage is insignificant, however, when compared with the area of these crops on the associated Pace and Greendale soils. A large acreage of small grain, chiefly wheat, is also grown.

This is a very extensive group of soils, and the present use and management varies greatly. Many farmers use

TABLE 18.—*Soils of management group 12 and average expected acre yields of adapted crops under two levels of management*

[Yields in columns A are those to be expected under prevailing management, as defined for management group 12 under the subheading, Present Use and Management; yields in columns B are those to be expected under improved management as defined in the subheading, Management Requirements]

Soil	Corn		Wheat		Oats		Lespedeza		Alfalfa		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Dewey silty clay loam, eroded hilly phase	25	40	12	20	24	40	0.9	1.3	2.3	3.3	55	105
Dunmore loam:												
Hilly phase	(2)	38	(2)	18	(2)	35	(2)	1.2	(2)	3.2	(2)	100
Eroded hilly phase	20	35	10	16	18	32	.7	1.1	2.0	3.1	40	90
Dunmore silt loam, hilly phase	(2)	40	(2)	18	(2)	38	(2)	1.2	(2)	3.4	(2)	100
Dunmore silty clay loam, eroded hilly phase	23	35	11	17	20	35	.7	1.1	2.3	3.3	40	90
Groseclose silty clay loam, eroded hilly phase	22	35	9	14	19	30	.7	1.1	2.0	3.0	40	85

[1] Number of days 1 acre will graze a mature cow without injury to the pasture. [2] Crop seldom grown on soil.

a planned rotation of properly selected crops, but many more do not. A rotation often used consists of corn, a small grain, and hay or pasture for 2 or 3 years. Many farmers use a longer rotation, however. Alfalfa generally is not used in crop rotations but is allowed to grow until the stand becomes thin or dies out. Small grains commonly follow row crops, although some farmers allow the land to lie fallow during the winter and sow lespedeza the next spring.

Fertilization of all crops is becoming common. Many farmers, however, fertilize chiefly the tobacco and truck crops. Small grains receive little or no fertilizer, and often only phosphorus is applied. The use of lime and fertilizers varies greatly among the operators. Many apply 2 to 3 tons of lime per acre at 3-year intervals. Large amounts of phosphorus and lime have been used, but much of the acreage still needs these amendments.

The soil is tilled with varying degrees of promptness and care, and reasonably near the contour. Insect and disease controls do not give complete protection to crops.

Management requirements.—These soils have stronger slopes and greater susceptibility to erosion than those of management group 8. They require the use of longer rotations of adapted crops and more careful tillage. A rotation consisting of corn followed by a mixture of alfalfa and orchardgrass for 4 or 5 years is suitable for these soils.

Contour tillage should always be practiced unless sinkholes or irregular slopes prevent it. If the land cannot be farmed along the contour, longer crop rotations should be used and row crops omitted. Contour stripcropping should be used on long regular slopes.

These soils are well suited to pasture. Pastures should be limed and fertilized according to needs indicated by soil tests. Maintenance topdressings of complete fertilizers should be applied. However, where the pastures are mostly legumes, nitrogen probably will not be needed. Pastures are hard to start on the more severely eroded areas. Applications of barnyard manure will help establish a stand. Other beneficial management practices are scattering droppings, controlling undesirable plants and weeds, and preventing overgrazing.

MANAGEMENT GROUP 13

The soils of management group 13 are fair for crops and good to very good for pasture. They differ from those of group 6 chiefly in having stronger slopes. The slope gradients of 12 to 25 percent make tilling and conserving these soils fairly difficult. Better management is needed for maintenance than for the soils of group 6. The soils are deep, very permeable, and well drained. They vary greatly in content of organic matter and plant nutrients. Water is readily absorbed and retained. All the soils have some cobblestones, stones, or gravel, but not enough to interfere with tillage. Table 19 shows the soils in this group and the crop yields to be expected under two levels of management.

These soils are well suited to corn, wheat, oats, barley, tobacco, and many vegetable crops. If properly fertilized, alfalfa and red clover can also be grown successfully.

The exacting conservation requirements limit the choice of crops and the frequency with which they can be grown.

Present use and management.—All but about 5 percent of the acreage in this group has been cleared. The land is now used for corn, small grains, hay, and pasture. A small acreage is idle, abandoned, or used for unimproved pasture. A very small acreage is used for tobacco and truck crops. About 20 percent of the land is permanent pasture.

The small grains grown are wheat alone or wheat mixed with oats. The legumes are lespedeza, red clover, and a large acreage of alfalfa. Red clover and lespedeza are generally grown in mixtures with redtop, timothy, and orchardgrass. Either can be pastured or cut for hay. Permanent pastures consist of mixtures of plants, chiefly orchardgrass, bluegrass, redtop, lespedeza, whiteclover, and red clover. Wild grasses are also part of the mixture. Some pastures are in lespedeza alone or in lespedeza mixed with wild plants.

Many farmers do not rotate crops systematically, but corn is usually followed by a small grain, and the small grain by hay or pasture for 2 or more years. If the land is not in permanent pasture, row crops are commonly grown at 3-year to 5-year intervals.

TABLE 19.—*Soils of management group 13 and average expected acre yields of adapted crops under two levels of management*

[Yields in columns A are those to be expected under prevailing management, as defined for management group 13 under the subheading, Present Use and Management; yields in columns B are those to be expected under improved management as defined under the subheading, Management Requirements; absence of yield figure indicates crop is not commonly grown and soil is not physically suitable for it under the management specified]

Soil	Corn		Wheat		Oats		Lespedeza		Alfalfa		Tobacco		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Lbs.*	*Lbs.*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Allen loam:														
Hilly phase	(2)	35	(2)	14	(2)	27	(2)	0.9	(2)	2.4	(2)	1,200	(2)	80
Eroded hilly phase	22	32	7	12	15	24	0.5	.8	1.2	2.2	------	(2)	45	75
Bolton loam, eroded hilly phase	25	40	12	18	24	40	.9	1.3	1.9	2.7	------	------	50	95
Cumberland silty clay loam, eroded hilly phase	27	45	13	21	28	45	.9	1.3	2.3	3.1	------	(2)	55	105
Masada clay loam, eroded hilly phase	26	38	11	17	24	35	.8	1.2	2.3	2.8	------	(2)	50	95
Nolichucky loam:														
Hilly phase	(2)	34	(2)	16	(2)	30	(2)	1.1	(2)	2.4	------	(2)	(2)	100
Eroded hilly phase	18	30	8	15	13	28	.6	1.0	1.4	2.4	------	(2)	50	95
Waynesboro loam, eroded hilly phase	23	35	11	18	18	35	.7	1.1	1.6	2.8	------	------	55	100

[1] Number of days 1 acre will graze a mature cow without injury to the pasture. [2] Crop seldom grown on soil.

Moderately heavy applications of a complete fertilizer are applied to tobacco and truck crops. These crops also get most of the available barnyard manure. Fertilization of corn and small grain is fairly common, but the applications are generally light and often consist of phosphorus only. The small grains usually are fertilized more heavily than corn. The use of phosphorus on pastures and hay is increasing. Lime has been applied on most areas of these soils. It is generally applied, along with phosphorus and potassium, preceding a legume crop.

Contour tillage is practiced to some extent. It is the only mechanical form of erosion control practiced in areas used for cultivated crops.

Management requirements.—Most of the soils of group 13 need careful management. Proper tillage and fertilization and long rotations consisting mostly of close-growing crops are the chief requirements. Suitable for most areas is a rotation consisting of corn, a small grain, and red clover mixed with orchardgrass for 4 years. A rotation of barley or some other small grain followed by a mixture of red clover and orchardgrass that is left for 3 years provides better protection against erosion. A rotation of a small grain sown in contour furrows and followed by lespedeza is used successfully by a few farmers.

These soils need lime and complete fertilizers, as indicated by soil tests, for continuous high yields of most crops. They vary considerably in amounts of fertilizer needed. Legume crops, especially red clover and alfalfa, require lime and complete fertilizer to establish a stand. Alfalfa should receive 20 pounds of borax per acre annually, applied before spring growth or just after the first cutting. Heavy applications of a complete fertilizer are required for truck crops and tobacco.

Good tilth is easily maintained, and the soils can be tilled over a wide range of moisture content. Runoff and soil erosion are difficult to control, but soil losses can be reduced by tilling on the contour and using long rotations consisting chiefly of close-growing crops. Contour stripcropping will be advisable on the longer slopes.

These soils are well suited to and best used for pasture. It is a good practice to apply lime and a complete fertilizer to adapted pasture species at the time of establishment. Yearly fertilization applied as topdressing is also needed, except where the pastures are mostly legumes. Other good management practices are grazing control and control of weeds by mowing.

MANAGEMENT GROUP 14

The soils of management group 14 are shallow and shaly. They are poorly to very poorly suited to crops because they are hilly, droughty, and extremely erodible. The uneroded soils are not deep, and the eroded soils usually consist of only a few inches of soil material and partly weathered shale. Table 20 lists the soils of this group and gives the yields to be expected under two levels of management.

The rolling phases occur chiefly on narrow winding ridge crests and are surrounded by hilly and steep soils unsuited to tilled crops. Because of their topographic position, it is not practical to use these soils for crops. They will produce fair to good pasture under a high level of management.

All the soils in this group are low in phosphorus and nitrogen. Most are well supplied with potassium. The Dandridge soils have enough lime. All are very low in water-holding capacity.

Present use and management.—A part of the acreage of this group is in a cutover forest. The cleared acreage is used mostly for pasture, but some is used for cultivated crops. Many areas are idle or abandoned. Pasture yields are low and of poor quality. They consist mainly of lespedeza mixed with wild and volunteer plants. A few of the best farmers have established good stands of white-clover, bluegrass, and orchardgrass. The most common crops are corn, small grains, and hay. The proportion of land used for these crops is much less than on the adjacent

TABLE 20.—*Soils of management group 14 and average expected acre yields of adapted crops under two levels of management*

[Yields in columns A are those to be expected under prevailing management, as defined for management group 14 under the subheading, Present Use and Management; yields in columns B are those to be expected under improved management as defined in the subheading, Management Requirements; absence of yield figure indicates crop is not commonly grown and soil is not physically suitable for it under the management specified]

Soil	Corn		Wheat		Oats		Lespedeza		Tobacco		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Lbs*	*Lbs*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Dandridge silt loam, hilly phase	------	------	------	------	------	------	(2)	0. 6	------	------	(2)	85
Dandridge shaly silt loam, eroded hilly phase	------	------	------	------	------	------	0. 4	. 6	------	------	35	80
Dandridge silt loam, rolling phase	(2)	20	(2)	11	(2)	27	(2)	. 9	(2)	800	(2)	95
Dandridge shaly silt loam, eroded rolling phase	13	18	5	10	15	25	. 5	. 8	550	950	45	90
Litz silt loam, hilly phase	------	------	------	------	------	------	------	. 7	------	------	(2)	70
Litz shaly silt loam, eroded hilly phase	------	------	------	------	------	------	. 4	. 6	------	------	30	65
Litz silt loam, rolling phase	(2)	20	(2)	12	(2)	25	(2)	. 9	(2)	800	(2)	85
Litz shaly silt loam, eroded rolling phase	13	18	6	11	12	22	. 5	. 8	450	700	40	80
Litz loam:												
Rolling phase	(2)	20	(2)	12	(2)	25	(2)	. 9	(2)	950	(2)	80
Eroded rolling phase	12	18	6	11	12	22	. 4	. 8	550	950	40	80

[1] Number of days 1 acre will graze a mature cow without injury to the pasture. [2] Crop seldom grown on soil.

limestone soils. Lespedeza is the chief hay crop. Little tobacco or alfalfa is grown. Many of the idle or abandoned areas are reverting to forest.

Crop rotations and the use of fertilizer are not common. A few of the best farmers apply phosphorus and lime to pastures, and this practice appears to be increasing. These soils ordinarily do not receive any barnyard manure because it is normally applied to the more productive limestone and colluvial soils. The soils of this group get very little protection from erosion. Cover crops are not generally used, and pastures are almost bare of vegetation during the winter months when rainfall is heaviest.

