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Soil Survey

Jefferson County Tennessee

By

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United States Department of Agriculture
and
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SOIL SURVEY OF JEFFERSON COUNTY, TENNESSEE

By J. W. MOON, in Charge, and HOWARD WM. HIGBEE, Soil Survey Division,[1] Bureau of Chemistry and Soils, United States Department of Agriculture, and WALLACE ROBERTS, FOSTER RUDOLPH, G. M. WELLES, and L. J. STRICKLAND, Tennessee Agricultural Experiment Station

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[2] The Tennessee Valley Authority also cooperated by supplying a part of the funds and materials used in this survey.

COUNTY SURVEYED

Jefferson County is in the northeastern part of Tennessee (fig. 1). Dandridge, the county seat, on the French Broad River, is 30 miles east of Knoxville and 190 miles east of Nashville. The county is nearly semicircular in outline. The Holston River forms part of the northern boundary, and the French Broad River, which forms part of the eastern boundary, flows across the southeastern part of the county. The total land area is 312 square miles, or 199,680 acres.

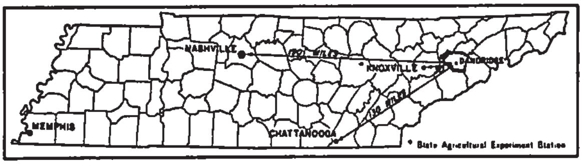

FIGURE 1.—Sketch map showing location of Jefferson County, Tenn.

Physiographically, the county is situated within the great valley of east Tennessee. Although the great valley is a belt of lowland in relation to the enclosing parallel highland belts, it varies from place to place in both relief and elevation and includes many roughly parallel ridges and valleys. The highest elevation in the State is about 2,100 feet above sea level, near Bristol on the State line in the northeastern corner. From this point the valley slopes gradually southwestward to an elevation of about 600 feet in the vicinity of Chattanooga on the southern boundary of the State.

For the most part, limestones, together with associated beds of shales, underlie this great valley. The fact that these rocks are consistently less resistant to weathering than those of either the Great Smoky Mountains on the east or the Cumberland Mountains on the west accounts for the existence of the valley. It is not a river valley. Both the limestones and shales show wide variations in content of calcium and magnesium carbonates, and some of the shales are noncalcareous. Outcrops of shales are common, as folding and faulting have resulted in several exposures of a single bed in any cross section of the great valley. Calcareous shales are more abundant in the eastern part of the great valley where this county is located.

Although all the rocks of the great valley weather faster than those of the enclosing highlands, their rates of weathering are not equal. If they were, the present physiography of Jefferson County would be that of a plain, with the minor exception of English Mountain, and the relief would be that developed by stream cutting of the present cycle of erosion. Severe folding and faulting of the rocks and differential weathering incident to variations in character of the underlying rocks have resulted in a series of six narrow parallel physiographic belts crossing the county in a northeast-southwest direction, parallel to the geologic formations. These are, from northwest to southeast, (1) the Holston hills, in the extreme northwestern part of the county, parallel to the Holston River; (2) the central red valley; (3) Bays Mountain; (4) the Dandridge plain, northwest of and parallel to the French Broad River; (5) the dissected shale plain, southeast of and parallel to the French Broad River; and (6) English Mountain, in the extreme southeastern part of the county.

The Holston hills consist of a discontinuous belt of hills and knolls, some of which reach heights ranging from 200 to 300 feet above the mean elevation of the county, which is between 1,100 and 1,200 feet above sea level.[8] This division comprises only about 25 square miles. The existence of these hills is due to the high resistance to weathering of the outcropping sandstone beds of the Knox dolomite formation, and the relief has been intensified by stream erosion.

The central red valley, through the center of which pass the Southern Railway and United States Highway No. 11 E, is underlain largely by the Knox dolomite formation, but the exposed part consists of rocks that contain large quantities of calcium and magnesium carbonates, which weather rather rapidly. The mean elevation of this valley is only about 1,000 feet above sea level, or about 150 feet less than the average elevation of the county. Some stream dissection has taken place, and limestone sinks are numerous. The relief is dominantly undulating to strongly rolling. This division embraces between 80 and 90 square miles.

The Bays Mountain belt consists of alternate narrow ridges and rocky valleys, resulting almost entirely from differential weathering of the several exposed tilted formations. Some of the ridges are as much as 1,700 feet above sea level, and in a few places differences in elevation between ridge tops and valley floors are as much as 500 feet even where little if any drainage channel cutting has taken place. In many other parts of this division the relief is almost entirely the result of dissection. This physiographic division includes between 30 and 40 square miles.

The Dandridge plain is underlain by Knox dolomite, with the exception of a northeast-southwest belt lying just west of White Pine. This belt is underlain by highly calcareous shale bordered by Chickamauga limestone. The plain ranges in elevation from about 1,000 feet southwest of Dandridge to approximately 1,100 feet in the vicinity of White Pine, and a few of the higher points in the neighborhood of Dandridge are 1,200 feet above sea level. Between 80 and 90 square miles are included in this plain. Stream cutting has been rather active, especially in the shale formation west of White Pine and near the channel of the French Broad River, where a pronounced relief has developed. Other parts of the plain range from undulating to hilly.

The dissected shale plain in most places is underlain by Athens and Sevier shales, most of which are highly calcareous, but some are sandy. Their calcareous character renders them relatively susceptible to weathering, and this plain therefore averages only about 150 feet higher than the Dandridge plain. The dissected shale plain covers a total area of about 80 square miles. It is thoroughly dissected by drainage channels and otherwise modified by the French Broad River, which flows through it. The relief is characteristically hilly and knobby.

Although English Mountain covers only about 2 square miles, it constitutes a conspicuous physiographic feature. The dominant rocks consist of sandstones, quartzites, and conglomerates of the

[8] Elevation data from U. S. Geological Survey topographic maps.

Unicoi formation. Of all the rocks of the county, these are the most resistant to weathering, and the maximum elevation of the mountain is about 3,700 feet above sea level, or more than twice that of any other part of the county. The terrain is typically mountainous, and the choppy configuration has been intensified by drainage channels.

Those parts of the county underlain by limestone are characterized by so-called limestone sinks (pl. 1, *A*) formed as a result of uneven underground solution of the rock. They reach a maximum depth of more than 100 feet and an average size of 10 acres each, but they are characteristically small and shallow. Some of them are intermittent or permanent ponds, whereas others are well drained and occupied by the very productive Abernathy soil. These sinks are more numerous in Jefferson County and its vicinity than in any other part of the great valley.

The general slope of the county and, hence, the general direction of drainage are from northeast to southwest, although the minor tributaries flow in a general transverse direction toward the Holston and French Broad Rivers, which drain the county and unite just east of Knoxville to form the Tennessee River. Both the Holston and the French Broad Rivers have cut meandering channels approximately 200 feet or more below the level of the plain, and the enclosing slopes to these streams are rather steep and incised by tributary streams in most places.

Fair-sized remnants of old terraces remain along these rivers, more commonly along the French Broad River. The only important terrace along the Holston River within this county is northeast of Strawberry Plains, at an elevation of about 200 feet above the level of the river. The largest and best preserved terraces along the French Broad River are between Oak Grove and White Pine, where they occupy two well-defined levels, the younger about 150 feet above the present level of the river and the older about 250 feet above. Representative areas at both levels are developed east and southeast of Swann Bridge. Rounded water-worn pebbles and cobbles, dominantly siliceous, are characteristic of these terraces, especially at the base of the deposits. Practically all of the other remnants of the old river terraces overlie shale formations. First bottoms, or flood plains, ranging from ½ to 1 mile in width, border the rivers in most places.

Drainage is well developed. No distinct stream pattern is discernible over that part underlain by limestones, which roughly includes the area northwest of the French Broad River, but a rather imperfect dendritic pattern characterizes the rest of the county, or that part underlain by shale. Much of the drainage in the limestone section is subterranean through crevices in the underlying rock. Owing to the narrowness of the area between the rivers, the character of the underlying rocks, and the characteristic transverse flow of tributaries, no large streams, except the two rivers, and no natural lakes of the type that attract resorters or sportsmen are in the county.

Most of the smaller perennial streams carry clear water and provide a supply for a rather large proportion of the permanent pastures, and, during seasons of heavy rainfall, intermittent streams serve the same purpose. Springs are rather common in the limestone valleys, and some of the large ones are in reality outflowings of subterranean streams. Cisterns afford the main source of water for farm and family use on the broader cherty limestone ridges, but wells are common on farms in the shale section. During dry periods it is necessary to haul water from a distance for the needs of livestock on probably less than 3 percent of the farms.

Jefferson County was formed by ordinance of Governor William Blount on June 11, 1792, contemporaneously with Knox County. The territory of the two counties was taken from Greene and Hawkins Counties. At that time Jefferson included what is now Sevier, Cocke, and a part of Hamblen Counties.

Settlers located on Mossy Creek, Beaver Creek, near Strawberry Plains, west of Dandridge, and at other places in the decade 1780–90. The Hopewell Presbyterian Church in Dandridge was organized in 1785, and Dandridge is reported to be the second oldest town in the State (*23*).[4] Most of the earlier settlers came from North Carolina and Virginia, with a few from South Carolina (*8*). The population of the county had increased to 7,840 by 1795 (*23*), but the county was much larger then than at present.

The 1930 census reported the population of the county to be 17,914, all classed as rural. The total population has changed little during the last 50 years. Native white people number 16,604, most of whom are of English, Irish, and Scotch descent. There are only 1,276 Negroes, most of whom live in the towns. The 1940 census reported a population of 18,621.

The farm population is not uniformly distributed. English Mountain, Bays Mountain, rolling stony land—the largest areas of which are southeast and southwest of Talbott—and parts of the Holston hills in the northwestern part of the county are sparsely populated. Although proximity to towns and main highways does influence the distribution of population, the character of the soils and the lay of the land largely determine the distribution of the rural population. The least productive and most unfavorable lands are the most sparsely settled, but it does not follow that the choicest lands are the most densely populated. Lands intermediate in these respects consist largely of small subsistence farms, and therefore the number of people to the square mile is greater than on the choice lands of the central red valley or on the bottom lands, where agriculture is more commercial and some individual land holdings approximate 400 acres.

Dandridge, with a population of 488 in 1940, is the county seat and provides a trading center for the south-central part of the county. Jefferson City, with a population of 2,576, is the largest town and serves as a market and shipping point for the north-central part. New Market, Strawberry Plains, Talbott, and White Pine are trading and shipping centers scattered over the county. Other markets are Piedmont, Oak Grove, Shady Grove, Chestnut Hill, Pleasant Hill, and Sandy Ridge. The larger marketing centers serve the better agricultural communities.

The county is provided with excellent facilities for transportation. A main and a branch line of the Southern Railway, three paved Federal highways—United States Highways Nos. 11 E, 25 E,

[4] Italic numbers in parentheses refer to Literature Cited, p. 103.

and 25 W and 70—and several State highways, either graveled or paved, cross the county. Good local graveled roads, penetrating all prosperous communities, are well maintained. Of the 2,204 farms enumerated in the 1930 census, 406 are located on paved roads, 276 on graveled roads, 272 on improved dirt roads, and 923 on unimproved roads. The type, number, and condition in which the local roads are maintained generally vary directly with the degree of productivity and workability of the land.

Churches, schools, and mail delivery are provided for all communities. Carson-Newman College is in Jefferson City.

The prevailing condition of farm buildings, general farm improvements, and modern conveniences for the rural home are in general an expression of soil character and land conditions. In the central red valley, especially in the vicinities of New Market, Jefferson City, and Talbott, and also on the Dandridge plain, where productive soils and favorable physical land conditions prevail, buildings are generally good and improvements have been made on most of the farms. This is also true of farms that include large parts of the bottom lands along the two rivers and some of their tributaries. Elsewhere, especially in the belt of Bays Mountain, the dissected shale plain, and English Mountain, where soils are less productive and physical land features are less favorable than in the first-mentioned sections, farms are not so well improved as in those sections. The 1930 census reports 67 farms equipped with both electric light and power, 124 farm homes with electric light, 78 with piped water, and 370 with telephones.

Farm equipment also varies according to the productivity and workability of the land. Tractors, trucks, binders, and other heavy farm implements are fairly common on the river and central red valley farms, but such equipment is extremely scarce in the rougher and poorer parts of the county. The 1930 census reports 933 farms with automobiles, 87 with trucks, and 62 with tractors. Work animals are generally of good stock, although their quality reflects the general land conditions.

The county is mainly agricultural. Zinc mining is important in the vicinities of Jefferson City and New Market. A number of flour mills, a few portable sawmills, and several canning factories are operated in various parts of the county. A spring factory at Jefferson City employs a number of people.

CLIMATE

The climate of Jefferson County is temperate and continental. Its more noticeable features are its moderate winters characterized by short erratic cold spells, mild summers with cool pleasant evenings, and a well-distributed mean annual precipitation of nearly 50 inches including about 10 inches of snow. Summer temperatures of 100° F. have been recorded. The difference between the mean summer and winter temperatures is not great—only about 36°.

Although no data of purely local variations in temperature and precipitation are available, apparently such variations exist. So far as is known, these variations are explained by the lay of the land, including direction of slope, and the effect of relief on air drainage, differences in elevation, and proximity and relationship to mountains. It is a matter of common observation that frosts frequently occur in valleys and depressions when vegetation on the ridges shows no effects of frost, and the early fall and late spring frosts invariably do greater injury in the lower situations. Damage to fruit trees from frost is less frequent on ridge tops and northward-facing slopes, as spring growth of orchards is retarded here compared with that on southward-facing slopes. Winter-killing of perennials, small grains, and other winter crops, owing to heaving, brought about by freezing and thawing, is more frequent on seepy slopes. That part of English Mountain within the county reaches an elevation of about 3,700 feet, and here the mean temperature is doubtless considerably lower, showers are more frequent, and total precipitation of both rain and snow is greater than elsewhere. The temperature on Bays Mountain is noticeably lower at times than that of the plains on either side.

The average frost-free season is 212 days, extending from April 1, the average date of the latest killing frost, to October 30, the average date of the earliest. This affords ample time in which to grow and mature practically all of the important southern field crops except cotton. Frosts have occurred as late as April 26 and as early as October 1, but at such unusual dates they are seldom severe. The grazing period continues from the last half of April to the last of November.

Although −16° F. has been recorded at the United States Weather Bureau station in Knoxville, subzero weather is unusual. The winters ordinarily are not severe. The most disagreeable feature during this season is the tendency to sudden changes associated with high humidity. The winters are for the most part sufficiently open to allow outdoor work. Even though winter crops get practically no protection from a snow blanket, a variety of winter cover crops, alfalfa, and small grains are grown on well-drained soils with little danger of winter-killing. Such winter vegetables as turnips, cabbage, celery, and kale are grown successfully.

The rainfall is evenly distributed throughout the winter, spring, and summer, but it is about 35 percent lower in the fall, when many of the crops are maturing and being harvested. The total annual rainfall is ample for even the most moisture-exacting crops of the section; but partly because of the heavy downpours in which some of it comes, much is lost through surface run-off. Neither extremely low nor excessive amounts of rainfall are common, but crop yields sometimes are reduced materially because of periods of light rainfall, especially on soils that are shallow over bedrock or otherwise of a droughty character. Destructive hailstorms and tornadoes may be expected but are not frequent.

Table 1, compiled from the records of the United States Weather Bureau station at Knoxville, about 30 miles southwest of Jefferson City, gives the normal monthly, seasonal, and annual temperature and precipitation at that place, which may be taken as fairly representative of climatic conditions in Jefferson County.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Knoxville, Knox County, Tenn.*

[Elevation, 921 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1930)	Total amount for the wettest year (1875)	Snow, average depth
	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*	*Inches*
December	40.3	75	−5	4.52	2.30	7.21	2.3
January	38.8	74	−16	4.66	2.19	6.92	3.2
February	41.9	79	−10	4.51	3.78	10.18	2.6
Winter	40.3	79	−16	13.69	8.27	24.31	8.1
March	48.7	87	5	5.05	4.41	13.07	1.1
April	58.0	90	24	4.14	1.39	5.86	3
May	67.2	95	34	3.75	4.21	1.23	(1)
Spring	58.0	95	5	12.94	10.01	20.16	1.4
June	74.0	99	42	4.10	2.60	4.96	.0
July	77.1	100	52	4.36	1.86	7.64	.0
August	76.2	100	50	3.92	2.03	5.60	.0
Summer	75.8	100	42	12.38	6.49	18 20	.0
September	70.6	99	85	2.68	4.56	4.14	.0
October	59.9	94	24	2.62	1.44	2.81	(1)
November	47.9	80	12	3.07	2.90	4.25	.3
Fall	59.5	99	12	8.37	8.90	11.20	.3
Year	58.4	100	−16	47.38	33.67	73.87	9.8

[1] Trace.

AGRICULTURAL HISTORY AND STATISTICS

It appears that a crude, simple agriculture was carried on in the area now occupied by Jefferson County by Cherokee Indians before the coming of white men. Indian corn, beans, and later, apples, peaches, and plums were grown by the Indian women (*23*). It is reported (*28*) that the Indians had horses of a fine Spanish breed left by De Soto. Wild fruits, such as persimmons, grapes, papaws, mulberries, mayapples, blackberries, wild strawberries, and wild plums are reported to have been abundant. Strawberry Plains is supposed to have received its name from the abundance of wild strawberries found growing there.

The first white settlements were made in the present Jefferson County in 1783, according to Ramsey (*23*) and other historians; but according to R. T. Zirkle, who has been active in local civic and business affairs for a long time, land records indicate a settlement at Shady Grove as early as 1776.

Available authentic information of pioneer agriculture is probably as meager here as in most of the early-settled parts of the country. It is apparent, however, that the white man's first agriculture typified American pioneer farming in that it consisted primarily of growing home supplies and subsistence crops. Corn, being a crop highly resistant to disease, quick to mature; easily cultivated, well adapted to virgin land conditions, nonexacting as to time of harvest, and providing a staple food and feed for both man and beast, was the principal staple crop of the pioneer, not only in Jefferson County but also in most of the humid part of the United States. In the latter part of the eighteenth century wheat was little known, a small crop of flax was grown for use in the home, and horses, cattle, sheep, and hogs were raised only for local needs (*8*). Sugar from maple sap, clothing (linsey-woolsey cloth), shoes, and furniture were made at home (*28*). Salt pork, potatoes, beans, turnips, corn bread, coffee, and milk constituted the principal food. Agriculture was, as it has been since, the main industry of the county, and every man had a farm or a garden.

Transportation facilities consisted of the river to New Orleans in addition to wagon roads and other crude methods of overland travel to Richmond, Baltimore, and Philadelphia. The small supplies purchased came largely from the latter three cities, and a few light easily transported commodities, such as feathers, furs, hides, beeswax, and tallow, were sold there; but the heavy produce, such as corn, oats, pork, honey, and other farm and forest products, was shipped by flatboat down the river to New Orleans. Inadequate transportation discouraged agricultural development until about 1858, when the country was opened up by its first railroad (*8*).

Wheat then became an important crop, and the practice of feeding corn on the farm to livestock that were later marketed was a change toward wider diversity in farming. Although a few minor crops, such as flax, were discontinued, many different products, including flour, corn, wheat, oats, poultry and poultry products, cattle and other livestock, dried fruit, and feathers, were offered for sale. The period of most rapid increase in population and general development was 1858–80.

According to the early United States census reports, the agriculture consisted largely of growing corn, small grains, and some hay, and raising livestock, with some income from forests, orchards, poultry, and market-garden crops. Although these products have been among the principal sources of agricultural income during most of the history of the county, they have differed in relative importance, and a number of alterations have been effected in agriculture from time to time, as indicated in table 2, which gives the acreages of the principal crops of Jefferson County for certain years.

The most striking change in agricultural practice brought out in table 2 is the consistent expansion in the acreages of hay and forage crops which include lespedeza and alfalfa. The present important crop of lespedeza has been developed almost entirely during the last decade. The acreages of rye, barley, tobacco, and vegetables have increased, whereas the acreages of wheat and oats have definitely declined. Both vegetables and tobacco took on commercial importance during the last two decades. Corn always has been and is still the most important single crop, and its total acreage has not changed greatly. Cowpeas and soybeans were not grown on significant acreages until after 1920.

Corn (*11*, *19*) leads all other crops (*14*) in acreage. The average yields reported at the last few census dates have been between 22 and 24 bushels an acre. It is estimated by the county agricultural agent that the county now produces 15 to 20 percent more corn than it consumes. This surplus increases with unfavorable prices for livestock, especially hogs. The greater part of the surplus is grown on bottom land and on farms in the central red valley along the Southern Railway, and it is trucked to Knoxville markets.

TABLE 2.—*Acreage of the principal crops in Jefferson County, Tenn., in stated years*

Crop	1879	1889	1899	1909	1919	1929	1934
	Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Corn	29,317	32,501	37,440	34,749	36,747	29,730	28,098
Wheat	21,261	19,381	30,018	18,240	20,459	10,061	11,283
Oats	9,448	8,797	2,519	4,926	2,446	747	1,057
Barley	17	5	30	----------	220	568	1,050
Rye	112	38	61	30	520	301	554
Soybeans	----------	----------	----------	----------	----------	1,682	1,106
Cowpeas	----------	----------	----------	----------	----------	224	2,179
All hay and forage	[1] 3,052	[1] 8,963	14,439	15,689	27,709	17,803	23,349
Timothy and clover	----------	----------	----------	3,779	5,242	7,880	5,523
Clover alone	----------	----------	2,663	----------	2,346	3,291	8,376
Timothy alone	----------	----------	----------	2,348	831	----------	----------
Alfalfa	----------	----------	25	----------	191	240	1,049
Other tame grasses	----------	----------	8,377	5,905	2,650	2,999	[2] 4,231
Grains cut green	----------	----------	1,020	2,951	292	164	275
Legumes cut for hay	----------	----------	----------	----------	4,292	2,061	3,432
Silage and coarse forage	----------	----------	1,817	581	11,378	668	463
Wild grasses	----------	----------	537	125	487	500	----------
Potatoes	----------	394	211	263	139	233	294
Sweetpotatoes and yams	211	314	301	166	134	88	307
All other vegetables	----------	----------	----------	793	798	1,702	1,906
Tobacco	19	28	39	10	77	1,526	1,826
	Trees	*Trees*	*Trees*	*Trees*	*Trees*	*Trees*	*Trees*
Apples	----------	54,156	66,625	43,198	29,811	20,117	21,384
Peaches	----------	66,619	25,592	34,914	45,382	20,886	30,977

[1] Hay only.
[2] Includes wild grasses.

During the last 15 years the wheat (*10*) acreage has been reduced nearly 50 percent. A little more than 11,000 acres were devoted to this crop in 1934. The census reports for the last 55 years indicate an average yield of about 8.5 bushels an acre, with a rather consistent increase in yield from about 6 to about 10 bushels. The greater part of this crop is grown in the central red valley along the Southern Railway. Nine flour mills, well distributed over the county, grind most of the wheat and sell the flour locally and to outside markets. A small part of the crop is processed by mills at Knoxville, and a part of the flour is returned to Jefferson County markets. A small proportion of the wheat crop is fed to poultry.