Management requirements.—These soils are fair for pasture and will respond to good management. They need liberal and frequent applications of phosphorus. Lime is generally needed on the Litz soils, but the others in the group should be tested before lime is applied. Pastures will require an application of complete fertilizer to get started but may not need topdressing after they are established if droppings are scattered. Nitrogen, however, is needed for maintenance if the proportion of legumes in the mixture is low. Barnyard manure, especially if applied on the galled areas, will help establish the pasture sod. Grazing must be carefully controlled during dry weather because the pastures are damaged by drought. Emergency pastures should be available for the dry summer and early fall months. Subsoiling along the contour to depths of 15 and 20 inches is believed to decrease surface runoff and increase water-holding capacity. This cannot be practiced on the Litz loam soils because they have outcrops of hard rock. Control of grazing and the use of soil amendments help control weeds on soils of this group, but an occasional clipping may be necessary.

MANAGEMENT GROUP 15

The soils of management group 15 are poor for crops but fair to good for pasture. They are poorly drained and occur on nearly level or slightly depressional areas. The Melvin, Prader, and Wehadkee soils occur on stream bottoms and are subject to flooding. The Tyler soil is on stream terraces above the present flood plain. The Tyler soil is low in fertility and strongly to very strongly acid. The Wehadkee soil is moderately low in natural fertility and medium to strongly acid. The Prader and Melvin soils contain moderate amounts of plant nutrients and organic matter and are generally slightly acid. Table 21 shows the soils in this management group and the crop yields expected at two levels of management.

Because of poor drainage, these soils are poorly suited to cultivated crops. Except for the Tyler, all are considered suitable for pasture. Their use suitability could

TABLE 21.—*Soils of management group 15 and average expected acre yields of adapted crops under two levels of management*

[Yields in columns A are those to be expected under prevailing management, as defined for management group 15 under the subheading, Present Use and Management; yields in columns B are those to be expected under improved management as defined in the subheading, Management Requirements; absence of yield figure indicates crop is not commonly grown and soil is not physically suitable for it under the management specified]

Soil	Corn		Lespedeza		Pasture	
	A	B	A	B	A	B
	Bu.	*Bu.*	*Tons*	*Tons*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Melvin silt loam	------	35	0. 6	1. 1	45	110
Prader silt loam	------	33	. 6	1. 1	45	110
Tyler silt loam	12	30	. 5	1. 0	35	90
Wehadkee silt loam	------	(2)	. 6	1. 0	35	90

[1] Number of days 1 acre will graze a mature cow without injury to the pasture.
[2] Crop seldom grown on soil.

be broadened by artificial drainage, and if adequately drained, they could be used for cultivated crops. Draining the Tyler soil would be difficult and probably not practical.

Present use and management.—Practically all the acreage in this group has been cleared. Most of the land is in pasture, but some is in crops and some is idle. The pastures consist chiefly of native water-tolerant plants. Some farmers, however, have established excellent whiteclover and bluegrass pastures. Hay crops consist chiefly of lespedeza mixed with wild plants. A small acreage of soybeans is also grown for hay. Crop rotations and fertilizers are not commonly used on these wet soils. The small acreage on which corn is grown ordinarily reverts to water-tolerant plants after the harvest and is then used for pasture.

Light applications of phosphorus have been used on these soils. Lime is generally not needed, except on the Tyler and Wehadkee soils. Open ditches 1 to 2 feet deep are commonly used to drain the land. Tiles are seldom used.

Management requirements.—These soils furnish a fair amount of pasture during spring, summer, and fall. The quality of the forage is only poor to fair. To improve pastures, the soils would have to be better drained. Drainage can be improved considerably in most places by the use of open ditches, bedding, and diversions. Tiling would probably be effective on the Melvin, Wehadkee, and Prader soils, but not on the Tyler soils, because of the pan. After drainage has been improved, seedings of bluegrass, whiteclover, redtop, and lespedeza can be expected to grow fairly well, especially if lime and complete fertilizer are applied according to needs indicated by soil tests. Redtop and lespedeza are now grown without amendments, but the pastures are of low quality. Weeds should be controlled by grazing and mowing.

These soils are poorly suited to cultivated crops. They may be better suited to crops such as sorghum and soybeans that can be planted late in spring or early in summer and harvested in fall. If these soils are effectively drained, use and management practices would be similar to those for the imperfectly drained soils of group 1, but crop yields would not be so high.

MANAGEMENT GROUP 16

The soils of this group are not alike, but they are similar in use and management. Included are the red to reddish-yellow plastic soils and red to yellow deep permeable soils. All except the cobbly alluvium and stony rolling land have slopes of 12 to 25 percent and are well drained. Nearly all contain enough chert, stones, and gravel to interfere with or prevent tillage. The workability of these soils is poor to very poor because they are steep, stony, and plastic. They are not very well suited to crops. Table 22 shows the soils in this group and the crop yields to be expected under two levels of management.

These soils have been so severely damaged by erosion that, although they are 3 feet or more deep, bedrock is

TABLE 22.—*Soils of management group 16 and average expected acre yields of adapted crops under two levels of management*

[Yields in columns A are those to be expected under prevailing management, as defined for management group 16 under the subheading, Present Use and Management; yields in columns B are those to be expected under improved management as defined in the subheading, Management Requirements; absence of yield figure indicates crop is not commonly grown and soil is not physically suitable for it under the management specified]

Soil	Corn		Wheat		Oats		Lespedeza		Alfalfa		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Cow acre-days* [1]	*Cow acre-days* [1]
Allen stony loam:												
Hilly phase	(2)	30	(2)	12	(2)	28	(2)	1.0	------	------	(2)	85
Eroded hilly phase	16	28	7	11	13	26	0.6	.9	------	------	45	75
Cobbly alluvium, Staser and Congaree soil materials	------	------	------	------	------	------	------	------	------	------	45	80
Dunmore silty clay, severely eroded hilly phase	------	------	------	------	------	------	.4	.9	1.2	2.3	25	70
Dunmore cherty silt loam, hilly phase	(2)	38	(2)	17	(2)	35	(2)	1.2	(2)	2.7	(2)	100
Dunmore cherty silty clay loam, eroded hilly phase	23	35	9	15	18	30	.6	1.1	1.4	2.6	50	95
Dunmore cherty silty clay, severely eroded hilly phase	------	------	------	------	------	------	.4	.9	1.0	2.0	25	75
Groseclose cherty silt loam:												
Hilly phase	(2)	26	(2)	12	(2)	27	(2)	1.0	(2)	1.5	(2)	85
Eroded hilly phase	16	25	6	11	12	25	.6	1.0	1.0	1.4	45	80
Holston cobbly loam, eroded hilly phase	12	26	6	11	11	23	.5	.8	------	------	35	70
Jefferson stony loam:												
Hilly phase	------	------	------	------	------	------	------	.9	------	------	(2)	80
Eroded hilly phase	------	------	------	------	------	------	.5	.8	------	------	35	75
Nolichucky cobbly loam, eroded hilly phase	16	28	7	13	14	25	.5	.9	1.2	2.3	45	85
Ramsey stony loam, hilly phase	------	------	------	------	------	------	------	------	------	------	15	40
Stony rolling land, Dunmore soil material	------	------	------	------	------	------	------	------	------	------	30	65
Stony hilly land, Dunmore soil material	------	------	------	------	------	------	------	------	------	------	25	60
Waynesboro cobbly loam, eroded hilly phase	20	30	10	16	18	28	.6	1.0	1.4	2.4	50	90

[1] Number of days 1 acre will graze a mature cow without injury to the pasture. [2] Crop seldom grown on soil.

exposed in many places. Shallow gullies are common in the heavily eroded areas. All have poor moisture conditions for plant growth, and most are low in natural fertility. They are not naturally productive of pasture plants, but pasture is probably their best use on most farms.

Present use and management.—Most of the acreage of these soils has been cleared, but some is still covered by cutover forest. Much of the cleared acreage is now in pasture. Some is used for crops, and a considerable area is idle or abandoned. Some of the idle land is reverting to forest.

Pasture yields are generally low and of poor quality. Poor pasture sods are responsible for the erosion on some of these soils. The average pasture consists of lespedeza alone or mixed with redtop and wild plants. Some farmers have established excellent permanent pastures by using mixtures of whiteclover, bluegrass, orchardgrass, lespedeza, redtop, and ryegrass.

Commonly grown crops are corn, small grains, and hay. Occasionally grown are tobacco and truck crops. Some alfalfa is grown, but proportionately much less than on the nonstony soils. Lespedeza, alone or mixed with grasses, is the most important hay crop. The crop rotation commonly used is corn, a small grain, and hay and pasture for 3 or 4 years. Many farmers, however, follow no systematic rotation. Most of them plant a small grain and a grass-legume mixture after a row crop is harvested. The use of cover crops varies, and many fields are unprotected during the winter months.

Lime and smaller quantities of phosphorus have been applied to most of the soils. The more strongly acid Allen, Jefferson, Holston, and Nolichucky soils apparently have received less lime than the less acid Dunmore, Groseclose, and Waynesboro soils. The use of phosphorus on pastures is becoming a common practice, but only a few farmers apply enough of this element. These soils receive practically no barnyard manure because it is applied to the more productive soils. Many farmers fertilize corn and small grains with a complete fertilizer, but the applications are usually too light. Sometimes phosphorus alone is applied. Small grains ordinarily get more fertilizer than corn. The use of fertilizer and lime varies greatly in amount and frequency of application.

Terracing and stripcropping for erosion control are not commonly used. In many areas good pasture sods and cover crops keep erosion at a minimum.

Management requirements.—Good pastures can be established and maintained on these soils by moderate to heavy applications of lime and complete fertilizer. Needs should be determined by soil tests. Pasture mixtures consisting of bluegrass, orchardgrass, whiteclover, hop clover, and lespedeza are well suited to these soils. Other management practices are proper control of grazing and eradication of weeds. Proper grazing and fertilizing help control the weeds in pastures. Mowing is impractical as a method of controlling weeds on strong slopes and stony lands. It is good practice to grow a tilled crop, such as corn, once every 8 or 10 years, if weeds are crowding out the desirable pasture plants.

These soils are poorly suited for crops. If used for this purpose they must be carefully managed. A vegetative cover should be maintained nearly all of the time; row crops should be avoided. Biennial and perennial varieties of close-growing crops should be selected in preference to those that require preparation of the seedbed every year. Grasses and legumes should be the chief plants in crop rotations.

Because of the stong slopes, terraces are not likely to be practical but diversion ditches may be beneficial in some places. If cultivated, the longer slopes should be stripcropped. Fertilizing, liming, adding organic matter, and tilling on the contour are also essential farming practices. The stony land types included in this group are not suitable for crops, because of their very poor workability.

MANAGEMENT GROUP 17

This is a group of upland soils. They are steep and moderately cherty. Because of low fertility, shallowness, and extreme erodibility, they are poorly to very poorly suited to crops. They are poor to fair for pasture. On most farms their best use is forestry. Depths to bedrock, supplies of organic matter and plant nutrients, and capacity to hold water are all variable in these soils. This group of soils is shown in table 23, which indicates their expected carrying capacity. They are not used for crops to any important extent.

TABLE 23.—*Soils of management group 17 and average expected carrying capacity of pasture under two levels of management*

[Yields in column A are those to be expected under prevailing management, as defined for management group 17 under the subheading, Present Use and Management; yields in column B are those to be expected under improved management as defined in the subheading, Management Requirements; absence of yield figure indicates soil is not commonly used for and is not physically suitable for pasture under the management specified]

Soil	Pasture	
	A	B
	Cow-acre-days [1]	*Cow-acre-days* [1]
Bolton loam, eroded steep phase	45	80
Dandridge shaly silt loam:		
Steep phase		75
Eroded steep phase	30	70
Dunmore silty clay loam, eroded steep phase	30	70
Dunmore cherty silt loam, steep phase	(2)	80
Dunmore cherty silty clay loam, eroded steep phase	35	75
Dunmore loam:		
Steep phase	(2)	80
Eroded steep phase	35	70
Groseclose cherty silt loam:		
Steep phase	(2)	75
Eroded steep phase	35	70
Litz shaly silt loam:		
Steep phase	(2)	60
Eroded steep phase	25	55
Litz loam:		
Steep phase		60
Eroded steep phase	20	55

[1] Number of days 1 acre will graze a mature cow without injury to the pasture.