The growing of hay is very important. Hay crops occupy more than 20,000 acres. Lespedeza is now the most important hay crop in the county. Red clover also is important and is growing in favor. Alfalfa (pl. 1, *B*) yields more heavily, although the total acreage is not large. Timothy, redtop, soybeans, and cowpeas are less important hay crops. Mixtures of red clover and redtop, red clover and timothy, or of all three, are commonly grown. Alfalfa and probably red clover are more commonly grown in the red central valley along the Southern Railway and on the Dandridge plain near and between Dandridge and White Pine. Lespedeza is grown on practically all of the well-drained soils. The recent increased use of lime and phosphate has encouraged the growing of more leguminous hay crops, particularly alfalfa and red clover. Although a part of the hay crop is sold on both local and outside markets most of it is fed to livestock on the farm, principally to the dairy cattle.

At present oats (*12*), barley (pl. 1, *C*), and rye (*20*, *22*) occupy small acreages. According to the census, the acreage devoted to oats has decreased from about 9,000 to about 1,000 acres during the 55 years previous to 1934, but the acreage of both barley and rye has shown some increase during the same period. In 1934, about 1,000 acres were devoted to each oats and barley, and only about 500 acres were in rye. Improved use and management of soils probably will revive production of these small grains, particularly oats and barley.

Soybeans have become a significant crop in recent years, and cowpeas are a comparatively new crop. In addition to the crops reported in table 2, clover seed was produced on 1,842 acres in 1929, but its production was not reported in 1934.

Burley tobacco is the only important strictly cash crop. Almost 1,300,000 pounds were grown on 1,326 acres in 1934. This crop has assumed commercial importance since 1919, when only 77 acres were planted to tobacco. The largest plantings and best yields are in the central red valley in the vicinity and northeast of Jefferson City, where acre yields of 2,000 pounds are obtained under favorable conditions. The average acre yield has increased from about 300 pounds to 1,000 pounds during the last 55 years. Tobacco is cut and stored in the barn to cure, stripped and graded in November, and then carried to Morristown, Greenville, or Knoxville markets.

Market gardening has become relatively important during the last 20 years. Census reports indicate an increase from 798 to 1,906 acres devoted to vegetables, other than potatoes, from 1919 to 1934. Although many of the vegetables are grown on the uplands, most of them are grown on Congaree soils along the French Broad River. Potatoes, sweetpotatoes, sweet corn, Alaska peas, snap beans, tomatoes, turnip greens, lima beans, cabbage, spinach, and carrots are the chief truck crops (*5*, *15*). Some of the vegetables are grown for home consumption, but probably the greater part, other than of potatoes and sweetpotatoes, are processed in local canneries at Chestnut Hill, Jefferson City, Oak Grove, and White Pine. A large quantity of the vegetables canned in the large factory at Newport, in adjoining Cocke County, comes from the fields on the Congaree soils of the French Broad River bottoms in Jefferson County.

Some fruit is produced for home use and market, but it is not an important crop, and no farm in the county is devoted chiefly to its production. The numbers of apple and peach trees have declined to a third of the numbers reported before the turn of the century. Small quantities of cherries, plums, pears, grapes, and berries are grown.

Table 3 gives the value of all agricultural products by classes as reported by the United States census for the years 1909, 1919, and 1929.

TABLE 3.—*Value of agricultural products, by classes, in Jefferson County, Tenn., in stated years*

Product	1909	1919	1929
Cereals	$708,609	$2,056,401	$881,474
Other grains and seeds	2,681	29,713	21,786
Hay and forage	152,274	757,042	348,442
Vegetables (including potatoes and sweetpotatoes)	76,969	210,288	214,915
Fruits and nuts	34,454	20,488	26,167
All other field crops	67,233	27,086	424,714
Livestock and livestock products:			
All domestic animals	1,007,726	1,748,460	1,056,392
Dairy products (excluding home use)	75,839	206,504	278,480
Poultry and eggs	166,069	350,888	376,842
Wool, mohair, and goat hair	2,025	5,166	2,932
Total value	2,293,879	5,412,036	3,632,144

The total value of all agricultural products increased during the 20 years preceding 1929, showing a peak evaluation of $5,412,036 in 1919, much of which is to be explained by the high prices prevailing at that time. Hay, vegetables, dairy products, and poultry products show absolute and relative increases in value from 1909 to 1929. Tobacco, included in the item "all other field crops," probably accounts for much of the large increment of this item as reported by the census.

Cattle are raised chiefly for dairy purposes. There were 16,312 cattle on farms on January 1, 1935, the largest number reported by the census since 1880. Price levels and market conditions probably have been potent influences encouraging the shift from beef raising to dairying, but the indications at present (1935) are that changes in economic conditions probably will check the change to some extent. According to the 1930 census, 76 farms make a specialty of dairying, but most of the dairy products are produced in connection with other types of farming. Considerable dairying, both as a specialty and as an adjunct, is carried on in the central red valley in the vicinities of Jefferson City and Strawberry Plains, around White Pines and Kansas School, and along Muddy Creek southeast of Dandridge.

Of the total production of 2,234,879 gallons of whole milk in 1929, nearly 522,282 gallons were produced on the 76 specialized dairy farms and 1,712,592 gallons on the other types of farms. In 1934 the milk production was 2,211,672 gallons. The small amount of milk needed by the villages is supplied by specialized dairies. The rest of the dairy products marketed are mainly in the form of whole milk and to less extent in the form of butterfat. Trucks collect and haul these products to a number of companies in Knoxville, Morristown, Greenville, and Rogersville. Most of the dairy cattle are Jersey and Guernsey grades, although some Holstein-Friesian grades are on some farms.

Although the raising of beef cattle has become very much subordinated to dairying, some cattle, chiefly of the Aberdeen Angus, Hereford, and Shorthorn breeds, are raised, especially along the French Broad River and in the central red valley in the vicinity of Jefferson City. Some of the better animals are sold locally and shipped to the east, and others are transported by truck to feeders in Virginia.

The number of swine decreased from 18,445 in 1920 to 8,456 in 1935. This decline largely expresses the trend in the corn-hog ratio, as surplus corn is sold as grain when such sale returns greater proceeds than marketing it indirectly through swine or, to a less extent, through beef cattle. Hampshire, Poland China, and Duroc-Jersey are popular breeds of swine. It is estimated that the pork production of the county ordinarily exceeds consumption by 20 to 30 percent. Most of the surplus is trucked to packing companies in Knoxville, and some is trucked as 25- to 60-pound "pen pigs" to points in North Carolina.

The 1935 census reported 2,606 sheep in the county. This number is slightly greater than that reported in 1920, but materially less than that reported in 1930. Hampshire, Southdown, and a few Shropshire are kept. Spring lambs and wool are marketed, the first through cooperative marketing to eastern cities, principally Jersey City, and the latter mainly to Cincinnati, Ohio, and Louisville, Ky. Only 141 goats were reported on farms by the 1935 census.

Work animals are approximately evenly divided between mules and horses, although the former have recently gained the lead. In 1935, 2,173 mules and 1,658 horses were enumerated by the census. Percheron is the principal breed of horse. It is estimated by the county agricultural agent that about 90 percent of the work animals are raised in the county.

Poultry and poultry products are important sources of cash income. Although some turkeys and a very few ducks and geese are kept, chickens represent more than 95 percent of the poultry. Poultry is produced both as a specialty and as an adjunct to other types of farming. The census reported 43 poultry farms in the county in 1930, but by far the greater part of the poultry is raised as a side line on general and other types of farms. The favored breeds of poultry are Rhode Island Red, Plymouth Rock, White Leghorn, and White Giant, a strain of the Jersey Black Giant. Generally two shipments of poultry to New York are arranged cooperatively annually, and one carload of turkeys is sold in a similar way in the fall. Most of the chickens and eggs are collected with trucks by local buyers and shipped to the eastern markets.

The number of farms increased from 1,455 in 1880 to 2,569 in 1935, but their average size decreased from 123 acres to 71.9 acres. The proportion of land in farms was only slightly greater in 1935 than in 1880, 92.5 percent as compared with 90 percent, although in 1900 it reached 94.4 percent. The proportion of improved land increased from 54 percent of the farm land in 1880, to 74.3 percent in 1920, after which it declined to 68.7 percent in 1935. Because of the smaller size and greater number of farms, the acreage of improved land per farm decreased from 66.6 acres to 49.4 acres.

Although the size of farms ranges from 3 to more than 1,000 acres, over half of them range between 20 and 100 acres. The 1935 census reports 606 farms less than 20 acres in size, and 576 more than 100 acres. The greater number of the 91 farms including more than 260 acres are located in the central red valley along the Southern Railway and on the broad bottom lands along the rivers. A slight tendency is evident during the last 15 years toward increasing the number of smaller farms at the expense of the larger ones.[5] Only two farms contain more than 1,000 acres each. By far the greater numbers of the smaller subsistence farms occur on the cherty ridges and dissected shale plains.

[5] Information from John R Fain.

According to the 1935 farm census, 1,387 farms are operated by owners, 265 by part owners, 906 by tenants, and 11 by managers. Tenancy has risen from 19.1 percent in 1880 to 35.3 percent in 1935. The change has not been gradual; the greater part of it took place in the last decade of the nineteenth century. The proportion of farms operated by managers has never been greater than 1.2 percent.

Most of the tenants who work on shares receive one-half of the tobacco produced and only one-third of the other crops. Tenants who furnish the labor, work animals, implements, and one-half of the fertilizer receive two-thirds of the tobacco and one-half of the proceeds from other crops; and those who furnish work animals, implements, seed, and all the fertilizer receive two-thirds of all crops, including tobacco.

In 1929, 747 farms, or 34 percent of the total number, reported a total wage bill of $110,063, or $147.34 per farm reporting the hire of labor. Farm labor is considered fair to good and is moderately plentiful. It consists largely of local white people. It seems that neither the amount nor the cost of farm labor has fluctuated here nearly so much as in many other places during the last 20 years. The common practice is for the landlord to supply the laborer with a house, fuel, water, a garden, pasture for a cow or two, and, on a few farms, feed for a cow, and to pay the laborer from 50 to 75 cents a day for such days as he may be called on to work. A few laborers have a small part-time crop for which they furnish only the labor and receive one-third of the proceeds, working as much of the rest of their time as is required by the landlord.

Census figures indicate that the total amount spent for fertilizer has increased from $2,895 in 1879 to $47,893 in 1929, with a corresponding increase in the proportion of farms using it, from 42.4 percent in 1909 to 53.5 percent in 1929. The greatest number of farms and the greatest amount spent for fertilizers were reported for 1919, when the price of farm crops was highest. The recent rapid expansion of the intensive crops of tobacco and vegetables. both of which require liberal applications of fertilizers; the gradual loss of soil fertility through long use and erosion; and education are probably factors having to do with the increased use of commercial fertilizers. The greater part of the fertilizer is factory mixed, although a few gardeners do home mixing.[6] Most of the fertilizer is used under wheat, corn, tobacco, and truck crops. Considerable superphosphate is used under corn (*19*), wheat, oats, and alfalfa. In addition, lime generally is applied for alfalfa. A 0–10–4[7] mixture is probably the most popular, and either this or superphosphate alone is often used under corn and small grain. A complete fertilizer, such as a 2–9–4 or 2–8–6,[8] generally is used for tobacco and truck crops.

Census data indicate that the average investment per farm increased from $2,028 to $5,562 during the 50 years prior to 1930. Although variations in the price level account for a part of this increase, the rise in price is somewhat offset by the decrease in average size of farms. Of the $5,562 invested in the average farm

[6] MOOERS, C. A. CONCENTRATED FERTILIZERS. Tenn. Agr. Expt. Sta. Inform. Cir. 30, 2 pp. 1935. [Mimeographed.]

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

[8] Information from the Tennessee Agricultural Experiment Station, county agricultural agent, fertilizer dealers, and farmers.

in 1930, 62.5 percent was in land, 24.1 percent in buildings, 4 percent in implements, and 9.4 percent in domestic animals. The acre value of land, including buildings, was reported to be $42.65 in 1935, as compared with $60.13 in 1930.

Of the 2,204 farms reported by the 1930 census, 762 are classed as general farms, 592 as self-sufficing, and 290 as crop-specialty farms. Of the rest, 76 are dairy, 81 are animal-specialty, 57 are cash-grain, 43 are poultry, 11 are truck, 184 are abnormal, and 108 are unclassified. Of the abnormal farms, 157 are part-time, and 12 are forest-product farms.

SOIL-SURVEY METHODS AND DEFINITIONS

Soil surveying consists of the examination, classification, and mapping of soils in the field.

The soils are examined systematically in many locations. Test pits are dug, borings are made, and exposures, such as those in road or railroad cuts, gullies, ditches, pits, and other excavations, are studied. Each excavation exposes a series of distinct soil layers, or horizons, called, collectively, the soil profile. Each horizon of the soil, as well as the parent material beneath the soil, is studied in detail; and the color, structure, porosity, consistence, texture, and content of organic matter, roots, gravel, and stone are noted. The content of lime in the soil profile is determined by simple tests. Drainage, both internal and external, and other external features, such as stoniness and relief, or lay of the land, are taken into consideration, and the interrelation of the soil and the vegetation is studied.

The soils are classified according to their characteristics, both internal and external, special emphasis being given to those features influencing the adaptation of the land for the growing of crop plants, grasses, and trees. On the basis of these characteristics, soils are grouped into classification units. The three principal units are (1) series, (2) type, and (3) phase. In places, two or more of these principal units may be in such intimate or mixed pattern that they cannot be clearly shown separately on a map but must be mapped as (4) a complex. Some areas of land, such as coastal beach or bare rocky mountainsides, that have no true soil, are called (5) miscellaneous land types.

The most important unit is the series, which includes soils having the same developed layers, similar in their important characteristics and arrangement in the soil profile and formed from a particular type of parent material. Thus, the series includes soils having essentially the same color, structure, and other important internal characteristics and the same natural drainage conditions and range in relief. The texture of the upper part of the soil, including that commonly plowed, may differ within a series. The soil series are given names of places or geographic features near which they were first recognized. Thus, Decatur, Dewey, Fullerton, and Talbott are names of important soil series in this county.

Within a soil series are one or more soil types, defined according to the texture of the upper part of the soil. Thus, the class name of the soil texture, such as sand, loamy sand, sandy loam, loam, silt loam, clay loam, silty clay loam, and clay, is added to the series name to give the complete name of the soil type. For example, Decatur silt loam and Decatur silty clay loam are soil types within the Decatur series. Except for the texture of the surface soil, these soil types have approximately the same internal and external characteristics. The soil type is the principal unit of mapping, and because of its specific character it is generally the soil unit to which informaton concerning crops and soil-management practices is definitely related.

A phase of a soil type is recognized for the separation of soils within a type, which differ in some minor soil characteristic that may, nevertheless, have important practical significance. Differences in relief, stoniness, and the degree of accelerated erosion frequently are shown as phases. For example, within the normal range of relief for a soil type certain areas may be adapted to the use of machinery and the growth of cultivated crops and others may not. Even though no important differences are observed in the soil itself or in its capability for the growth of native vegetation throughout the range in relief, important differences may exist in respect to the growth of cultivated crops. In such an instance, the more sloping parts of the soil type may be segregated on the map as a sloping or a hilly phase. Similarly, different parts of the same soil type may vary greatly in degree and kind of accelerated erosion, and such differences may be expressed as phases.

Texture refers to the relative amounts of clay, silt, and various grades of sand making up the soil mass. Light-textured soils contain much of the coarser separates (sands), and heavy-textured soils contain much clay. Structure refers to the natural arrangement of the soil material into aggregates, or structural particles or masses. Consistence refers to such conditions as friability, plasticity, stickiness, hardness, compactness, toughness, and cementation. Permeability and perviousness refer to the ease with which water, air, and roots penetrate the soil. The term surface soil, as used in this report, refers to the lighter textured surface layer, which generally extends to a depth ranging from 6 to 12 inches. The subsoil is the deeper and heavier textured layer, which generally is uniformly colored in well-drained soils. The substratum lies beneath the subsoil and is characteristically splotched or mottled with two or more colors. Bedrock is consolidated rock underlying the soil or outcropping on the surface.

In a practical sense, the degree of acidity may be thought of as the degree of poverty in lime (available calcium), or as indicating the amount of lime that should be applied for certain crops, such as some of the legumes. An alkaline soil in this county is rich in available calcium, and a neutral soil contains a sufficient amount for any crop commonly grown. The term "reaction"[9] refers to the condition of the soil as regards lime content or degree of acidity.

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[9] The reaction of the soil is its degree of acidity or alkalinity, expressed mathematically as the pH value. A pH value of 7 indicates precise neutrality, higher values alkalinity, and lower values acidity. Terms that refer to reaction and are commonly used in this report are defined in the Soil Survey Manual (7) as follows:

	pH value
Extremely acid	Below 4.5
Very strongly acid	4.5–5.0
Strongly acid	5.1–5.5
Medium acid	5.6–6.0
Slightly acid	6.1–6.5
Neutral	6.6–7.3
Mildly alkaline	7.4–8.0
Strongly alkaline	8.1–9.0
Very strongly alkaline	9.1 and higher

A, Karst or sinkhole landscape characteristic of an extensive acreage of soils overlying limestone, showing the steep easily eroded slope of the sinkhole and the typical hummocky surface in the background. *B*, Landscape of the larger areas of Dewey and Decatur soils. Note the smooth to gently rolling surface, good farm buildings, and excellent stand of alfalfa. *C*, Fall-sown barley on Dewey silty clay loam. This crop probably will become more important with increased interest in land and farm management, as it is a good substitute for corn and fits well in rotations necessary to soil improvement.

A, An area of stony land, which at one time was productive Decatur silt loam and free of stones. Erosion tells the story of wrong land use and soil management. The distance from the sticks to the surface of the ground is about 2 feet. *B*, This remnant of virgin forest in Jefferson County consists predominantly of red, black, and white oaks on Fullerton silt loam.

The soil surveyor makes a map of the county or area, showing the location of each of the soil types, phases, complexes, and miscellaneous land types, in relation to roads, railroads, houses, streams, lakes, and other local cultural and natural features of the landscape.

SOILS AND CROPS

Soil and land conditions, for the most part, have determined local differences in the present agriculture of Jefferson County, although social and economic factors have exerted some influence; and soil and land conditions have also been determining factors in local variations in the social and economic conditions.

For example, the soil and land conditions characterizing the bottom lands suit them ideally for the production of corn, which, combined with livestock raising, dominates the agriculture on these lands. The dominant soils of the central red valley and of the Dandridge plain are inherently fertile. They have wide crop adaptations and prevailingly favorable land features; consequently, a widely diversified agriculture, including the production of all crops grown in the county, has become established here. Practically all of the alfalfa and tobacco, as well as most of the hay and a large part of the corn, are produced on these soils. Dairying also is carried on largely in this section.

These bottom lands and red lands, being fertile and easily cultivated, attracted the early settlers. Large farms were established, and today the larger farms of the county are on these lands. The more progressive type of citizens were attracted in the first place, and the fertile soils and favorable land features provided opportunity for further development; consequently, the better economic and social conditions of the county prevail here.

The rest of the land has less desirable soil and land conditions than the bottom lands and red lands. Most of the soils of the dissected shale plain are shallow over bedrock, and the lay of the land is choppy and hilly. The soils of the Holston hills, Bays Mountain, and English Mountain for the most part are poor and stony, and the lay of the land ranges from hilly to mountainous. Reflecting the prevailing soil and land conditions, the present agriculture on these lands consists chiefly of subsistence farming. The land in these sections offered little attraction to the more ambitious settlers, and once it was occupied the very nature of the land inhibited social and economic development.

As brought out in a previous section, a great number of crops combine with livestock raising to make up a diversified agriculture, and the history of local agriculture is woven about a gradual evolution from the simple toward the complex. This trend is not only logical but also inevitable. It reflects, at least in part, an effort on the part of the farmers to adjust themselves to the soils and land, which are even more diverse in character than the present agriculture. Such extreme diversity of soils applies not only to their inherent characteristics but also to their possibilities for productive use.

The soils of this county differ widely in color, texture, consistence, depth, reaction, fertility, relief, and in conditions of stoniness, erosion, and moisture, all of which bear close relationship to productivity, workability, cost of conservation, or adapted use. They exhibit all

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shades of color from nearly white through gray, yellow, and brown to dark brown and deep red, with shades of red predominant in the subsoils. Although the spread in texture and consistence ranges from loose incoherent sands to tenacious clays, silt loams predominate. They occupy 65.4 percent of the total county area, fine sandy loams and very fine sandy loams only 10.6 percent, silty clay loams 11 percent, and miscellaneous soils and land types 13 percent. It is estimated that less than 4 percent of the land requires artificial drainage before cultivation can be carried on. The proportions of the land that are unsuited for cultivated crops largely because of strong relief, stoniness, and severe erosion are estimated at 35, 8, and 5.5 percent, respectively. About 50 percent of the land is practically nonarable because of some one of these features or some combination of these and other unfavorable features. In addition to this, about 38 percent of the land is characterized by one or more of these conditions to various but moderate degrees. It is estimated that about 11.4 percent of the county is nearly level, 22.5 percent is practically stone free, and about 15 percent is injured a little or not at all by erosion.

The well-developed soils occur only in the uplands, having formed in an environment of moderately high temperature, heavy rainfall, and forest cover. For the most part they never have possessed the inherent fertility characteristic of the western prairies; on the other hand, they are more fertile than comparable soils farther south and southeast where the temperature is higher and leaching has been more severe and continuous. Even in the uplands the virgin soils differ widely from one another in this respect. The character of the materials from which the soils are developed is strongly reflected in the natural fertility as well as in other characteristics. During the history of cultivation, erosion and other artificially stimulated processes of impoverishment have simply served to intensify further such local variations in fertility and productivity.

Taking the average of the great valley of east Tennessee as a standard, about 23 percent of the land suited to cultivation in Jefferson County is relatively high in natural fertility and productivity, about 48 percent is medium, and about 29 percent is relatively low. The parent rocks of most of the soils suited to cultivation are rich in calcium and magnesium carbonates; nevertheless lime is deficient in most of the soils of the uplands, as practically all of it has been lost through leaching during the processes of weathering and soil development. The organic-matter content was not high even in the virgin state, generally speaking, and much of it has been oxidized, lost in drainage waters, or otherwise dissipated during the time the land has been under cultivation, although both the amount and the character of this constituent differ widely, even in the virgin state, and differ much more after cultivation. Most of the soils of the bottom lands are well supplied with lime, organic matter, and the mineral plant nutrients.

The natural tilth of the surface soils is favorable, except on parts of the silty clay loams, which are subject to puddling, surface baking, and cloddy conditions when tilled under adverse moisture conditions and are exacting as regards moisture conditions for tillage. With relatively few exceptions, such refractory surface soils are really exposures of the subsoils resulting from erosional loss of the original surface material.

DESCRIPTION OF SOIL SERIES

Twenty soil series, seven miscellaneous land types, and alluvial soils, undifferentiated, are mapped. Some of the soils are relatively unimportant because of their small extent, unfavorable use adaptation, or both. It is necessary to become familiar with the important soils of the different series in order to use the results of this survey to the best advantage. This can be done more readily by associating the soil series with prominent physical land features of the county. Table 4 presents a key to these associations.

SOILS OF THE UPLANDS

As indicated in table 4, the Talbott, Decatur, Dewey, Fullerton, and Clarksville soils constitute the series on the uplands developed from limestone materials. The principal differentiating characteristic of the soils of the Talbott series is the tough plastic character of their subsoils. The soils of the other series of this group are differentiated in the field largely on the basis of color of their surface soils and subsoils, although other significant differences exist. The surface soils of members of the Decatur series are definitely brown, whereas those of members of the Dewey series are grayish brown, of the Fullerton series are brownish gray, and of the Clarksville series are whitish gray. The subsoils of the Decatur soils are very dark red, of the Dewey soils are brownish red, of the Fullerton soils are pale red, and of the Clarksville soils are yellow. Natural fertility decreases in the same order, the Decatur soils being the most fertile and the Clarksville soils poorest, whereas the amount of chert and resistance to erosion increase in this order. The Talbott and Decatur soils are, in general, in the valleys; the Dewey, on foot slopes; the Fullerton, on higher slopes and mild ridges; and the Clarksville, on sharp high ridges.