[2] Soil suitable but seldom used for pasture.

Present use and management.—A large part of these soils is in forest. The cleared areas are being used mainly for pasture. A small acreage is in crops, and much of the land is idle or temporarily abandoned. The pastures are unimproved and rather poor. Lespedeza alone or mixed with volunteer plants is the most common pasture plant. A few farmers have established very good pastures by using mixtures of bluegrass, whiteclover, orchardgrass, redtop, lespedeza, and ryegrass. Corn is the main crop grown, but the acreage of this and of small grains is very small.

Fertilization of this group of soils has been very light. Many of the areas have received some lime and phosphorus, but a substantial acreage has not. A very few farmers have applied both of these amendments at fairly heavy rates. The use of phosphorus on permanent pasture is increasing. These soils ordinarily do not receive barnyard manure. Cultivation is approximately on the contour in most places. Stripcropping is not common, but subsoiling is practiced to a limited extent.

Management requirements.—These soils are not naturally productive for pasture, but by good management, fair to good pastures can be established and maintained. Lime and complete fertilizer are needed by most of the soils. The amounts needed should be determined by soil tests. Nitrogen is needed in the early life of the pastures or if the proportion of legumes in the stand is low. Although amendments are needed, applying them to these soils may be very difficult because of the strong slopes. If properly fertilized, most of the soils are suited to bluegrass, orchardgrass, redtop, white clover, red clover, hop clover, and lespedeza. Grazing should be carefully regulated to help control weeds and to maintain a good sod. Weed control will be difficult, but the less strong slopes can be mowed.

These soils are poorly suited to crops. If the need for cropland requires that they be used for this purpose in some places, management practices should include supplying lime, phosphorus, and possibly potassium, maintaining or increasing supplies of nitrogen and humus, and conserving moisture and soil material. Long rotations consisting largely of close-growing hay and small grains are best for preventing erosion. All tillage should be on the contour; stripcropping is also desirable.

MANAGEMENT GROUP 18

The soils in this group have one or more undesirable characteristics that practically prohibit use for crops or for pasture. They may be extremely stony, very steep, or severely gullied. Table 24 shows the soils in this group and their carrying capacity under two levels of management. Crops are seldom grown on these soils.

Present use and management.—About 95 percent of the acreage in this group is in forest. The eroded phases have been cleared, but some of them are reverting to forest. Many of the cleared areas are idle and some are used for pasture. Little effort has been made to improve either the wooded or the cleared areas. Pasture consists mainly of broomsedge, mixed with weeds, brush, and briers.

Selective cutting in the woodlands is not practiced; few attempts are made to improve tree utilization and prevent waste. Cutting practices are poor, except in the Cherokee National Forest, where timber harvesting and cultural practices are aimed toward soil and timber improvement (*12*).

TABLE 24.—*Soils and land types of management group 18 and average expected carrying capacity of pasture under two levels of management*

[Yields in column A are those to be expected under prevailing management, as defined for management group 18 under the subheading, Present Use and Management; yields in column B are those to be expected under improved management as defined in the subheading, Management Requirements; absence of yield indicates soil is not commonly used for pasture and is not physically suitable for it under the management specified]

Soil	Pasture	
	A	B
	Cow-acre-days [1]	*Cow-acre-days* [1]
Dandridge shaly silt loam, very steep phase	20	40
Dunmore cherty silty clay, severely eroded steep phase	20	40
Gullied land, Dunmore soil material		
Litz shaly silt loam, very steep phase	20	40
Litz loam, very steep phase		40
Ramsey stony loam:		
Steep phase		
Very steep phase		
Riverwash		
Stony colluvium, Jefferson soil material	15	25
Stony steep land, Dunmore soil material		
Stony very steep land, Ramsey soil material		

[1] Number of days 1 acre will graze a mature cow without injury to the pasture.

Management requirements.[8]—Practically all of these soils are in forest. In general, the cleared areas should be reforested.

These soils are not suited for crops or pasture, but social and economic factors may require that they be used for those purposes. If tilled crops are grown, lime and fertilizer are needed, and every reasonable measure should be taken to control runoff. The use of amendments and the selection and rotation of crops are especially important, to assure a good cover of vegetation. Stripcropping is advisable on most slopes.

Lime and fertilizer are needed to maintain good pastures. Legumes should make up a good part of the pasture sod. Steep slopes and stoniness make it difficult to apply fertilizers and to control weeds in many places.

In farm woodland management, the following measures are essential: (1) preventing fires and excluding livestock, (2) eliminating growth that competes with future crop trees, (3) harvesting timber by the tree selection method.

Forest fire hazards are greatest in the mountains inside the Cherokee National Forest. Vigilance and care by the local people can almost eliminate fires caused by incendiaries, hunters, smokers, and brush-burners. Fire prevention requires that all people be cautious while in the forest, particularly during critical fire weather in spring and in fall. Control of fires and grazing is needed to maintain soil porosity and prevent soil loss, as well as to protect the forest.

[8] Discussion on forest management for soils of this group prepared by G. E. Shivery, Extension Forester, University of Tennessee.

Grazing in the woodlands does not pay. Experiments in Indiana show that farm animals grazed on 6 acres or less of woodlands per animal unit, without supplemental feed, deteriorated seriously in a 6-month season (*2*). Repeated browsing gradually slows tree growth, kills small trees, and prevents forest reproduction. Compaction of the soil and disturbance of the humus destroy the porosity of the soil and decrease its capacity to absorb water.

If shade for livestock is needed, a small part of the woodland should be fenced off, and farm animals be excluded from the rest.

Proper harvesting is essential to good forest management. Trees that are unsound, crooked, short, or bushy topped, and those that are slow growing or of little commercial value, should be removed. Much of this inferior timber can be used for fuel or pulpwood. Its removal will permit the sound trees of commercially valuable species to grow more rapidly. These trees should be cut selectively, according to the stage of maturity of the individual trees. The cut timber should be removed by means that will not damage the reserved trees nor interfere with reforestation.

Denuded areas may reforest naturally in places. In others, planting will be needed. For natural reproduction, seed trees of desirable species must be in the vicinity. Exposed mineral soil is favorable for germination of seed and survival of seedlings. Virginia pine is an especially prolific seeder and will reforest dry and less favorable sites. Shortleaf pine, less prevalent in this county, grows at the lower elevations on more productive soils. At higher elevations, Virginia pine is displaced by pitch pine.

Planting is necessary if volunteer seeding by desirable species does not take place. Preparation for tree planting on the difficult sites includes breaking and mulching galled areas, building low check-dams of brush in gullies, and plowing contour furrows. Suitable forest tree seedlings can be obtained without cost from the Tennessee Valley Authority through the county agricultural agent.

Forest tree seedlings should be selected to suit the soil, the aspect, and the elevation. Shortleaf pine is one of the best species for all the soil associations except the higher elevations of the Ramsey-Rough stony land soil association. White pine is suited to comparatively low elevations where there is more moisture, and to northern or eastern aspects. Ravines, if the soil is fairly deep, are also good sites for white pine. Black locust is not recommended, except in mixed plantings or for areas where well-aerated soil material has accumulated, as, for example, behind check-dams in gullies. Yellow-poplar seedlings are sensitive and thrive only in cool moist situations at moderate elevations on north- and east-facing slopes, or in ravines, hollows, and coves where the soil is deep and fertile.

Forests supply many indirect benefits in addition to producing wood. The layer of leaves, needles, and twigs on the forest floor protects the soil. It absorbs the impact of falling rain and keeps open the tiny pores between the grains of soil through which water percolates downward. Under good forest management bacteria, worms, and fungi consume the litter and each other and form dark-brown humus. Gradually the humus is mixed with the soils to improve fertility, structure, and water-absorbing ability. Soil porosity is also improved by the channels left by decaying plant roots.

Surface roots have a beneficial soil-binding function. The densest network of roots usually is found in the lower parts of well-developed layers of litter. The erosion station near Statesville, North Carolina, reports that virgin woods lost only 0.002 ton of soil per acre and 0.06 percent of the rainfall in runoff (*10*). A woods plot that was burned over twice a year lost 3.08 tons of soil per acre and 11.5 percent of the rain; an unburned woods plot lost 0.001 ton of soil per acre and 0.06 percent of the rainfall.

Similar experiments were made at Zanesville, Ohio, for a 9-year period on cultivated land, pasture, and woodland (*11*). Runoff was 20.6 percent on cultivated land, 13.8 percent on pasture, and 3.2 percent on woodland. Soil losses per acre were 17.18 tons from cultivated land, 0.10 ton from pasture, and 0.01 ton from woodland. These studies show that a complete forest cover controls erosion and absorbs the most water. The soil under an old-growth forest is more porous and absorbs water more rapidly than that in cultivated fields. If a second-growth forest cover is properly maintained, the soil does not lose its porosity unless overgrazing or fires destroy the ground cover and litter (*1*).

Capability groups of soils

The capability grouping is an arrangement of soils to show relative suitability for crops, grazing, forestry, or wildlife. Soils that are nearly level, well drained, free from overflow, fairly fertile, and not otherwise limited are placed in class I. They are widely adaptable. The farmer can use his class I soils for crops without special practices, and can choose one of several cropping systems; if he wishes he may use the soil for pasture or for some other purpose.

Soils are placed in class II if they are a little less widely adaptable, and thus more limited than those in class I. A gently sloping soil, for example, must be farmed on the contour, kept under vegetation most of the time, or handled in some other manner to control erosion. Other soils may be in class II because they are too droughty, too wet, or too shallow to be in class I.

Class III contains the soils that are suitable for regular cropping but that have more narrow adaptations for use or more stringent management requirements than those in class II. The soils that are even more limited and that have narrower crop adaptations than those of class III, but that are still usable for tillage part of the time or with special precautions, are placed in class IV.

Soils not suitable for cultivation, or on which cultivation is not advisable, are in classes V, VI, VII, or VIII. Class V, not used in Washington County, consists of soils not subject to erosion but unsuitable for cultivation because of standing water or frequency of overflow. Class VI contains soils that are steep or droughty or that have other serious limitations but will produce fairly good amounts of forage or forest products. As a rule class VI soils should not be cultivated, but some of them can safely be disturbed enough to prepare them for planting

trees or seeding to extremely longtime pastures. Soils in class VII are more limited than those in class VI. They usually give only fair to poor yields of forage or wood products. Soils in class VIII, a class not used in Washington County, are so severely limited that they produce little useful vegetation. They may make attractive scenery or may be parts of useful watersheds. Some have value for wildlife.

Subclasses: Since the broad capability classes are based on total suitability of the soils for different uses, one class usually contains different kinds of soils. The kinds of management problems then differ because the soils are different. Class III soils in this county, for example, consist of some rolling soils subject to erosion, some shallow and droughty soils, and some terrace and bottomland soils limited by excess water. It is convenient to recognize, within the broad classes, capability subclasses based on the dominant limitation. The subclasses used in Washington County are established according to dominant limitations or risks, as follows: Erosion, designated by the symbol (e); excess water (w); and shallowness or droughtiness (s). The subclass is denoted by a small letter following the class number, such as IIe, IIIw, or IIIs.

CAPABILITY CLASSES AND SUBCLASSES IN WASHINGTON COUNTY

Capability classes and subclasses in Washington County are given in the following lists. The brief description of each subclass gives the general nature of the major soils included.

Class I.—Soils that are easy to farm and have no more than slight limitations in use. They may be used for intensive cultivation without special measures to control excess water or erosion, and they may be expected to produce high yields with good soil and crop management. No subclasses of class I are used.

Class II.—Soils that can be used for tilled crops with only slight risks of erosion or other limitations.
- IIe: Undulating soils subject to erosion.
- IIw: Imperfectly drained bottom and colluvial soils.

Class III.—Soils that can be used for tilled crops but under moderate risk of erosion, excess water, or other limitations.
- IIIe: Rolling soils subject to erosion.
- IIIs: Soils limited by stoniness, shallowness, or low water-supplying capacity.
- IIIw: Imperfectly and poorly drained soils.

Class IV.—Soils that have severe limitations for cultivation and under that use require extreme care.
- IVe: Hilly soils subject to severe erosion.
- IVs: Rolling and hilly soils limited by droughtiness, or shallowness, or low fertility.