The members of the Talbott series are underlain by argillaceous high-grade limestone. Where uneroded, the 8- to 10-inch surface soil is light-brown friable or mellow silt loam. The subsoil is yellowish-red tough plastic slowly pervious silty clay extending to a depth of about 24 to 30 inches. Gray and yellow splotches are characteristic in the lower part of this layer. The parent soil material underlying the subsoil consists of very plastic and sticky silty clay that is predominantly yellow but is splotched with brown, gray, red, and ocher. This material rests on an uneven or jagged bedrock floor at an average depth of about 5 feet. Small outcrops of bedrock are common, particularly where erosion has been active. The greater part of the Talbott soils in Jefferson County are eroded to the extent that the upper part of the yellowish-red subsoil is being brought to the surface by tillage. In this condition, the cultivated soil exhibits a somewhat red color.

The Decatur soils are derived from weathered products of marble and other high-grade limestones, some of which are dolomitic. The virgin surface soil is distinctly brown mellow silt loam, has a granular structure, and extends to a depth ranging from about 8 to 12 inches. This material is underlain by brownish-red friable clay loam that continues to a depth of 16 or 18 inches. The subsoil is red or deep-red dense silty clay that is slightly plastic when wet but mod-

TABLE 4.—*Key to the soils of Jefferson County, Tenn.*

Topographic position	Series	Parent materials		Drainage	Subsoil consistence	Color	
		Mode of accumulation	Parent rock			Surface soil	Subsoil
Upland	Talbott	Residual from underlying rock.	High-grade limestone	Good	Tough, plastic	Light brown	Yellowish red.
	Decatur		do	Excellent	Dense, permeable	Brown	Dark red.
	Dewey		High-grade dolomitic limestone	do	Firm, permeable	Light brown	Brownish red.
	Fullerton		Cherty dolomitic limestone	Very good	do	Brownish gray	Yellowish red.
	Clarksville		do	Good	do	Light gray	Yellow.
	Dandridge		Calcareous shale	do	Firm, friable	Light brown	Do.
	Montevallo		Acid shale	do	do	Pale yellow	Do.
	Muskingum		Sandstone	Excellent	Friable	Gray	Do.
	Hanceville		do	do	do	Grayish yellow	Red.
Terrace land	Nolichucky	Transported (alluvial and colluvial).	Acid rocks	Very good	Moderately tough	Gray	Yellowish red.
	Holston		do	Good	Friable	Light gray	Yellow.
	Monongahela		do	Fair	Compact	do	Do.
	Tyler		do	Very poor	Tough, plastic	do	Mottled.
	Etowah		Limestone	Very good	Firm, friable	Light brown	Reddish brown.
Colluvial land	Leadvale		Shale	Good	Slightly compact	Grayish yellow	Yellow.
	Jefferson		Sandstone	Very good	Friable	Light brown	Do.
	Abernathy		Limestone	Good	Firm, friable	Brown	Reddish brown.
Bottom land	Congaree		Crystalline rocks	do	do	do	Brown.
	Huntington		Limestone	do	Friable	do	Do.
	Staser		Shale and sandstone	Fair to good	Firm, friable	Light brown	Brownish yellow.

erately friable under normal moisture conditions. This material crumbles readily into soft granular aggregates that are easily crushed. Most of the aggregates are brown, but the crushed material is red. The uniformly red subsoil in most places extends to a depth of about 6 to 7 feet. The underlying parent material is firm tough silty clay, predominantly yellow but splotched with rust brown, ocher, and some gray.

Most of the Decatur soils in Jefferson County have been under cultivation for a long time, and a great part of the surface soil has been lost through erosion, which has impaired the original granular structure. In such places, freshly plowed fields have a somewhat red surface. In places where the soils are developed from marble, bedrock lies from 6 to 10 feet below the surface. In most other places it is at a depth of 40 feet or more.

The Dewey soils differ from the Decatur soils chiefly in that their surface soils are less brown and their subsoils are lighter red. High-grade dolomitic limestone underlies the Dewey soils. In virgin areas the surface soil is grayish-brown mellow silt loam to a depth of 10 or 12 inches. The subsoil is brownish-red or red friable silty clay or silty clay loam. The structure of this layer is somewhat similar to that of the corresponding layer in the Decatur soils but is not so well defined. The subsoil extends to a depth ranging from about 4 to 5 feet. The soil parent material underlying this consists of dense or tough silty clay, which is dominantly yellow but splotched with brown, ocher, and gray. The depth to bedrock may be 40 feet or more. The Dewey soils, like the Decatur, have become eroded under cultivation in many places, so that the present surface soil is somewhat red.

The Fullerton soils are related to the Dewey soils but differ from them chiefly in that their surface soils are lighter colored and their subsoils are paler red. Also, the parent rock material of the Fullerton soils is more cherty than that of the Dewey soils. The Fullerton soils are derived from cherty dolomitic limestone materials. The virgin surface soil is brownish-gray loose silt loam extending to a depth of about 12 inches. The subsoil consists of yellowish-red firm but moderately friable silty clay loam to a depth ranging from 40 to 50 inches. A moderate content of chert fragments is characteristic. The parent material underlying the subsoil is tough cherty silty clay, which is predominantly yellow but is splotched with reddish brown, ocher, and some gray. The depth to bedrock in most places is 30 feet or more.

The Clarksville soils are developed from weathered products of very cherty dolomitic limestone. They resemble the Fullerton soils but differ from them chiefly in that they have lighter colored surface soils and yellow subsoils. Of all the soils in the county derived from limestone materials, only the Clarksville have yellow subsoils. The surface soils are composed of very light gray or almost white loose characteristically cherty silt loam. The subsoils are yellow friable silty clay loam and in most places are cherty. At a depth of about 40 inches this material is underlain by the parent soil material, which consists of dense or tough cherty silty clay, predominantly yellow but splotched with reddish brown, ocher, and gray. In most places this material extends to a depth of more than 30 feet, where it rests on solid cherty dolomitic limestone.

Of the remaining four series of soils of the uplands in the county, the soils of two—the Dandridge and Montevallo—are developed from the weathered products of shales, and of two—the Muskingum and the Hanceville—are developed from sandstone materials. Calcareous shale, for the most part, gives rise to the Dandridge soils, whereas acid shale materials give rise to the Montevallo soils. The profiles of the soils of these two series are very similar, and they are differentiated in the field largely on differences in the parent material. The soils of the two series also differ in productivity and crop adaptation.

The Dandridge soils occupy thoroughly and deeply dissected plains for the most part. The slopes are rather steep, and erosion, both natural and accelerated, has been rather active. Profile characteristics are weakly developed in this shallow soil. In most places the 2-inch surface layer is light-brown loose silt loam somewhat stained with organic matter. This is underlain by firm but moderately friable yellow silty clay loam that continues to a depth of about 8 or 10 inches. This material, in turn, is underlain by yellow silty clay that is hard when dry and sticky and plastic when wet. This layer is variable in depth and rests on unweathered calcareous shale at a depth ranging from 12 to 20 inches.

The profiles of the Montevallo soils are very similar to those of the Dandridge soils, and they occupy similar topographic positions. They differ from the Dandridge soils in general field appearance, largely in the character and amount of vegetation.

Deep phases of both the Montevallo and Dandridge soils are mapped. The deeper areas have milder relief, and consequently erosion has been less active. The profiles are more distinct than in the typical soils. In contrast to the normal shallow soils on stronger relief, productivity and crop adaptation are very similar for the soils of the two phases. The deep phase of the Dandridge soil has an 8- to 12-inch surface soil of pale yellowish-gray loose silt loam and a subsoil of brownish-yellow moderately friable silty clay continuing to a depth of 18 or 20 inches. The parent material underlying the subsoil is tough, moderately plastic, silty clay that is predominantly yellow but is splotched with gray, ocher, and brown. This material rests on bedrock at a depth ranging from 24 to 40 inches. The deep phase of the Montevallo soil is very similar to the corresponding phase of the Dandridge soil, except that the underlying shale is not calcareous.

The soils of the other two series of the uplands—the Muskingum and Hanceville—are derived from the weathered products of sandstone. They are developed on English Mountain and a few outlying ridges. They are differentiated chiefly on the basis of subsoil color, the Muskingum being brownish yellow and the Hanceville red; and profile development is considerably more advanced in the Hanceville soils.

The Muskingum soils occupy strong relief where natural erosion has kept pace with soil formation. Hence, in this county, they have little opportunity for profile development. In general, they have a 2- or 3-inch surface layer of dark-gray loose fine sandy loam, stained with organic matter, underlain by gray friable fine sandy loam, which continues to a depth ranging from 10 to 18 inches. The subsoil is brownish-yellow or yellow friable light fine sandy clay, which varies in thickness. Depth to bedrock is extremely variable, ranging from 18 inches to 3 feet. Splotches of yellow, gray, and rust brown characterize the material just above the bedrock. Practically all of the areas of Muskingum soil are still in forest.

The Hanceville soils are derived from parent material very similar to that of the Muskingum soils, but they have more distinct profile characteristics. The 3- or 4-inch surface layer of the Hanceville soil is loose fine sandy loam darkly stained with organic matter in the virgin state. It is underlain by pale grayish-yellow loose fine sandy loam that continues to a depth of 12 or 14 inches. The subsoil is red firm but friable fine sandy clay extending to a depth of about 40 inches. The substratum beneath the subsoil is hard but brittle and friable heavy fine sandy clay that is predominantly brownish red but profusely splotched with yellow, rust brown, and gray. Bedrock lies at a variable depth, in many places as much as 10 feet. Most of the Hanceville soil occurs near the foot of English Mountain.

SOILS OF THE TERRACES

The soils of the Nolichucky, Holston, Monongahela, Tyler, and Etowah series include all the terrace land in this county. Soils of the first four series of this group constitute a chain, or catena, as the parent material of all these soils arises chiefly from a mixture of acid rocks, particularly sandstone and crystalline rocks. Differentiating characteristics result chiefly from differences in drainage conditions. Drainage becomes progressively poorer from the Nolichucky soils through the Holston and Monongahela to the Tyler.

The Nolichucky soils have developed on old high river terraces and are characterized by well-developed profiles. To a depth of 10 or 12 inches the surface soil is light-gray or yellowish-gray loose very fine sandy loam. This grades into pale-yellow loose or friable fine sandy loam that continues to a depth of 16 or 18 inches. The subsoil is stiff but moderately brittle heavy very fine sandy clay, red, brownish red, or yellowish red in color. It extends to a depth ranging from 40 to 50 inches, where it grades into mottled light-red and yellow heavy fine sandy clay. This material continues to the base of the terrace deposit and rests on a bed of quartzitic gravel and cobbles in most places.

In the field, the Holston soils are distinguished from the Nolichucky soils chiefly by their yellow subsoils.

The Monongahela soils are associated with the Holston soils, which they resemble. They are not so well drained as those soils, and their thicker subsoils and substrata are definitely compact and relatively impervious. The 10- or 12-inch surface soil of the Monongahela soils is light-gray or pale yellowish-gray fine sandy loam or very fine sandy loam. The subsoil is yellow firm but moderately friable very fine sandy clay that continues to a depth of about 22 inches, and the underlying material is compact slowly permeable fine sandy clay that is predominantly pale yellow but splotched with dull brown and gray.

The Tyler soils occupy flat or depressed situations in association with the Holston and Monongahela soils. Both external and internal drainage are very poor. Their surface soils are conspicuously light colored and are splotched with gray and yellow. Their subsoils, which are plastic, sticky, tough, and impervious, are dominantly yellow but are profusely splotched.

The Etowah soils are developed on younger terraces, and their transported parent materials are derived largely from limestone. The profiles of the Etowah and Dewey soils are similar. The surface layer of the Etowah soil is light-brown mellow silt loam to a depth ranging from 12 to 18 inches. The subsoil is yellowish-brown or reddish-brown friable very fine sandy clay or silty clay, extending to a depth of about 40 inches. The material beneath the subsoil is variable because of accidents of deposition, but in most places it is friable somewhat brown fine sandy clay containing various quantities of gray and yellow splotches.

SOILS OF THE COLLUVIAL LAND

The so-called colluvial land might be more properly designated as local alluvial deposits. These are in reality a combination of local wash and materials slumped down from slopes. Such accumulations have taken place at the bases of slopes, particularly the longer slopes on which erosion has been active. The members of three soil series, the Leadvale, Jefferson, and Abernathy, include such accumulations. The material giving rise to the Leadvale soils originated from shales, that giving rise to the Jefferson soils from sandstone, and that giving rise to the Abernathy soils from limestone. Although these soils are important, particularly in relation to crop growing, they are not extensive. Profile development has not reached an advanced stage and is characteristically variable.

In general the Leadvale soil has a 10- to 14-inch surface layer of friable pale grayish-yellow silt loam and a rather thin subsoil of dominantly yellow firm dense slightly compact silty clay or silty clay loam. Splotches of bright yellow and brown appear at a depth of 18 or 20 inches and increase in size and numbers downward.

The Jefferson soils in this county occur only at the base of English Mountain. The 10- to 16-inch surface soil is grayish-brown loose gravelly fine sandy loam. The subsoil is brownish-yellow or reddish-brown gravelly friable sandy clay extending to a variable depth, generally between 2 and 4 feet. This rests on a sandy and gravelly substratum that is extremely variable in character. Well-rounded boulders are characteristic of this soil.

The Abernathy soils are developed in depressions or in areas near the heads of drainageways, in association with the Decatur and Dewey soils of the uplands. Drainage is good and is generally through subterranean channels. As regard use capabilities, these soils resemble the Huntington soils although they are dominantly reddish brown. The 12- to 18-inch surface layer of the Abernathy soils is brown or reddish-brown mellow silt loam. The subsoil is yellowish-brown or reddish-brown heavy silt loam or silty clay loam, reaching a depth ranging from 2 to 3 feet, below which the material tends to become gray mottled with yellow, rust brown, and light gray.

SOILS OF THE BOTTOM LAND

Members of only three soil series and one complex are mapped in the bottom lands of the county. The series are the Congaree, Huntington, and Staser, and the complex land type is alluvial soils, undifferentiated. These soils are differentiated chiefly on the basis of the character of the soil material, which is closely associated with its source. The Congaree soils had their origin largely from the crystalline rocks of the Great Smoky Mountains; those of the Huntington soils, largely from the limestones of the valley; and those of the Staser soils, largely from sandstones and shales. All these soils are young, and little profile development has taken place.

The Congaree soils consist of brown mellow silt loam or very fine sandy loam to a depth ranging from 12 to 20 inches. This material is underlain by moderately firm brown or yellowish-brown friable silt loam that continues to a depth of 30 or more inches, and below this depth splotches of rust brown, yellow, and drab appear. These soils are somewhat micaceous and are well drained. In Jefferson County they occur only on the French Broad River bottoms.

The Huntington soils are characterized by brown mellow silt loam or very fine sandy loam to a depth ranging from 18 to 24 inches. This material is underlain by brown moderately firm friable heavy silt loam or silty clay loam. Beginning at a depth ranging from 3 to 4 feet the material is variable, depending on accidents of stream deposition, but in most places it is mottled material somewhat similar to that of the surface soils and the subsoils.

The Staser soil is on the bottom land, where it receives drainage from the surrounding Montevallo, Dandridge, Muskingum, and Hanceville soils. The 12- to 18-inch surface soil is light-brown friable silt loam, and the subsoil is brownish-yellow or brown firm silty clay loam to a depth ranging from 24 to 30 inches. Beneath this, a similar material becomes profusely splotched with yellow and gray.

Alluvial soils, undifferentiated, includes bottom land that is extremely variable as regards character of material and has local differences in drainage and texture. This separation consists largely of Philo, Atkins, Lindside, and Melvin soils, which occur in small patches too intricately associated to justify their separation. This alluvial land is imperfectly or poorly drained, and even the best of it requires artificial drainage for satisfactory crop use.

MISCELLANEOUS LAND TYPES

As explained elsewhere in this report, it becomes necessary in places to recognize certain land conditions as units of mapping. Six such miscellaneous land types have been recognized in this county. Four of them include land characterized by many outcrops of bedrock. Such outcrops are sufficiently numerous to prevent tillage or to make it infeasible, even if other features of the land were favorable.

Smooth stony land (Talbott soil material), rolling stony land (Talbott soil material), and rough stony land (Talbott soil material) carry limestone outcrops and are separated on the basis of differences in lay of the land, as indicated by the names. Rough stony land (Muskingum soil material) carries sandstone outcrops and is separated from rough stony land (Talbott soil material) because of the striking differences between the soil materials of the two land types. That of the former resembles the Muskingum soils, whereas that of the latter resembles the Talbott soils.

The two remaining miscellaneous land types include land characterized by a close network of destructive gullies. Erosion has advanced to the point that the owner ordinarily cannot afford to reclaim the land except through very slow processes. Largely because of severe erosion, this land is unsuited to cultivated crops or pasture. Rough gullied land (Dewey soil material) consists of very severely eroded soil derived from limestone materials. Rough gullied land (Montevallo soil material) consists of very severely eroded soil derived from shale materials.

GROUPING OF SOILS ACCORDING TO RELATIVE PHYSICAL SUITABILITY FOR AGRICULTURAL USES[10]

In order that the soil types and phases may have more meaning in relation to land use capabilities and management requirements, it is necessary to base their classification not only on the internal characteristics of the soils but also on certain external soil features, such as slope, stoniness, and degree of accelerated erosion. On the bases of internal and external soil characteristics, the soils of Jefferson County have been classified and mapped into 24 soil types, 19 soil phases, 1 complex, and 7 miscellaneous land types.

The soils of Jefferson County differ widely in physical characteristics, and consequently in use capabilities and management needs. Such differences are the results of a number of internal and external soil features, such as texture, structure, consistence, amount and character of organic matter, chemical character (including reaction), moisture conditions, soil depth, erosion, stoniness, and slope or lay of the land. Inasmuch, however, as these soil characteristics affect land use and management through productivity, workability, and problems of conservation, the soil types and phases in Jefferson County are placed in five classes on these bases for convenience in discussing their relationship to agriculture. These classes are, in the order of their desirability, First-class soils, Second-class soils, Third-class soils, Fourth-class soils, and Fifth-class soils.

Productivity, as used here, refers to the capacity of the soil to produce crops under the prevailing farming practices. The soil may be productive of a crop but not well adapted because of its poor workability or problem of conservation, or both. Workability refers to the ease of tillage, harvesting, and other field operations. The following characteristics affect workability: Texture, structure, consistence, organic matter, moisture conditions, stoniness, and slope or lay of the land. Conservation refers to maintenance and/or improvement of the productivity and workability of the soil, including control of erosion. The degree to which the soil responds to management practices is reflected in the problem of conservation.

An ideal soil for crop production is one that is very productive, is easily worked, and is capable of being conserved with minimum effort. A soil with such an ideal combination of features is very rare, if it exists at all. All the soil types and phases in Jefferson

[10] This same grouping is discussed in the section on Productivity Ratings and Land Classification and is shown also on the accompanying soil map.

County fall short of this ideal, but they differ widely in the degree of such shortcoming.

Although the soils of no one class are ideal for plant production, the First-class soils more nearly approach the ideal than do those of the Second class. Likewise, the soils of each succeeding class are farther from the ideal than those of the preceding group.

In the following pages the soils of the county are described in detail, and their agricultural relationships are discussed; their location and distribution are shown on the accompanying soil map; and their acreage and proportionate extent are given in table 5.

TABLE 5.—*Acreage and proportionate extent of the soils mapped in Jefferson County, Tenn.*

Soil type	Acres	Per-cent	Soil type	Acres	Per-cent
Decatur silt loam	1,408	0.7	Monongahela very fine sandy loam	2,624	1.3
Decatur silt loam, slope phase	1,536	.8	Monongahela very fine sandy loam, slope phase	4,992	2.5
Dewey silt loam	1,984	1.0	Nolichucky very fine sandy loam	1,728	.9
Dewey silt loam, slope phase	6,080	3.0	Dewey silty clay loam, steep phase	448	0.2
Etowah silt loam	1,280	.6	Fullerton silt loam, hilly phase	22,080	11.1
Huntington silt loam	1,920	1.0	Talbott silty clay loam, eroded hilly phase	1,216	.6
Huntington very fine sandy loam	1,600	.8	Smooth stony land (Talbott soil material)	1,024	.5
Congaree silt loam	3,392	1 7	Rolling stony land (Talbott soil material)	11,840	5.9
Congaree very fine sandy loam	2,048	1.0	Dandridge silt loam	1,472	.7
Abernathy silt loam	2,496	1.3	Dandridge silt loam, hilly phase	27,840	13.9
Decatur silty clay loam, eroded phase	1,920	1.0	Tyler silt loam	4,032	2.0
Dewey silty clay loam, eroded phase	4,864	2.4	Alluvial soils, undifferentiated	2,752	1.4
Talbott silty clay loam	7,936	4.0	Fullerton silt loam, steep phase	4,928	2.5
Talbott silt loam	1,024	.5	Clarksville cherty silt loam, hilly phase	1,280	.6
Fullerton silt loam	20,672	10.4	Rough gullied land (Dewey soil material)	3,392	1.7
Fullerton silt loam, smooth phase	512	.3	Montevallo silt loam	2,176	1.1
Fullerton fine sandy loam	1,920	1.0	Montevallo silt loam, hilly phase	7,808	3.9
Holston very fine sandy loam	2,304	1.1	Rough gullied land (Montevallo soil material)	2,816	1.4
Holston very fine sandy loam, slope phase	1,408	.7	Muskingum stony fine sandy loam	2,112	1.0
Staser silt loam	5,120	2.6	Rough stony land (Talbott soil material)	3,392	1.7
Decatur silty clay loam, eroded hilly phase	960	.5	Rough stony land (Muskingum soil material)	576	.3
Dewey silty clay loam, eroded hilly phase	4,672	2.3	Pits, mines, and mine dumps	128	.1
Fullerton silt loam, eroded phase	2,624	1.3	Total	199,680	
Clarksville cherty silt loam	1,920	1.0			
Dandridge silt loam, deep phase	3,008	1.5			
Montevallo silt loam, deep phase	1,216	.6			
Leadvale silt loam	2,496	1.3			
Hanceville fine sandy loam	320	.1			
Jefferson gravelly fine sandy loam	384	.2			

FIRST-CLASS SOILS

The First-class soils differ in degree of profile development, character of parent materials, and other respects; but they are similar in productivity, workability, and requirements for conservation. All these soils are fairly well to well supplied with plant nutrients, but even the least fertile of them is very responsive to applications of needed amendments. None of them is very poor in lime (available calcium); the Huntington and Abernathy soils are well supplied, although they are slightly acid in reaction. All the soils of the group are well drained yet retain moisture well, thereby tending to insure an even and adequate supply for plant growth. Their physical character, therefore, enables growing crops to withstand both excessive rainfall and drought. Tilth conditions are favorable, and the range of moisture conditions for tillage is rather wide. These soils are relatively well supplied with organic matter, and their character is favorable to humifying processes, as most of the organic matter is well combined with the soil. The physical properties of these soils are favorable to normal circulation of air and moisture, resulting in free penetration of roots and growth of beneficial soil bacteria. No prominent adverse external soil or land condition characterizes these soils. Stones are virtually absent. The slope, or lay of the land, favors soil conservation and cultural operations. Severe erosion has not occurred and is not likely to occur.