Class VI.—Soils too steep, too eroded, too stony, or too shallow for cultivation except occasionally to seed long-producing pasture or forage, or to plant trees.
- VIe: Hilly and steep soils.
- VIs: Rolling, hilly, or stony soils of limited depth, fertility, or water-supplying capacity.

Class VII.—Soils too steep, too stony, too erodible, or too droughty for cultivation.
- VIIe: Steep or erodible soils and gullied land.
- VIIs: Cobbly, shaly soils with low moisture-supplying capacity, and stony steep land.

The capability class and subclass for each soil is shown in the following list:

	Capability class and subclass
Allen loam:	
Rolling phase (Aa)	IIIe.
Eroded rolling phase (Ab)	IIIe.
Hilly phase (Ac)	IVe.
Eroded hilly phase (Ad)	IVe.
Allen stony loam:	
Eroded rolling phase (Ae)	IVs.
Hilly phase (Af)	VIs.
Eroded hilly phase (Ag)	VIs.
Augusta loam (Ah)	IIIw.
Barbourville loam (Ba)	IIe.
Barbourville stony loam (Bb)	IIIs.
Bolton loam:	
Eroded rolling phase (Bc)	IIIe.
Eroded hilly phase (Bd)	IVe.
Eroded steep phase (Be)	VIe.
Buncombe loamy fine sand (Bf)	IVs.
Chewacla loam (Ca)	IIw.
Cobbly alluvium, Staser and Congaree soil materials (Cb)	VIIs.
Congaree fine sandy loam (Cc)	I.
Congaree loam (Cd)	I.
Cumberland silt loam, undulating phase (Ce)	IIe.
Cumberland silty clay loam:	
Eroded rolling phase (Cf)	IIIe.
Eroded hilly phase (Cg)	IVe.
Dandridge shaly silt loam:	
Eroded rolling phase (Da)	IIIs.
Eroded hilly phase (Db)	IVs.
Steep phase (Dc)	VIIs.
Eroded steep phase (Dd)	VIIs.
Very steep phase (De)	VIIs.
Dandridge silt loam:	
Rolling phase (Df)	IIIs.
Hilly phase (Dg)	IVs.
Dewey silty clay loam:	
Eroded rolling phase (Dh)	IIIe.
Eroded hilly phase (Dk)	IVe.
Dunmore cherty silt loam:	
Rolling phase (Dna)	IIIe.
Hilly phase (Dnb)	IVe.
Steep phase (Dnc)	VIIe.
Dunmore cherty silty clay:	
Severely eroded hilly phase (Dnd)	VIe.
Severely eroded steep phase (Dne)	VIIe.
Dunmore cherty silty clay loam:	
Eroded rolling phase (Dnf)	IIIe.
Eroded hilly phase (Dng)	IVe.
Eroded steep phase (Dnh)	VIIe.
Dunmore loam:	
Rolling phase (Dnk)	IIIe.
Eroded rolling phase (Dnl)	IIIe.
Hilly phase (Dnm)	IVe.
Eroded hilly phase (Dnn)	IVe.
Steep phase (Dno)	VIe.
Eroded steep phase (Dnp)	VIe.
Dunmore silt loam:	
Rolling phase (Dsa)	IIIe.
Hilly phase (Dsb)	IVe.
Dunmore silty clay:	
Severely eroded rolling phase (Dsc)	IIIe.
Severely eroded hilly phase (Dsd)	IVe.
Dunmore silty clay loam:	
Eroded rolling phase (Dse)	IIIe.
Eroded hilly phase (Dsf)	IVe.
Eroded steep phase (Dsg)	VIe.
Emory silt loam (Ea)	IIe.
Greendale silt loam (Ga)	IIe.
Groseclose cherty silt loam:	
Rolling phase (Gb)	IIIe.
Hilly phase (Gc)	IVe.
Eroded hilly phase (Gd)	IVe.
Steep phase (Ge)	VIIe.
Eroded steep phase (Gf)	VIIe.

	Capability class and subclass
Groseclose cherty silty clay loam, eroded rolling phase (Gg).	IIIe.
Groseclose silty clay loam:	
Eroded rolling phase (Gh)	IIIe.
Eroded hilly phase (Gk)	IVe.
Gullied land, Dunmore soil material (Gl)	VIIe.
Hamblen loam (Ha)	IIw.
Hamblen silt loam (Hb)	IIw.
Hayter loam:	
Undulating phase (Hc)	IIe.
Eroded rolling phase (Hd)	IIIe.
Hayter stony loam, undulating phase (He)	IIIs.
Hermitage silt loam:	
Undulating phase (Hf)	IIe.
Eroded rolling phase (Hg)	IIIe.
Holston cobbly loam:	
Eroded rolling phase (Hh)	IVs.
Eroded hilly phase (Hk)	VIs.
Holston loam:	
Undulating phase (Hl)	IIe.
Eroded rolling phase (Hm)	IIIe.
Jefferson loam:	
Undulating phase (Ja)	IIe.
Eroded rolling phase (Jb)	IIIe.
Jefferson stony loam:	
Undulating phase (Jc)	IVs.
Rolling phase (Jd)	IVs.
Eroded rolling phase (Je)	IVs.
Hilly phase (Jf)	VIs.
Eroded hilly phase (Jg)	VIs.
Leadvale silt loam:	
Undulating phase (La)	IIe.
Eroded rolling phase (Lb)	IIIe.
Lindside silt loam (Lc)	IIw.
Litz loam:	
Rolling phase (Ld)	IIIs.
Eroded rolling phase (Le)	IIIs.
Steep phase (Lf)	VIIs.
Eroded steep phase (Lg)	VIIs.
Very steep phase (Lh)	VIIs.
Litz shaly silt loam:	
Eroded rolling phase (Lk)	IIIs.
Eroded hilly phase (Ll)	VIs.
Steep phase (Lm)	VIIs.
Eroded steep phase (Ln)	VIIs.
Very steep phase (Lo)	VIIs.
Litz silt loam:	
Rolling phase (Lp)	IIIs.
Hilly phase (Lr)	VIs.
Masada clay loam:	
Eroded rolling phase (Ma)	IIIe.
Eroded hilly phase (Mb)	IVe.
Masada loam, undulating phase (Mc)	IIe.
Melvin silt loam (Md)	IIIw.
Monongahela loam (Me)	IIe.
Monongahela silt loam (Mf)	IIe.
Nolichucky cobbly loam:	
Eroded rolling phase (Na)	IVs.
Eroded hilly phase (Nb)	VIs.
Nolichucky loam:	
Rolling phase (Nc)	IIIe.
Eroded rolling phase (Nd)	IIIe.
Hilly phase (Ne)	IVe.
Eroded hilly phase (Nf)	IVe.
Ooltewah silt loam (Oa)	IIw.
Pace silt loam:	
Undulating phase (Pa)	IIe.
Rolling phase (Pb)	IIIe.
Eroded rolling phase (Pc)	IIIe.
Prader silt loam (Pd)	IIIw.
Ramsey stony loam:	
Hilly phase (Ra)	VIs.
Steep phase (Rb)	VIIs.
Very steep phase (Rc)	VIIs.
Riverwash (Rd)	VIIs.
Sequatchie cobbly fine sandy loam (Sa)	IIIs.
Sequatchie loam (Sb)	IIe.
Staser loam (Sc)	I.
Stony colluvium, Jefferson soil material (Sd)	VIIs.
Stony hilly land, Dunmore soil material (Se)	VIIs.
Stony rolling land, Dunmore soil material (Sf)	VIs.
Stony steep land, Dunmore soil material (Sg)	VIIs.
Stony very steep land, Ramsey soil material (Sh)	VIIs.
Tyler silt loam (Ta)	IIIw.
Waynesboro cobbly loam:	
Eroded rolling phase (Wa)	IVs.
Eroded hilly phase (Wb)	VIs.
Waynesboro loam:	
Undulating phase (Wc)	IIe.
Eroded rolling phase (Wd)	IIIe.
Eroded hilly phase (We)	IVe.
Weaver silt loam (Wf)	IIw.
Wehadkee silt loam (Wg)	IIIw.
Whitesburg silt loam (Wh)	IIw.

Soil associations

A soil association is a geographic group of two or more soils that normally occur together in about the same proportions and in a fairly uniform distribution pattern. Ordinarily, the boundaries of an association are fairly well defined. The soils in each association may differ from each other, but their proportions and distribution are about the same wherever the association occurs. The usefulness and agricultural importance of a particular soil are affected by the kinds of soils with which it is associated.

The nine soil associations recognized in Washington County are described briefly in the following pages. The locations in which each association occurs is shown on a colored map in the back of the report.

DUNMORE (ROLLING TO HILLY)-PACE-GREENDALE (DP)

This soil association occupies about 50.2 percent of the county, or the major part of the limestone area. It is the largest and perhaps the most important soil association in the entire region. The prevailing relief is rolling to hilly. The association has a very irregular dendritic drainage pattern that is modified by sinks and subterranean streams which give, in some places, a karst or hummocky appearance (fig. 14). The ridgetops are comparatively broad and winding; the ridge slopes are short and moderately steep.

Dunmore soils are by far the most extensive in this association. Greendale and Pace soils are considerably

***Figure 14.*—An area of the Dunmore (rolling to hilly)-Pace-Greendale soil association, showing hummocky relief.**

less extensive but are very important to the agriculture of the area. The Dunmore soils occupy most of the rolling and hilly upland slopes; the Greendale and Pace soils are on the gently sloping colluvial areas at the base of slopes and along narrow, intermittent drainageways. Other less extensive soils occurring in the association are the Lindside, Melvin, and Weaver, which occupy the first bottoms; the Litz, which extends across the association at rather widely spaced intervals in a southwest-northeast direction; and the Dandridge, Groseclose, Dewey, Emory, and Ooltewah soils and the stony land types. A thin layer of terrace material covers many of the ridgetops and milder ridge slopes in the extreme southern part of the association.

The soils in this association are productive and well suited to the agriculture of the county. Dunmore soils are well suited to a wide variety of crops, but they are not desirable for tilled crops because they are hard to conserve. They are very well suited to pasture and hay, especially the deep-rooted legumes such as alfalfa and red clover. The Pace, Greendale, Lindside, and Weaver soils are well suited to intensive use and, though the acreage is small, they are very important to the farms on which they occur.

Practically all of this association is in farms (fig. 15). A very high proportion of the land is in crops and pasture;

Figure 15.—**Strongly rolling or hilly landscape in the Dunmore (rolling to hilly)-Pace-Greendale soil association.**

very little is idle or abandoned. Practically all forest in the association is in small farm woodlots. Most of the forest is of the upland hardwoods type, but some areas of the yellow pine-hardwoods type occur in the vicinity of Telford.[9]

The high proportion of well-built and well-kept farm buildings and fences indicates that the agriculture on this association is among the most prosperous in the county. The farms in this area are generally larger than those on the Dunmore (hilly to steep)-Stony land-Litz soil association. Farming is diversified (fig. 16). Corn, small grains, livestock, and livestock products are produced for sale and for home use. The chief products sold by farmers are burley tobacco, livestock, and livestock products, chiefly milk.

The soils in this association apparently are very well suited to livestock farming. Productive pasture soils

[9] Forest classification and description for this association and the others in the county are according to G. B. Shivery, extension forester, University of Tennessee.

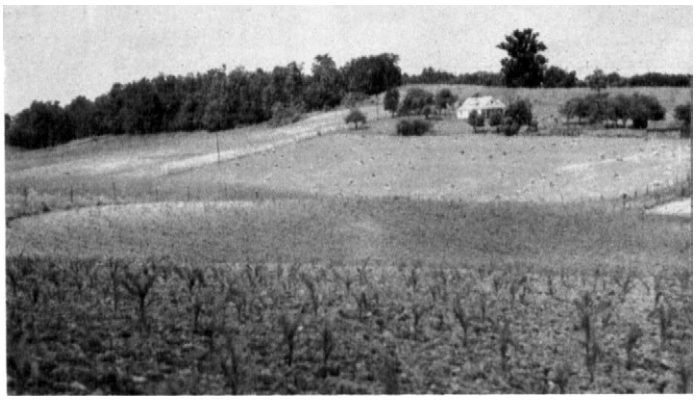

Figure 16.—**Farm in the Dunmore (rolling to hilly)-Pace-Greendale soil association.**

are plentiful, and most farms have sufficient bottom land or colluvial land for feed crops and tobacco. The choice of enterprises, although broader than in the Dunmore (hilly to steep)-Stony land-Litz soil association is limited by the difficult conservation problems presented by soils on the rolling to hilly uplands. Among the farmers there is a definite trend to adjust uses to the capabilities of the soils. The management, however, is not yet good enough to allow for high production of crops or for proper maintenance of the soils. Inadequate management is evidenced by active erosion, low yields, and the presence of broomsedge and other wild plants in pastures. A number of successful farmers have shown that a much higher level of management than that ordinarily followed would be practical.