The natural productivity of these soils is relatively high, their working qualities are favorable, and the problem of conserving both the soil fertility and the soil material itself is relatively simple; that is, none of the detrimental characteristics, such as poverty of organic matter and plant nutrients, adverse conditions of texture, structure, consistence, erosion, stoniness, or moisture are highly developed in any of these soils. All these soils are well adapted to most of the exacting and intensive crops of the locality.

Decatur silt loam.—Decatur silt loam has a dark rich-brown or reddish-brown mellow silt loam surface soil and a firm, dense, brittle, dark-red silty clay subsoil. The surface soil normally ranges from 10 to 16 inches in thickness. The subsoil extends to a depth of 6 to 7 feet. In most places the material beneath the subsoil is heavy, tough, reddish-yellow silty clay splotched with bright yellow, gray, and red. In a few places the subsoil rests directly on bedrock.

For an upland soil, the organic-matter content of the virgin surface soil is comparatively high. Organic matter has become thoroughly incorporated in the 3- or 4-inch surface layer, and with proper management, it endures well under cultivation. Tilth conditions are good, and stones are practically absent.

This soil occupies well-drained uplands and is developed from materials derived either in part or entirely from high-grade limestones. A few areas are underlain by marble, but the greater part is underlain by the Knox dolomite formation. Although the soil underlain by Knox dolomite is not identical with that overlying marble, there is little doubt that interbedded or once overlying high-grade limestones contributed in part to the residue from which the soil, now overlying Knox dolomite, is developed. The differences discernible in the field between these two types of Decatur silt loam are not sufficient to justify a separation. This soil is closely associated with Decatur silt loam, slope phase, and with various members of the Dewey series. Small areas resembling those soils are included in places.

Decatur silt loam is not an extensive soil. It occupies land of mild relief with slopes ranging from barely enough to effect adequate surface drainage to nearly 8 percent. It occurs almost entirely in the central red valley along the Southern Railway. The greater part is mapped in the vicinities of New Market and Jefferson City. The soil occupies comparatively low elevations among the uplands.

Decatur silt loam is characterized by good tilth of the plow soil and favorable physical properties of the subsoil. The favorable physical character throughout the soil increases its capacity to absorb and retain moisture, prevents alternate extremely wet and dry conditions of the surface soil, and minimizes loss of plant nutrients by leaching. Such a physical condition makes for normal movement of moisture and air throughout the soil and encourages the accumulation, humification, and preservation of organic materials. These physical properties largely explain why Decatur silt loam ranks among the first of the soils of the uplands in inherent fertility and in productivity. The early pioneers recognized the productivity of this soil, and it was one of the first to be used. More than 98 percent of it is now in cultivation.

This soil is used mainly for the production of the general field crops—corn, hay (including alfalfa), wheat, and tobacco. It has an unusually wide range of adaptation. It is probably the best soil for tobacco in the county, and yields of more than 2,000 pounds an acre have been reported. This crop is sensitive to soil conditions, and the equable supply of moisture and plant nutrients exacted by tobacco are provided largely because of the favorable soil characteristics noted above. Corn yields normally range from 30 to 40 bushels an acre. This is an excellent soil for wheat, which often yields about 20 bushels an acre. It is well adapted to alfalfa, partly because of its relative richness in humus and other plant nutrients, including lime, and from 3 to 5 tons of alfalfa hay an acre frequently are harvested. Red clover, other clovers, and lespedeza do well. Fruits and vegetables are produced satisfactorily where air drainage is adequate. It is estimated that about 40 percent of this soil is devoted to corn, about 30 percent to hay, and the rest to other crops.

Although both surface soil and subsoil are acid in reaction, the Decatur soils contain probably twice as much lime (available calcium) as the Dewey soils, and about three times as much as the Fullerton or Clarksville soils. Compared with the Clarksville and Fullerton soils, the Decatur soils contain about twice as much phosphate and about three times as much potash. Compared with the Dewey soils, the Decatur soils are somewhat richer in phosphate and nearly 50 percent richer in potash.[11]

Among the many important practices of management are the proper choice and rotation of crops, growing of legumes, return of organic matter to the soil, contour tillage, and judicious use of amendments. Erosion presents a problem on the steeper slopes (pl. 2, *A*).

Fertilizer recommendations for crops on this soil are as follows: Corn and small grain, 250 pounds per acre of a 6–8–0 mixture; small grains, to be followed by clover and grass, 300 pounds of 4–10–5; cowpeas, soybeans, and other legumes, 250 pounds of 0–10–5; tomatoes, potatoes, and other vegetables, 500 pounds of 6–10–4; meadow and pasture, 200 pounds of 8–8–5; tobacco, 600 pounds of 6–10–4 (*21*).

Decatur silt loam, slope phase.—Decatur silt loam, slope phase, differs from the typical soil in that it occupies slopes ranging from about 8 to 15 percent. Other incidental differences exist, such as a somewhat thinner surface soil, less organic matter, and other somewhat less favorable features associated with the slope.

The greater part of Decatur silt loam, slope phase, is mapped in the valley along the Southern Railway, especially northeast of Jef-

[11] Based on chemical analyses by C. A. Mooers, Director, Tennessee Agricultural Experiment Station.

ferson City, in close association with Decatur silt loam and the Dewey soils. Small areas resembling these associated soils and the usual minor variations are included. A few eroded areas, too small to justify delineation, also are included. Like the typical soil, Decatur silt loam, slope phase, is inextensive.

The percentage of land under cultivation, the crops grown, and the fertilizer requirements are about the same as for normal Decatur silt loam. Fertility is slightly inferior, as erosion has removed from 2 to 4 inches of the original surface soil, and surface run-off is greater. Crop yields are estimated to be from 5 to 10 percent lower than on typical Decatur silt loam.

The Decatur soils seem to be rather susceptible to erosion. The absence of chert fragments, the moderately dense subsoil, and the silty deflocculated condition of the surface soil, as well as the long time this soil has been in cultivation, are probably significant factors in this respect. The inherent fertility and physical properties of the Decatur soils provide a good foundation for rejuvenating or building up after becoming impoverished or eroded. This sloping soil must be managed and conserved more carefully than typical Decatur silt loam to control erosion.

Dewey silt loam.—The 10- to 16-inch surface soil of Dewey silt loam consists of gray-brown or brown mellow silt loam. A moderate amount of organic matter is well combined with the topmost 3 or 4 inches, imparting a dark cast to the virgin soil. The content of humus is only slightly less durable than in Decatur silt loam, but it gradually disappears and allows the surface soil to become lighter colored under cultivation. The subsoil, which is red or brownish-red rather firm silty clay loam, extends to a depth of about 5 feet in most places, where it grades into reddish-yellow or brown heavy silty clay loam or silty clay splotched with gray, yellow, and red. Bedrock is 30 feet below the surface in most places. Very small patches have thinly dispersed chert fragments over the surface and throughout the soil mass. Tilth conditions are favorable.

This soil is developed on well-drained uplands underlain by dolomitic limestone. It typically occurs along the lower parts of the slopes and in the valleys at an elevation little or no higher than the Decatur soils. The slope is everywhere less than 8 percent and in most places ranges from 3 to 6 percent. Most of this soil occupies irregular-shaped moderate to large areas. A large part of it is associated with the Decatur soils in the central red valley near New Market and Jefferson City. A few areas are in the northeastern part of the county near White Pine, in the southern part near Shady Grove, and in the north-central part near Mount Horeb. Its total area is small.

Dewey silt loam is similar to Decatur silt loam in all essential respects, both in character and in productivity. Compared with that soil physically, it has a lighter colored surface soil and a paler red, more cherty, less dense subsoil. Compared with that soil agronomically, Dewey silt loam probably is 10 percent less productive, and, owing partly to the presence of a moderate sprinkling of chert and a more permeable subsoil, not quite so erodible. Although tobacco, alfalfa, and a few other crops highly sensitive to soil conditions are not quite so well adapted as they are to the Decatur soil, the range of crop adaptation is almost as wide as that of the Decatur soil. Approximately the same crops are grown in similar proportions on both soils. Nearly all of this soil is occupied by crops, which is its proper adapted use.

As Jefferson County is near the northern border of the section occupied by Dewey soils, some of Dewey silt loam closely approaches the Hagerstown soils in color and other characteristics. Dewey silt loam is closely associated with the Fullerton and Decatur soils and also with the slope phase of Dewey silt loam, and small scattered areas resembling these soils are included with it in mapping.

Decatur silt loam and Dewey silt loam are similar as regards relative ease of rejuvenation, fertilizer requirements, and necessity of proper crop rotations and control of erosion, although the Dewey soils generally show a slightly greater response to applications of amendments, particularly lime and potash.

Dewey silt loam, slope phase.—The slope phase of Dewey silt loam differs from the typical soil in occupying slopes ranging from 8 to 15 percent. The surface soil probably is from 2 to 4 inches thinner and organic matter and certain plant nutrients are slightly less abundant in soil of the slope phase. Average tilth properties of the slope phase are slightly inferior to those of the normal soil, and small eroded patches with a reddish-brown surface soil are numerous. The subsoil, substratum, and underlying rocks are practically identical in the two soils.

Dewey silt loam, slope phase, occupies a larger area than the typical soil. It occurs mainly in the central red valley between Strawberry Plains and Talbott and on the Dandridge plain. The largest areas are in the vicinities of Jefferson City and Nina. This soil is intricately associated with typical Dewey silt loam, and in places with the Decatur and Fullerton soils. Small variations resembling these soils and also eroded patches with heavier texture are included in mapping.

The amount of land cleared, proportions devoted to the various crops, soil amendment needs, crop yields, and methods of management are all similar to those features of Decatur silt loam, slope phase, although the latter soil has a slight advantage in natural fertility and adaptation to tobacco and alfalfa. The Dewey soil seems to be a little less erodible of the two.

Etowah silt loam.—The 12- to 18-inch surface soil of Etowah silt loam is grayish-brown or brownish-yellow silt loam. The subsoil is yellow-brown or reddish-brown friable very fine sandy clay or silty clay that continues to a depth ranging from 3 to 4 feet. The material beneath the subsoil is variable but generally brown friable fine sandy clay containing faint splotches of gray and yellow.

Organic matter in the virgin soil is moderately abundant and well mixed with the 3- or 4-inch surface layer, and, although rather durable, it gradually disappears under cultivation, leaving the surface soil lighter colored. The tilth is good. In places a few waterworn pebbles with a maximum diameter of 5 inches are scattered over the surface. Pebbles are strewn over the surface in but few places, but a stratum of gravel at the base of the terrace material is common. The physical character and permeability of both the surface soil and the subsoil favor normal circulation and retention of moisture.

Etowah silt loam is developed on well-drained moderately young or very young terraces along the French Broad and the Holston Rivers. The terraces or benches are so-called second and third bottom lands. The materials were deposited many years ago, before these rivers had cut their present deep channels and when they probably carried much more water than at present. These terraces now lie above ordinary overflow, some of them only a few feet above and others as much as 75 feet above. The areas of this soil occupying the higher terraces show a more distinct difference between the surface soil and the subsoil. The surface soil is grayer and the subsoil redder compared with the areas on the lower and younger terraces. Equal and corresponding differences in fertility and productivity also apply in favor of the soil on the low terraces. Although the greater part of the terrace material was washed from uplands underlain by limestone, a part was washed from uplands underlain by shales or crystalline rocks, and the relative proportions of these materials differ from place to place, giving rise to variations in the soil itself. A few small areas with a reddish-brown surface soil and deep-red subsoil are included on a terrace of the Holston River northwest of New Market and on a terrace of the French Broad River southeast of White Pine. A very small total area is mapped.

Etowah silt loam on the younger terraces is closely associated with and lies only a few feet higher than the Huntington soils along the Holston River and the Congaree soils along the French Broad River, but that part on the higher and older terraces is associated with the Holston and Nolichucky soils. Most of the areas are long narrow strips paralleling the rivers.