DUNMORE (HILLY TO STEEP)-STONY LAND-LITZ (DS)

This association occupies 18.2 percent of the county and is in the dissected ridge-and-valley area. The prevailing relief is rolling to hilly or steep. The drainage pattern is very irregularly dendritic and is modified by sinks and subterranean streams. Ridgetops are relatively narrow and winding, and the ridge slopes are short and moderately steep.

Dunmore soils are the most extensive, but stony land, confined chiefly to the steeper slopes, also has considerable acreage. Numerous Litz ridges dissect the association and give it a ridge-and-valley appearance. Greendale and Pace soils, on the foot slopes and along the narrow intermittent drainageways, together occupy a significant acreage (fig. 17). Other less extensive soils are the Lindside, Weaver, Melvin, Ooltewah, Dewey, Emory, Groseclose, and Dandridge. This association differs from the Dunmore (rolling to hilly)-Pace-Greendale association in occupying steeper slopes and in having a significant acreage of the stony land types and shaly Litz soils. It also differs in having a higher proportion of forested land, and generally in being less productive of most crops.

The Dunmore soils are well-suited to many kinds of crops; but strong slopes and the difficulty of controlling erosion make them unsuitable for intensive cropping. The selection of adapted crops and suitable rotations is very important to proper use of these soils. Pasture and hay are suited to these soils; the best plants are alfalfa, red clover, or other deep-rooted legumes. The Greendale, Pace, Lindside, and Weaver soils are suited to intensive use. The acreage of these soils is small, but

they are very important on the farms on which they occur. Most of the stony land types and the Litz soils are fairly well suited to pasture, but the largest part of the Litz acreage is still forested.

Figure 17.—**Pace and Greendale soils at the base of short, moderately steep slopes of Dunmore soils. These small areas of good crop soil are very important in the association of hilly and steep soils.**

Forests of this association are predominantly of the upland hardwoods type. Conspicuous species are black oak, white oak, scalybark hickory, white ash, post oak, chestnut killed by blight, dogwood, white hickory, and blackgum. The dominant species are yellow-poplar, Southern red oak, scarlet oak, pignut hickory, sourwood, yellow locust, redbud, and Northern red oak. The cedar-hardwoods forest type occupies some Stony hilly land, Dunmore soil material, and Stony steep land, Dunmore soil material. In this type, redcedar accounts for 25 to 75 percent of the total dominant and codominant stems. The yellow pine-hardwoods forest type, consisting largely of Virginia pine, replaces the upland hardwoods type in the general locality of Little Cherokee Creek.

The farms in this association generally are smaller than those in the Dunmore (rolling to hilly)-Pace-Greendale soil association. More part-time farms and farms producing for home use are on this association. Nearly all of the land is in small farms, and the rural population is rather high. The agriculture is highly diversified. Chief products are grain and livestock grown for home use. Tobacco, the chief cash crop, is grown in small areas on most farms, mainly on the Pace and Greendale soils. Livestock and livestock products, chiefly milk, are produced for sale on a few of the farms.

The relative extent of Pace, Greendale, and Lindside soils, the best in the association, greatly influences prosperity. Farms on which areas of these soils are small and scarce are generally the subsistence type, on which tobacco, the chief cash crop, is grown in small patches. Where areas of the better soils are significantly larger, their greater productivity of corn and hay generally is reflected in the appearance of the farmsteads. As a whole, the soils in this association are only moderately productive. Most of them are suited only to pasture. They respond to management, and their productivity can be increased by fertilization and improved management.

DANDRIDGE-LITZ LOAM-WHITESBURG (DL)

This association occupies about 4.5 percent of the county. It covers practically all of the shale-hill section and consists chiefly of the Dandridge, Whitesburg, and Litz loam soils. It is divided into four small but distinctive areas, which are highly dissected by the irregular dendritic drainage pattern. The association is characterized by rounded "knoblike" hills; narrow, winding ridges; and steep-walled, V-shaped valleys (fig. 18). It is predominantly steep to very steep.

Figure 18.—**Dandridge-Litz loam-Whitesburg soil association on rounded knoblike hills in background. Leadvale and Monongahela soils on gently sloping area in foreground.**

Steep and hilly Dandridge soils occur on most of the ridge slopes, and rolling Dandridge soils on the narrow winding ridge crests. Steep and very steep Litz soils are common on many upland slopes, and frequently they occupy the ridge slopes that are immediately above the lower lying Dandridge soils. Whitesburg and Leadvale soils occupy gently sloping alluvial-colluvial accumulations that lie at the base of slopes and along the narrow intermittent drainageways. Hamblen soils occupy most of the nearly level flood plains. Small areas of Staser, Prader, and Weaver soils also occur on the flood plains.

Steep slopes, shallow depth, and high susceptibility to erosion make most of the Dandridge acreage poor for crops. The comparatively small acreage of Whitesburg, Leadvale, and Hamblen soils is suited to intensive use for adapted crops. The Hamblen soils are limited in use and suitability because they are susceptible to overflow and are imperfectly drained. Hamblen soils, however, are well suited to corn and many other feed and forage crops.

The farmers on this soil association produce mainly for home use. Much of the land is now in cutover forest; a large acreage of farmland has been abandoned and is reverting to poor-quality forest. The Whitesburg and Leadvale soils, with the bottom-land soils, account for the comparatively small acreage used intensively for feed crops and tobacco. Only a small part of the potential pastureland is used.

Both the upland hardwoods and the yellow pine-hardwoods forest types occur in the association. Many kinds of forest trees are represented, particularly in the

northeastern part of the county. White pine grows on lower slopes in association with Northern red oak, yellow-poplar, basswood, sycamore, and cucumber-tree. Other species are scarlet oak, the hickories, and almost any species common to the county, with the possible exception of pitch pine. The occurrence of pitch pine depends on altitude and direction of the slopes. Dry south- and west-facing slopes are favored sites for Virginia pine, chestnut oak, and sourwood; moist north- and east-facing slopes and ravines are good sites for Northern red oak, yellow-poplar, and black walnut.

The small amount of land suited to crops makes it difficult to use the soils according to their capabilities. Good agricultural use is practical only on those farms that extend into other associations that have a higher percentage of crop-adapted soils. Even on livestock farms, it is difficult to have good pastures on the Dandridge and Litz soils during hot dry months, or to produce enough feed for wintering the livestock. The management of soils and farms is difficult, especially on the small units. It is hard to grow enough crops without damaging the soils. Nevertheless, a level of management much higher than that now practiced is both feasible and desirable. A few farmers have demonstrated that this soil association can produce much more than it does now. The yield of pasture and hay could be increased the most.

CUMBERLAND-WAYNESBORO-EMORY (CW)

This association occupies about 4.6 percent of the county. It consists of soils that occur chiefly on the high terraces. Associated soils on the first bottoms and low terraces are included in some places. The first bottoms and low terraces occupy a very small percentage of the area. The relief is predominantly undulating to rolling, though there are a few short, moderately steep slopes.

Cumberland and Waynesboro soils cover the major part and are about equal in total area. Emory and Hermitage soils occupy most of the foot slopes and also occur along intermittent drainageways. On the first bottoms included in this association are chiefly the Buncombe and Congaree soils. These soils are along the Nolichucky River. The Buncombe soil typically is nearest the stream. Along the Watauga River, Staser and Hamblen soils occupy the first bottoms, and Sequatchie soils are on the low terraces.

The soils of this association are probably the most productive in the county. They are well suited to any crop commonly grown and respond very well to good management. All land in the association is in farms, and a very large part is in crops and pasture. The small acreage in forest is covered chiefly by trees of the upland hardwoods forest type. The farms, as a whole, are highly productive. The well-built and well-maintained farm buildings indicate that the agriculture is prosperous. The farms are larger than those on other soil associations. Farming is highly diversified. Corn, small grains, livestock, and livestock products are produced for sale and home use. Burley tobacco, livestock, and livestock products are the chief sources of income.

Most of the farmers have a wide choice in crops and in type of farming. They also have the advantage of being able to use the soils for crops to which they are suited. Management is not exacting if the soils are used within their capabilities. Proper selection of crops, the use of good rotations, application of fertilizers, and use of reasonable supporting practices for the control of runoff are necessary on all farms.

SEQUATCHIE-CONGAREE-CHEWACLA (SC)

This association occupies some of the first bottoms and low terraces along the Nolichucky River. It covers only about 1.8 percent of the county, but because of its location and the high proportion of productive soils, it is important to agriculture.

The association is undulating to nearly level (fig. 19). It has natural levees and other low ridges, and intervening swales or sloughs that run nearly parallel to the Nolichucky River. Buncombe soil or cobbly alluvium typically occurs on the natural levees, the Congaree and Chewacla soils on the low first bottoms, and the Chewacla and Wehadkee soils in the swales and sloughs. The Sequatchie soils are on the low terraces, and the Augusta soil lies between the low terraces and the first bottoms. All of the soils, except the Sequatchie, are periodically flooded.

***Figure 19.*—An intensively cropped area in the Sequatchie-Congaree-Chewacla soil association, showing undulating to nearly level topography. Ramsey soils on mountains in background.**

The Sequatchie soils, lying between the first-bottom soils and the Jefferson and Allen soils of the old colluvial lands, are above overflow. They may be derived from colluvium, alluvium, or a mixture of both. The Sequatchie soils are predominantly undulating.

Others included in the association are the Jefferson, Masada, Hayter, Tyler, and Monongahela; their combined acreage is very small.

As a whole, this association is well suited to intensive use for crops. The soils are fairly productive, but the suitability for agriculture is restricted by susceptibility to flooding, imperfect drainage, droughtiness, or stoniness. The Sequatchie soils are very well suited to all of the field crops commonly grown. The Congaree and Chewacla soils are too wet for alfalfa and small grains; they are best for corn, hay crops, and pasture. The soils in this association are moderately well supplied with plant nutrients and organic matter. Fair yields can be expected without amendments, but they can be improved by applying amendments, particularly phosphorus.

This association is so narrow that practically none of the farms are entirely located on it. A general type of farming is practiced. There are only a few part-time

farms or subsistence farms. The area is densely populated, and the farms are rather small. The fact that farmsteads are well built and well maintained indicates that the area is highly prosperous.

Practically all of this association has been cleared and is now used intensively for crops. Pastures are generally on the adjacent upland slopes. Corn, small grains, and tobacco are the most commonly grown crops. These crops and livestock and livestock products are the chief source of income. Management on this association is not especially difficult, and the farmer has a wide choice of enterprises.

HOLSTON-STASER-HAMBLEN (HS)

The small narrow, elongated areas of this association occupy first bottoms, low terraces, and high terraces along the Watauga River (fig. 20). The association

Figure 20.—**Holston-Staser-Hamblen soil association. Low first bottoms (center) and high terraces (right), separated by short, steep slope.**

covers only about 0.7 percent of the county, but it is agriculturally important because it is adjacent to soil associations that have large areas of soils suitable for hay and pasture.

The first bottoms and low terraces of this association are undulating to nearly level. The high terraces are dominantly undulating to rolling and have uniform, very short, steep slopes toward the low terraces and first bottoms.

Staser and Buncombe soils typically occur near the stream; Hamblen and Prader soils occupy the level or slightly depressed parts of the first bottoms. The Sequatchie soils are on the low terraces, and Tyler and Monongahela soils lie between the low terraces and the adjacent high terraces. The Holston soils, on the high terraces, are the most extensive soils (fig. 21). The entire association is underlain by calcareous shale.

Except for the poorly drained Tyler and Prader soils, the association is suited to most of the crops commonly grown. The suitability of the Monongahela soils is restricted by the pan in the lower layers, but the acreage of this soil is insignificant.

The use of the first bottoms and part of the low terraces is limited by flooding. The Holston soils are naturally low in fertility, and yields of most crops are low under the prevailing management. Holston soils respond well

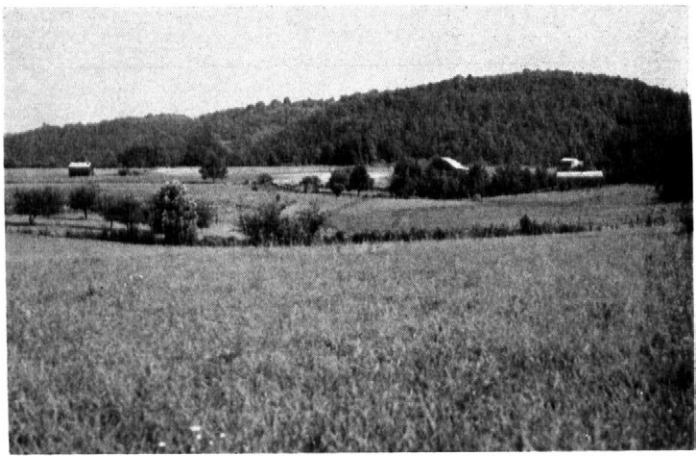

Figure 21.—**Holston soils on undulating and rolling high terraces.**

to good management, especially if lime and a complete fertilizer are applied.

The farms in this soil association are small and are mainly general farms. The chief cash crop is tobacco. Corn, small grains, livestock, and livestock products are produced on a small scale, chiefly for home use. Few of the farms are entirely within this association; many extend onto the adjacent association, which is dominated by Dandridge soils.

ALLEN-JEFFERSON-BARBOURVILLE (AJ)

This association occupies a narrow band of foothills running northeast-southwest across the county. It covers about 0.6 percent of the county and lies at the base of steep mountains. The soils have formed in thin colluvial deposits that overlie limestone materials. In places limestone is exposed. The colluvial material, which has washed from the Ramsey soils, spreads out a short distance over the adjoining valley. The relief is predominantly hilly and is characterized by short, moderately steep, hilly slopes and fairly broad rolling ridge crests. Allen and Jefferson soils, on the colluvial slopes and ridge crests, are the most abundant soils in the association. Small areas of Dunmore soils are on the steeper slopes not covered with colluvial material. Barbourville soils are on the recent alluvial-colluvial areas at the base of slopes and along narrow intermittent drainageways. Most of the acreage of Jefferson and Allen soils contains much stone. The most stony areas typically are near the mountains, but the soil is less stony the farther it is from the base of the mountains. Small areas of Hayter soils and of stony lands consisting of Dunmore soil material are included in the association.

Hilly relief and stoniness make nearly half of this association unsuitable for row crops and rather poor for pasture. Amendments are needed to establish and to maintain even fair pasture.

The farms of this association are small and chiefly of the crop-and-livestock type or the subsistence type. Tobacco is their chief cash crop; peppers are an important cash crop in the western half of the area. Tobacco and peppers are grown in small plots, mainly on recent colluvial soils. Corn, small grains, livestock, and livestock products are grown chiefly for home use. Livestock and pasture enterprises are not as prominent on this association as are other types of farming.

The hilly, stony soils are mainly in unimproved pasture or are idle. A considerable acreage is in cutover forest. Yellow pine-hardwoods is the most common forest type, and it consists chiefly of Virginia pine and some pitch pine. The upland hardwoods forest type occurs in places, and the closely related oak-chestnut forest type of the higher elevations encroaches upon it. White pine, yellow locust, Northern red oak, yellow-poplar, red maple, hemlock, chestnut oak, and sourwood are among the hardwoods common to this soil association.

The soils on the average farm are suitable for growing a wide variety of crops, but they need rather exacting management. Because of stones and strong slopes, many of the soils are difficult to till, and it is difficult to keep fertility at a high level. The farmer has a fairly wide choice of enterprises, but a high level of management generally will be necessary for any type of farming.

NOLICHUCKY-WAYNESBORO-DUNMORE (NW)

This soil association covers 2.8 percent of the county and consists chiefly of old high terraces along the Nolichucky River. The soils differ from those of the Cumberland-Waynesboro-Emory soil association in being more highly leached, lighter colored, less productive, and generally shallower to the underlying limestone materials. In general, the area consists of thin alluvial deposits over limestone materials, which are exposed in places. The predominantly hilly relief is characterized by short moderately steep slopes that have broad rolling crests.

Nolichucky and Waynesboro soils are the most extensive; they occupy the rolling crests and colluvial slopes. Dunmore soils are on the steeper slopes. Common in this association are terrace materials on ridgetops and Dunmore soils on ridge slopes. Greendale and Pace soils occupy most of the colluvial foot slopes and also occur along intermittent drainageways. Other less extensive soils are the Emory, Lindside, Hermitage, Melvin, and Holston, and the stony land types.

As a whole, this association is well suited to nearly all the crops commonly grown in the county. The natural fertility of the Nolichucky soils is rather low, but all the soils respond well to good management that includes the addition of needed amendments.

Individual farms in the association are medium-sized units that have a diversified type of farming. Corn, small grains, livestock, and livestock products are the chief products sold. Farmlands, farm buildings, and roads are well maintained.

The farmers in this association have a wide choice of enterprises, but a fairly high level of management is required for all of them. Rotation of adapted crops, fertilization, and supporting practices to control runoff are needed.

RAMSEY-ROUGH STONY LAND (RR)

This is a large, mountainous soil association consisting of steep or very steep Ramsey soils and very steep stony land. Very small acreages of Jefferson, Allen, and Barbourville soils occur on the colluvial slopes; they are normally stony or very stony and are isolated by large areas of the dominant soils of the association (fig. 22). Practically all of the association is in forest, a large part of which is in the Cherokee National Forest. Forestry is probably the best use for these soils, although they are not good forest soils. The association covers about 10.6 percent of the county.

Figure 22.—**Isolated homestead in the Ramsey-Rough stony land soil association.**

Upland hardwoods and oak-chestnut are the dominant forest types. These grade to the yellow pine-hardwoods type where sufficient pine has come in. Virginia pine occurs on the lower elevations, and pitch or Table-Mountain pine is at the higher elevations. The exact character of the vegetation is influenced by ravines, stream courses, aspect, and elevation. Black oak, the hickories, yellow locust, Northern red oak, scarlet oak, chestnut oak, sourwood, and dead chestnut, with or without yellow pine, occur where the prevailing aspect is northwest. Many kinds of trees grow along the ravines, but mainly yellow-poplar, sycamore, hemlock, sugar maple, red maple, yellow buckeye, cucumber-tree, basswood, and black birch. Mountain maple and rhododendron are conspicuous along ravines.

Soil Survey Methods and Definitions

The scientist who makes a soil survey examines soils in the field, classifies the soils in accordance with facts that he observes, and maps their boundaries on an aerial photograph or other map.

FIELD STUDY.—The soil surveyor bores or digs many holes to see what the soils are like. The holes are not spaced in a regular pattern, but are located according to the lay of the land. Usually they are not more than a quarter of a mile apart and sometimes they are much closer. In most soils each boring or hole reveals several distinct layers, called horizons, which collectively are known as the soil profile. Each layer is studied to see how it differs from others in the profile and to learn the things about this soil that influence its capacity to support plant growth.

Color is usually related to the amount of organic matter. The darker the surface soil, as a rule, the more organic matter it contains. Streaks and spots of gray, yellow, and brown in the lower layers generally indicate poor drainage and poor aeration.

Texture, or the content of sand, silt, and clay, is determined by the way the soil feels when rubbed between the fingers, and is later checked by laboratory analysis. Texture determines how well the soil retains moisture,

plant nutrients, and fertilizer, and whether it is easy or difficult to cultivate.

Structure, which is the way the individual soil particles are arranged in larger grains, gives us clues to the ease or difficulty with which the soil is penetrated by plant roots and by moisture.

Consistence, or the tendency of the soil to crumble or to stick together, indicates whether it is easy or difficult to keep the soil open and porous under cultivation.

Other characteristics observed in the course of the field study and considered in classifying the soil include the following: The depth of the soil over bedrock or compact layers; the presence of gravel or stones in amounts that will interfere with cultivation; the steepness and pattern of slopes; the degree of erosion; the nature of the underlying parent material from which the soil has developed; and acidity or alkalinity of the soil as measured by chemical tests.

CLASSIFICATION.—On the basis of the characteristics observed by the survey team or determined by laboratory tests, soils are classified into phases, types, and series. The soil type is the basic classification unit. A soil type may consist of several phases. Types that resemble each other in most of their characteristics are grouped into soil series.

As an example of soil classification, consider the Waynesboro series. This series is made up of two soil types subdivided into phases, as follows:

Series	*Type*	*Phase*
Waynesboro	Cobbly loam	Eroded rolling.
		Eroded hilly.
	Loam	Undulating.
		Eroded rolling.
		Eroded hilly.

Soil type.—Soils similar in kind, thickness, and arrangement of soil layers are classified as one soil type.

Soil phase.—Because of differences other than those of kind, thickness, and arrangement of layers, some soil types are divided into two or more phases. Slope variations, frequency of rock outcrops, degree of erosion, depth of soil over the substratum, or natural drainage, are examples of characteristics that suggest dividing a soil type into phases.

The soil phase (or the soil type if it has not been subdivided) is the unit shown on the soil map. It is the unit that has the narrowest range of characteristics. Use and management practices therefore can be specified more easily than for soil series or yet broader groups that contain more variation.

Soil series.—Two or more soil types that differ in surface texture, but are otherwise similar in kind, thickness, and arrangement of soil layers, are normally designated as a soil series. In a given area, however, it frequently happens that a soil series is represented by only one soil type. Each series is named for a place near which it was first mapped.

Miscellaneous land types.—Areas that have little true soil are not classified into types and series, but are identified by descriptive names. Examples in Washington County are Cobbly alluvium, Staser and Congaree soil materials; Gullied land, Dunmore soil material; and Riverwash.

Soil complex.—If two or more soils are so intricately associated in small areas that it is not feasible to show them separately on the soil map, they are mapped together and called a soil complex. No soil complexes were mapped in Washington County.

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Soils of Washington County, Tenn.:

Soil	Map symbol	Management group	Slope range	Drainage
Allen loam:				
Rolling phase	Aa	6	*Percent* 5–12	Well drained
Eroded rolling phase	Ab	6	5–12	Well drained
Hilly phase	Ac	13	12–25	Well drained
Eroded hilly phase	Ad	13	12–25	Well drained
Allen stony loam:				
Eroded rolling phase	Ae	7	5–12	Well drained
Hilly phase	Af	16	12–25	Well drained
Eroded hilly phase	Ag	16	12–25	Well drained
Augusta loam	Ah	5	0– 3	Imperfectly drained
Barbourville loam	Ba	2	2– 7	Well drained
Barbourville stony loam	Bb	2	2– 7	Well drained
Bolton loam:				
Eroded steep phase	Be	17	25–50	Well drained
Eroded rolling phase	Bc	6	5–12	Well drained
Eroded hilly phase	Bd	13	12–25	Well drained
Buncombe loamy fine sand	Bf	1	0– 3	Excessively drained
Chewacla loam	Ca	1	0– 3	Imperfectly drained
Cobbly alluvium, Staser and Congaree soil materials	Cb	16	0–3	Well drained
Congaree loam	Cd	1	0–3	Well drained
Congaree fine sandy loam	Cc	1	0–3	Well drained
Cumberland silty clay loam, eroded rolling phase	Cf	6	5–12	Well drained
Cumberland silt loam, undulating phase	Ce	3	2–5	Well drained
Cumberland silty clay loam, eroded hilly phase	Cg	13	12–25	Well drained
Dandridge shaly silt loam:				
Steep phase	Dc	17	25–50	Excessively drained
Eroded steep phase	Dd	17	25–50	Excessively drained

Summary of Important Characteristics

Color of surface soil	Subsoil		Parent material or parent rock
	Color	Consistence	
Light brownish gray to grayish brown.	Yellowish red	Moderately friable	Colluvium or alluvium from quartzites and sandstones, some limestone.
Brownish gray to brownish yellow	Yellowish red	Moderately friable	Same.
Light brownish gray to grayish brown.	Yellowish red	Moderately friable	Same.
Brownish gray	Yellowish red	Moderately friable	Same.
Light brownish gray to reddish yellow.	Yellowish red	Moderately friable	Same.
Light brownish gray to grayish brown.	Yellowish red	Moderately friable	Same.
Light brownish gray to reddish yellow.	Yellowish red	Moderately friable	Same.
Light brownish gray to pale brown	Pale brown to brownish yellow, mottled.	Moderately friable	Alluvium from granites and gneisses.
Pale brown to yellowish brown	Light yellowish brown to yellowish brown.	Friable	Recent colluvium from quartzite, sandstone, and shale.
Pale brown to yellowish brown	Light yellowish brown to yellowish brown.	Friable	Same.
Brown to reddish brown	Yellowish red to reddish brown	Moderately friable	High grade dolomitic limestone, slightly sandy or cherty.
Brown to dark brown	Yellowish red to reddish brown	Moderately friable	Same.
Brown to dark brown	Yellowish red to reddish brown	Moderately friable	Same.
Light yellowish brown, pale brown, or light brownish gray		Loose, very friable	Alluvium from granites, gneisses, quartzites, and shales.
Grayish brown	Medium to dark gray, mottled	Friable	Same.
Very stony alluvium, predominantly light yellowish brown		Friable	Alluvium from granites and gneisses or quartzite, sandstone, slates, and shales.
Grayish brown to brown	Very dark gray to brown	Friable	General alluvium from granites, quartzite, and shales.
Grayish brown	Very dark gray to yellowish brown	Very friable	Same.
Dark brown to dark reddish brown	Reddish brown to dark red	Firm	Mixed alluvium, chiefly from limestone.
Dark brown to dark reddish brown	Reddish brown to dark red	Firm	Mixed alluvium, chiefly from lime stone.
Dark brown to dark reddish brown	Reddish brown to dark red	Firm	Mixed alluvium, chiefly from limestone.
Light yellowish brown to light brownish gray.	Light yellowish brown	Moderately plastic	Calcareous shale.
Light yellowish brown to light brownish gray.	Light yellowish brown	Moderately plastic	Calcareous shale.

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Soils of Washington County, Tenn.: Summary

Soil	Map symbol	Management group	Slope range	Drainage
			Percent	
Dandridge silt loam, hilly phase	Dg	14	12–25	Well drained to excessively drained.
Dandridge shaly silt loam, eroded hilly phase	Db	14	12–25	Same
Dandridge silt loam, rolling phase	Df	14	5–12	Same
Dandridge shaly silt loam:				
Eroded rolling phase	Da	14	5–12	Same
Very steep phase	De	18	50+	Excessively drained
Dewey silty clay loam:				
Eroded rolling phase	Dh	8	5–12	Well drained
Eroded hilly phase	Dk	12	12–25	Well drained
Dunmore silt loam, rolling phase	Dsa	8	5–12	Well drained
Dunmore silty clay loam, eroded rolling phase	Dse	8	5–12	Well drained
Dunmore silty clay, severely eroded rolling phase	Dsc	8	5–12	Well drained
Dunmore silt loam, hilly phase	Dsb	12	12–25	Well drained
Dunmore silty clay loam, eroded hilly phase	Dsf	12	12–25	Well drained
Dunmore silty clay, severely eroded hilly phase	Dsd	16	12–25	Well drained
Dunmore silty clay loam, eroded steep phase	Dsg	17	25–50	Well drained
Dunmore cherty silt loam, rolling phase	Dna	9	5–12	Well drained
Dunmore cherty silty clay loam, eroded rolling phase	Dnf	9	5–12	Well drained
Dunmore cherty silt loam, hilly phase	Dnb	16	12–25	Well drained
Dunmore cherty silty clay loam, eroded hilly phase	Dng	16	12–25	Well drained
Dunmore cherty silty clay, severely eroded hilly phase	Dnd	16	12–25	Well drained
Dunmore cherty silt loam, steep phase	Dnc	17	25–50	Well drained
Dunmore cherty silty clay loam, eroded steep phase	Dnh	17	25–50	Well drained
Dunmore cherty silty clay, severely eroded steep phase	Dne	18	25–50	Well drained
Dunmore loam:				
Rolling phase	Dnk	8	5–12	Well drained
Eroded rolling phase	Dnl	8	5–12	Well drained
Hilly phase	Dnm	12	12–25	Well drained

of Important Characteristics—Continued

Color of surface soil	Subsoil		Parent material or parent rock
	Color	Consistence	
Light yellowish brown to light brownish gray.	Light yellowish brown to brownish yellow.	Moderately plastic	Calcareous shale.
Light yellowish brown to light brownish gray.	Same	Moderately plastic	Calcareous shale.
Light yellowish brown to light brownish gray.	Same	Moderately plastic	Calcareous shale.
Light yellowish brown to light brownish gray.	Same	Moderately plastic	Calcareous shale.
Light yellowish brown to light brownish gray.	Same	Moderately plastic	Calcareous shale.
Brown to yellowish brown	Red to yellowish red	Plastic	High grade dolomitic limestone.
Brown to yellowish brown	Red to yellowish red	Plastic	High grade dolomitic limestone.
Light yellowish brown	Yellowish red to reddish yellow	Plastic	Slightly clayey dolomitic limestone.
Light yellowish brown to reddish yellow.	Yellowish red to reddish yellow	Plastic	Slightly clayey dolomitic limestone.
Yellowish red to yellowish brown	Yellowish red to reddish yellow	Plastic	Slightly clayey dolomitic limestone.
Light yellowish brown	Yellowish red to reddish yellow	Plastic	Slightly clayey dolomitic limestone.
Light yellowish brown to yellowish red.	Yellowish red to reddish yellow	Plastic	Slightly clayey dolomitic limestone.
Yellowish red to yellowish brown	Yellowish red to reddish yellow	Plastic	Slightly clayey dolomitic limestone.
Light yellowish brown to yellowish red.	Yellowish red to reddish yellow	Plastic	Slightly clayey dolomitic limestone.
Light yellowish brown	Yellowish red to reddish yellow	Plastic	Slightly clayey and cherty dolomitic limestone.
Light yellowish brown to reddish yellow.	Yellowish red to reddish yellow	Plastic	Same.
Light yellowish brown	Yelllowish red to reddish yelow	Plastic	Same.
Light yellowish brown to reddish yellow.	Yellowish red to reddish yellow	Plastic	Same.
Yellowish red to yellowish brown	Yellowish red to reddish yellow	Plastic	Same.
Light yellowish brown	Yellowish red to reddish yellow	Plastic	Same.
Light yellowish brown to reddish yellow.	Yellowish red to reddish yellow	Plastic	Same.
Yellowish red to yellowish brown	Yellowish red to reddish yellow	Plastic	Same.
Light yellowish brown to very pale brown.	Yellowish red to reddish yellow	Plastic	Slightly clayey dolomitic limestones with lenses of sandy limestone.
Light yellowish brown to reddish yellow.	Yellowish red to reddish yellow	Plastic	Same.
Light yellowish brown to very pale brown.	Yellowish red to reddish yellow	Plastic	Same.

Soils of Washington County, Tenn.: Summary

Soil	Map symbol	Management group	Slope range	Drainage
Dunmore loam—Continued				
Eroded hilly phase	Dnn	12	*Percent* 12–25	Well drained
Steep phase	Dno	17	25–50	Well drained
Eroded steep phase	Dnp	17	25–50	Well drained
Emory silt loam	Ea	2	2–7	Well drained
Greendale silt loam	Ga	2	2–7	Moderately well drained to well drained.
Groseclose cherty silt loam, rolling phase	Gb	9	5–12	Well drained
Groseclose cherty silty clay loam, eroded rolling phase	Gg	9	5–12	Well drained
Groseclose cherty silt loam:				
Hilly phase	Gc	16	12–25	Well drained
Eroded hilly phase	Gd	16	12–25	Well drained
Steep phase	Ge	17	25–50	Excessively drained
Eroded steep phase	Gf	17	25–50	Excessively drained
Groseclose silty clay loam:				
Eroded rolling phase	Gh	8	5–12	Well drained
Eroded hilly phase	Gk	12	12–25	Well drained
Gullied land, Dunmore soil material	Gl	18	7–40	Well drained
Hamblen silt loam	Hb	1	0–3	Imperfectly drained
Hamblen loam	Ha	1	0–3	Imperfectly drained
Hayter loam:				
Eroded rolling phase	Hd	6	5–12	Well drained
Undulating phase	Hc	3	2–5	Well drained
Hayter stony loam, undulating phase	He	4	2–5	Well drained
Hermitage silt loam:				
Undulating phase	Hf	3	2–5	Well drained
Eroded rolling phase	Hg	6	5–12	Well drained

of Important Characteristics—Continued

Color of surface soil	Subsoil		Parent material or parent rock
	Color	Consistence	
Light yellowish brown to yellowish red.	Yellowish red to reddish yellow	Plastic	Same.
Light yellowish brown	Yellowish red to reddish yellow	Plastic	Same.
Light yellowish brown to yellowish red.	Yellowish red to reddish yellow	Plastic	Same.
Dark brown to brown	Reddish brown to yellowish brown	Moderately friable	Colluvium or alluvium from soils drained from high-grade limestone.
Light yellowish brown to pale brown	Light yellowish brown to brownish yellow.	Friable	Colluvium or alluvium from soils derived from cherty or other low grade limestone.
Light to dark yellowish brown	Yellowish brown to olive yellow	Very plastic	Clayey, shaly or cherty, dolomitic limestone.
Light yellowish brown to yellowish brown.	Yellowish brown to olive yellow	Very plastic	Same.
Light to dark yellowish brown	Yellowish brown to olive yellow	Very plastic	Same.
Light yellowish brown to yellowish brown.	Yellowish brown to olive yellow	Very plastic	Same.
Light yellowish brown to yellowish brown.	Yellowish brown to olive yellow	Very plastic	Same.
Light yellowish brown to yellowish brown.	Yellowish brown to olive yellow	Very plastic	Same.
Light yellowish brown to yellowish brown.	Reddish yellow to brownish yellow	Very plastic	Clayey dolomitic limestone.
Light yellowish brown to yellowish brown.	Reddish yellow to brownish yellow	Very plastic	Clayey dolomitic limestone.
A land type, characterized by a close network of gullies			Dolomitic limestone.
Grayish brown to dark yellowish brown.	Yellowish brown	Moderately friable	Alluvium from calcareous shale, slates, quartzites, and sandstone.
Grayish brown to brown	Grayish brown to dark yellowish brown.	Friable	Same.
Grayish brown to brown	Yellowish brown to reddish brown	Friable	Colluvium from quartzites or sandstones, some limestone influence.
Grayish brown to brown	Yellowish brown to reddish brown	Friable	Same.
Grayish brown to brown	Yellowish brown to reddish brown	Friable	Same.
Brown to dark brown	Reddish brown to yellowish red	Moderately friable	Colluvium from high-grade dolomitic limestone.
Brown to reddish brown	Reddish brown to yellowish red	Moderately friable	Same.

Soils of Washington County, Tenn.: Summary

Soil	Map symbol	Management group	Slope range	Drainage
Holston loam:				
Undulating phase	Hl	5	*Percent* 2–5	Well drained
Eroded rolling phase	Hm	10	5–12	Well drained
Holston cobbly loam:				
Eroded rolling phase	Hh	11	5–12	Well drained
Eroded hilly phase	Hk	16	12–25	Well drained
Jefferson stony loam:				
Undulating phase	Jc	4	2–5	Well drained
Rolling phase	Jd	11	5–12	Well drained
Eroded rolling phase	Je	11	5–12	Well drained
Hilly phase	Jf	16	12–25	Well drained
Eroded hilly phase	Jg	16	12–25	Well drained
Jefferson loam:				
Undulating phase	Ja	5	2–5	Well drained
Eroded rolling phase	Jb	10	5–12	Well drained
Leadvale silt loam:				
Undulating phase	La	5	2–5	Moderately well drained
Eroded rolling phase	Lb	10	5–12	Moderately well drained
Lindside silt loam	Lc	1	0–3	Imperfectly drained
Litz shaly silt loam:				
Steep phase	Lm	17	25–50	Excessively drained
Eroded steep phase	Ln	17	25–50	Excessively drained
Litz silt loam, hilly phase	Lr	14	12–25	Excessively drained
Litz shaly silt loam, eroded hilly phase	Ll	14	12–25	Well drained to excessively drained.
Litz silt loam, rolling phase	Lp	14	5–12	Same
Litz shaly silt loam:				
Eroded rolling phase	Lk	14	5–12	Same
Very steep phase	Lo	18	50+	Excessively drained
Litz loam:				
Steep phase	Lf	17	25–50	Excessively drained
Eroded steep phase	Lg	17	25–50	Excessively drained
Rolling phase	Ld	14	5–12	Well drained to excessively drained.

of Important Characteristics—Continued

Color of surface soil	Subsoil		Parent material or parent rock
	Color	Consistence	
Very pale brown or light yellowish brown.	Yellow or brownish yellow	Moderately friable	Mixed alluvium from quartzites, sandstone, and shale.
Very pale brown or light yellowish brown.	Yellow or brownish yellow	Moderately friable	Same.
Very pale brown or light yellowish brown.	Yellow or brownish yellow	Moderately friable	Same.
Very pale brown or light yellowish brown.	Yellow or brownish yellow	Moderately friable	Same.
Light yellowish brown	Pale yellow to brownish yellow	Friable	Colluvium from quartzites, and sandstone, and shale.
Light yellowish brown	Pale yellow to brownish yellow	Friable	Same.
Light yellowish brown to pale brown	Pale yellow to brownish yellow	Friable	Same.
Light yellowish brown to pale brown	Pale yellow to brownish yellow	Friable	Same.
Light yellowish brown to pale brown	Pale yellow to brownish yellow	Friable	Same.
Light yellowish brown	Pale yellow to brownish yellow	Friable	Same.
Light yellowish brown	Pale yellow to brownish yellow	Friable	Same.
Yellowish brown	Pale yellow to brownish yellow	Firm	Colluvium from shale.
Yellowish brown	Pale yellow to brownish yellow	Firm	Colluvium from shale.
Dark yellowish brown to brown	Dark yellowish brown, mottled	Friable	Alluvium chiefly from limestone.
Light yellowish brown to pale yellow throughout		Friable	Acid shale with thin strata of limestone or calcareous shale.
Light yellowish brown to pale yellow throughout		Friable	Same.
Light yellowish brown to pale yellow throughout		Friable	Same.
Light yellowish brown to pale yellow throughout		Friable	Same.
Light yellowish brown to pale yellow throughout		Friable	Same.
Light yellowish brown to pale yellow throughout		Friable	Same.
Light yellowish brown to pale yellow throughout		Friable	Same.
Yellowish brown	Brownish yellow	Friable	Interbedded shale and calcareous sandstone.
Yellowish brown	Brownish yellow	Friable	Same.
Yellowish brown	Brownish yellow	Friable	Same

Soils of Washington County, Tenn.: Summary

Soil	Map symbol	Management group	Slope range	Drainage
Litz loam—Continued				
Eroded rolling phase	Le	14	*Percent* 5–12	Well drained to excessively drained.
Very steep phase	Lh	18	50+	Excessively drained
Masada loam, undulating phase	Mc	3	2–5	Well drained
Masada clay loam:				
Eroded rolling phase	Ma	6	5–12	Well drained
Eroded hilly phase	Mb	13	12–25	Well drained
Melvin silt loam	Md	15	0–3	Poorly drained
Monongahela silt loam	Mf	5	1–5	Imperfectly drained to moderately well drained.
Monongahela loam	Me	5	1–5	Same
Nolichucky loam:				
Rolling phase	Nc	10	5–12	Well drained
Eroded rolling phase	Nd	10	5–12	Well drained
Hilly phase	Ne	13	12–25	Well drained
Eroded hilly phase	Nf	13	12–25	Well drained
Nolichucky cobbly loam:				
Eroded rolling phase	Na	11	5–12	Well drained
Eroded hilly phase	Nb	16	12–25	Well drained
Ooltewah silt loam	Oa	1	0–3	Imperfectly drained
Pace silt loam:				
Undulating phase	Pa	5	2–5	Moderately well drained to well drained.
Rolling phase	Pb	10	5–12	Same
Eroded rolling phase	Pc	10	5–12	Same
Prader silt loam	Pd	15	0–3	Poorly drained
Ramsey stony loam:				
Steep phase	Rb	18	25–50	Excessively drained
Hilly phase	Ra	16	12–25	Excessively drained
Very steep phase	Rc	18	50+	Excessively drained
Riverwash	Rd	18	0–3	Excessively drained

of Important Characteristics—Continued

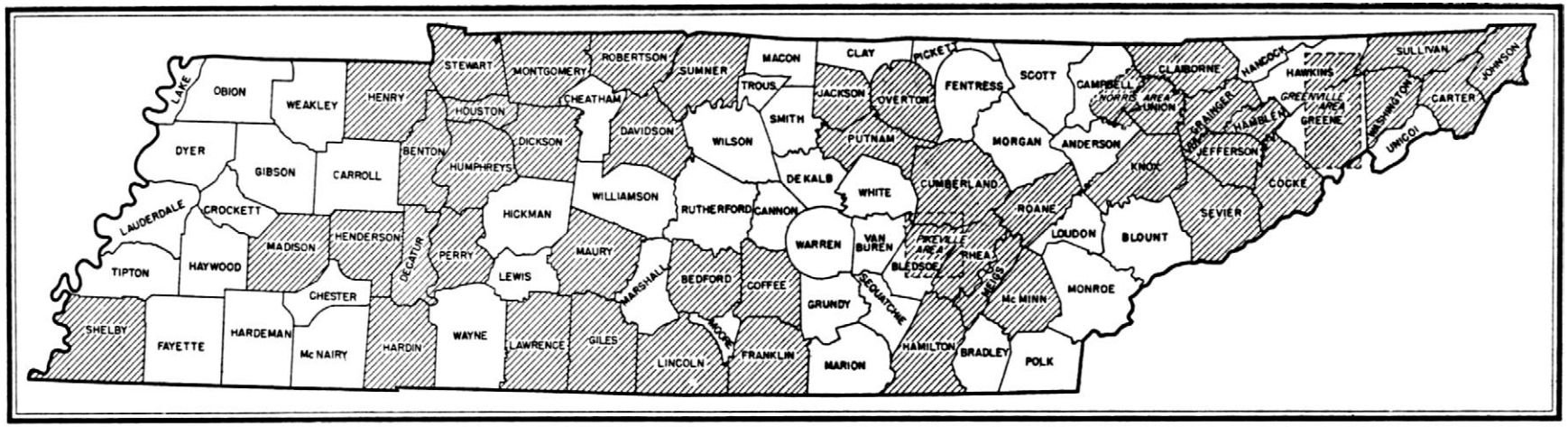
Color of surface soil	Subsoil		Parent material or parent rock
	Color	Consistence	
Yellowish brown	Brownish yellow	Friable	Same.
Yellowish brown	Brownish yellow	Friable	Same.
Brown	Yellowish red to reddish brown	Friable	Alluvium from granites and gneisses.
Brown to reddish brown	Yellowish red to reddish brown	Friable	Alluvium from granites and gneisses.
Brown to reddish brown	Yellowish red to reddish brown	Friable	Alluvium from granites and gneisses.
Brownish gray to yellowish brown, splotched.	Light gray or light olive gray	Firm	Alluvium from limestone.
Yellowish brown or dark yellowish brown.	Pale yellow or yellow	Firm	Alluvium from quartzite, sandstone, shale, and slate.
Yellowish brown or dark yellowish brown.	Pale yellow or yellow	Firm	Same.
Pale brown to light yellowish brown	Reddish yellow or yellowish red	Firm	Alluvium from quartzite, sandstone, slate, and shale, with some limestone influence.
Light yellowish brown to brownish yellow.	Reddisn yellow or yellowish red	Firm	Same.
Light yellowish brown or pale brown.	Reddish yellow or yellowish red	Firm	Same.
Light yellowish brown to brownish yellow.	Reddish yellow or yellowish red	Firm	Same.
Light yellowish brown to brownish yellow.	Reddish yellow or yellowish red	Firm	Same.
Light yellowish brown to brownish yellow.	Reddish yellow or yellowish red	Firm	Same.
Yellowish brown or pale brown	Yellowish brown to light brownish gray, mottled.	Friable	Local alluvium or colluvium from limestone.
Light yellowish brown	Pale yellow to brownish yellow	Friable	Same.
Light yellowish brown	Pale yellow to brownish yellow	Friable	Same.
Light yellowish brown to yellow	Pale yellow to brownish yellow	Friable	Same.
Dark yellowish brown, splotched	Olive gray	Firm	Alluvium from shales, slates, and sandstone.
Light yellowish brown to brownish yellow to bedrock		Very friable	Quartzites, sandstones, shale, and slate.
Light yellowish brown	Brownish yellow to pale yellow	Very friable	Same.
Light yellowish brown to brownish yellow throughout		Very friable	Same.
A land type consisting of cobbles, gravel, and sand			

Soils of Washington County, Tenn.: Summary

Soil	Map symbol	Management group	Slope range	Drainage
			Percent	
Sequatchie loam	Sb	3	1–5	Well drained
Sequatchie cobbly fine sandy loam	Sa	4	1–10	Well drained
Staser loam	Sc	1	0–3	Well drained
Stony colluvium, Jefferson soil material	Sd	18	2–25	Well drained
Stony rolling land, Dunmore soil material	Sf	16	5–12	Well drained
Stony hilly land, Dunmore soil material	Se	16	12–25	Well drained
Stony steep land, Dunmore soil material	Sg	18	25–60	Well drained
Stony very steep land, Ramsey soil material	Sh	18	50+	Well drained
Tyler silt loam	Ta	15	0–3	Poorly drained
Waynesboro loam:				
Undulating phase	Wc	3	2–5	Well drained
Eroded rolling phase	Wd	6	5–12	Well drained
Eroded hilly phase	We	13	12–25	Well drained
Waynesboro cobbly loam:				
Eroded rolling phase	Wa	7	5–12	Well drained
Eroded hilly phase	Wb	16	12–25	Well drained
Weaver silt loam	Wf	1	0–3	Imperfectly drained
Wehadkee silt loam	Wg	15	0–3	Poorly drained
Whitesburg silt loam	Wh	2	2–7	Imperfectly drained

of Important Characteristics—Continued

Color of surface soil	Subsoil		Parent material or parent rock
	Color	Consistence	
Light brown or brown	Brownish yellow to yellowish brown.	Friable	Alluvium from sandstone, quartzites, slate, and shale with some limestone.
Light brown or brown	Brownish yellow to yellowish brown.	Friable	Same.
Grayish brown to dark grayish brown.	Grayish brown or brown	Friable	Same.
A land type characterized by extreme stoniness			Colluvium from Ramsey soils.
A land type characterized by numerous limestone bedrock outcrops			Dolomitic limestone.
A land type characterized by numerous limestone bedrock outcrops			Dolomitic limestone.
A land type characterized by numerous limestone bedrock outcrops			Dolomitic limestone.
A land type characterized by numerous loose boulders and bedrock outcrop			Quartzite, sandstone, shale, and slate.
Light brownish gray	Pale yellow, splotched	Firm	Alluvium from quartzite, sandstone, shale, and slate.
Brown to light brown	Yellowish red	Firm	Alluvium from quartzite, sandstone, slate, shale, and some limestone.
Brown to yellowish red	Yellowish red	Firm	Same.
Brown to yellowish red	Yellowish red	Firm	Same.
Brown to yellowish red	Yellowish red	Firm	Same.
Brown to yellowish brown	Yellowish red	Firm	Same.
Brown to dark yellowish brown	Yellowish brown, mottled	Friable	Alluvium from dolomitic limestone.
Light brownish gray to grayish brown, mottled.	Gray, mottled	Friable	Alluvium from granites and gneisses.
Yellowish brown to grayish brown	Light yellowish brown to yellowish brown, mottled.	Firm	Colluvium or local alluvium from calcareous shale.



Areas surveyed in Tennessee shown by shading.

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