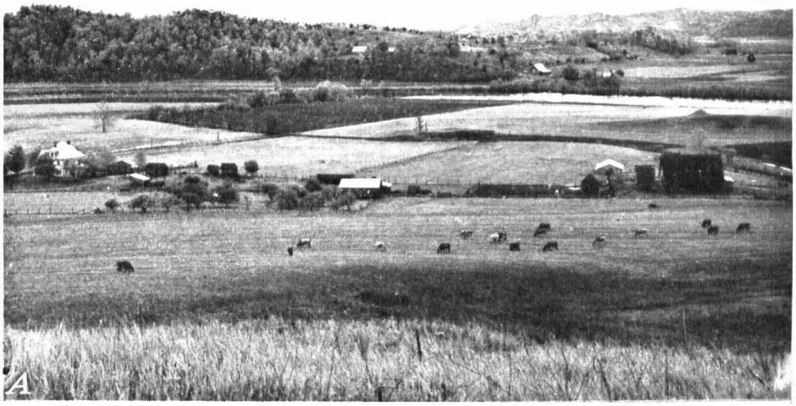
Practically all of this soil is cultivated to the general field crops and vegetables. It is well adapted to cultivated crops, as it is comparatively fertile, has favorable physical properties, and lies favorably. The slope ranges, in most places, from 2 to 4 percent and nowhere exceeds 8 percent. That part devoted to vegetables is along the French Broad River south of Swann Bridge. Yields seem to be satisfactory.

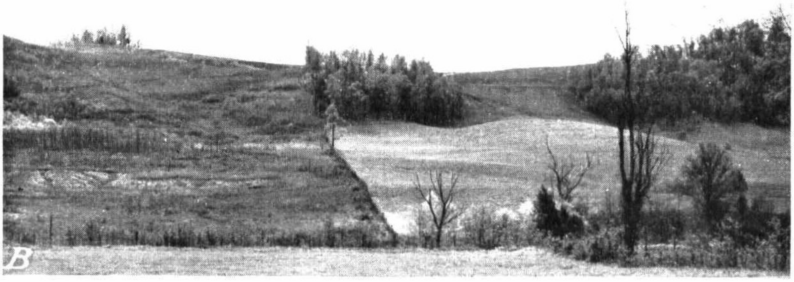
Fertilizer requirements for this soil do not differ widely from those for Decatur silt loam. About the same crops are grown and similar yields are produced on the two soils.

Huntington silt loam.—Huntington silt loam, like Etowah silt loam, is developed from materials washed from soils underlain largely by limestone, but partly by other rocks. Unlike the Etowah soil, however, Huntington silt loam occupies first bottoms that are subject to periodic overflow and receive additional deposition of material. The Huntington soil is, therefore, younger, darker, more fertile, more productive, and less developed into distinct surface, subsurface, and subsoil layers than the Etowah soil.

Huntington silt loam consists of brown mellow silt loam to a depth ranging from 18 to 24 inches. This is underlain by brown moderately firm friable heavy silt loam or silty clay loam with a slightly more yellow cast than the surface soil. Below a depth ranging from 3 to 4 feet the material varies considerably, showing more yellow in most places, together with splotches of bright yellow and drab.

The 12- to 24-inch surface soil is rich in durable humus, but the color fades slowly under cultivation. The reaction is about neutral,





A, A large part of the tillable acreage on this farm is Congaree soil Here dairy products are the principal source of income, although market gardening and the production of corn are more important on other areas of Congaree soils *B*, Poor management (left) and good management (right) on the Dewey soils. The slope ranges from 15 to about 45 percent. The idle land on the left was devoted to row crops until it was no longer capable of producing satisfactory yields Note the gullies. The steepest parts of the land on the right have been kept in forest and the hilly parts in permanent pasture. The smoother acreage has been fertilized properly and devoted largely to small-grain and hay crops. *C*, An unusually clear, sharp soil boundary. Montevallo silt loam, on the right, is a light-gray poor soil developed from material derived from acid shale. Talbott silt loam, on the left, is a dark reddish-brown productive soil developed from material derived from limestone

A, The Fullerton soils are characterized by more rolling relief and more diversified use than are the Decatur and Dewey soils. Within this view are virgin forest, idle land, meadow, and fields of wheat, rye, and corn. *B*, Stoniness is a significant soil condition in this county Two important types—outcrops and loose stones—are mapped This soil is Fullerton fine sandy loam on which mixed sandstone and chert fragments are sufficiently abundant to interfere materially with tillage *C*, Appreciable acreages of apples, grapes, and other fruits produce good yields of good-quality products where the land is well managed. This vineyard is on Holston very fine sandy loam.

indicating an abundance of lime (available calcium). Other plant nutrients appear to be equally adequate. Tilth conditions are excellent, and the occurrence of stones is unusual. The land is nearly level, nowhere exceeding 2½ percent gradient. Although surface run-off is slow, internal drainage is free.

This is a very productive and valuable soil, but only a small total area is mapped. The greater part of it is along the Holston River, Lost Creek, and Mossy Creek. Narrow strips border smaller streams northwest of the French Broad River, and a few small areas are along the French Broad River.

In places Huntington silt loam is associated with Huntington very fine sandy loam, and boundary lines between the two soils are rather arbitrarily marked. In a few areas, such as those along Lost Creek north of the Southern Railway, the texture approaches silty clay loam. The narrow strips along the smaller streams are more variable in several respects, but such variations are not important.

This soil is characterized by favorable conditions of productivity, workability, and durability and is, therefore, well adapted to many crops. It is one of the best soils for corn in the county, and on some of the more productive areas corn follows corn year after year. Alfalfa, grass, and clover do well and are used in rotations with corn on some of the less productive areas. This soil is well adapted to barley, but both wheat and oats tend to lodge and are more subject to rust than on the uplands.

From 2 to 4 tons of hay and from 40 to 60 bushels of corn to the acre are common yields. Practically all of this soil is under cultivation, and it is one of the most productive soils in the county. Fertilizers are rarely used.

Huntington very fine sandy loam.—Huntington very fine sandy loam differs from Huntington silt loam primarily in having a little lighter texture. The greater part of Huntington very fine sandy loam occurs along small streams where less uniformity and more frequent overflows are to be expected. Several areas occur immediately along the Holston River banks where the coarser materials are deposited and merge into Huntington silt loam inland from the river. As compared with Huntington silt loam, the soil of these leveelike strips of very fine sandy loam lies a little higher, is better drained, and is more permeable. It is also slightly lower in fertility and in general a little less productive of corn and hay but better adapted to vegetables and tobacco. Yields of corn, hay, and forage crops are probably less than 10 percent lower than on Huntington silt loam. In many places along the river bank very narrow strips, ranging from 30 to 50 feet in width, lie just a few feet above the normal water level. Only a small total area is mapped.

Although the areas of Huntington very fine sandy loam mapped along the smaller streams and drainageways differ in many respects, all the material is washed from soils underlain by limestone. Most of the narrow bottom strips are overflowed frequently, but they do not remain inundated long at a time. Use of these narrow strips depends on the use of the associated sloping lands in many places, but, in general, the use and management of the two Huntington soils are about the same.

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Congaree silt loam.—Congaree silt loam occurs only on the first bottoms along the French Broad River (pl. 3, *A*). In those features discernible in the field it differs from Huntington silt loam chiefly in that it contains a noticeable quantity of small mica scales and has a slightly lower content of lime; that is, it is slightly more acid, according to colorimetric tests. There are doubtless other differences, as the greater part of the Congaree soil material was washed from soils underlain by granitic rocks and quartzites, whereas most of that of Huntington silt loam was washed from soils underlain by limestone.

Congaree silt loam consists of brown mellow silt loam with a yellow cast, to a depth ranging from 12 to 20 inches. This is underlain by brown or yellowish-brown moderately firm friable silt loam extending to a depth of about 30 inches, below which are splotches of rust brown, yellow, and drab. All parts of the soil mass contain many mica scales.

Areas having minor variations in depth to the water table, content of mica, and color are included in mapping. In a few places dark-colored layers are present at a depth ranging from 20 to 30 inches, and, here and there, slight tightness characterizes parts of the subsoil, but such irregularities are not significant. The total area of this soil is not large.

Vegetables are grown commercially on much of this land. Proximity to canning plants and natural adaptation of the soil to these crops account for this special use. In other places the Congaree soils are used much as are the Huntington soils.

This soil is medium acid in most places and seems to be similar to the Huntington soils as regards productivity, adapted use, and problems of management, although the Congaree soil is more responsive to applications of lime and probably is better adapted to some special crops, particularly vegetables. Practically no fertilizers are used for general farm crops, but lime, manure, and commercial fertilizers are used for truck crops. The section on Land Uses and Soil Management gives a more detailed description of the crops grown and the fertilizers used on this and other Congaree soils.

Congaree very fine sandy loam.—Congaree very fine sandy loam is differentiated from Congaree silt loam on the basis of texture, as otherwise the two soils are similar. The relationship between them is the same as that existing between the two Huntington soils.

Congaree very fine sandy loam is restricted, like Congaree silt loam, to the French Broad River bottom lands, and, like Huntington very fine sandy loam, it is developed near the banks of the river where the more sandy sediments are deposited. Like the Huntington soil, it occurs in very narrow strips in many places along the edge of the water and a few feet back. A small total area is mapped.

This soil is devoted to the same crops as are grown on Congaree silt loam, although such crops as tobacco, alfalfa, and small grains grow better on this soil than on Congaree silt loam. Congaree very fine sandy loam is slightly more acid than Congaree silt loam, and some of the plant nutrients may be slightly lower. Yields of most crops are similar on the two soils.

Abernathy silt loam.—Abernathy silt loam occupies depressed areas. It has been washed down the slopes from surrounding soils underlain by dolomitic and other limestones. Although this soil has little or no surface run-off, subterranean drainage through crevices in the limestone bedrock is sufficiently free to afford satisfactory growth of crops.

The soil is variable, and no distinct layers have developed. In most places the surface material, to a depth ranging from 12 to 18 inches, is brown or reddish-brown heavy silt loam. This is underlain by yellowish-brown or reddish-brown heavy silt loam. A very dark colored layer is reached in many places, at a depth ranging from about 2 to 3 feet, which probably was the surface soil before the surrounding land was cleared. Yellow, brown, and gray splotches appear at a depth ranging from 3 to 4 feet, and the deeper material in most places is silty clay.

As this soil occupies depressions, it has not only maintained its productivity but receives highly fertile materials washed from the surrounding areas of Decatur and Dewey soils. Such materials accumulate not only by wash carrying organic and other solid matter, but also by seepage waters carrying materials in solution. Although this soil is not susceptible to erosion, it is injured by deposition of materials brought in from deeply gullied and otherwise severely eroded slopes.

The physical properties of this soil favor tillage, normal percolation of water, and good circulation and retention of moisture. Cultivation changes the character of the surface soil very slowly. Inherent fertility and good drainage make this a productive and valuable soil. It is, however, not very extensive. The greater part occurs in the central red valley, along the main line of the Southern Railway, particularly southwest and northeast of Jefferson City. Smaller areas are scattered in all sections underlain by limestone. A depreciative feature of this soil is its occurrence in many places in long narrow areas, small rounded areas, or well-defined sinks, especially where these are surrounded by soils having vastly different use adaptations.

Areas large enough to receive individual attention are devoted mainly to the production of corn, which yields from 40 to 60 bushels an acre, comparing favorably in this respect with the Huntington soils. The adaptation of this soil is a little broader than that of the Huntington soils. Tobacco and alfalfa are grown to some extent. Like the Huntington and Congaree soils, this soil is not rigid in its requirements of rotation and soil amendments, and little or no fertilizer is used for the common crops.

SECOND-CLASS SOILS

The Second-class soils differ one from another in several respects, although not very widely in productivity, workability, and problems of conservation. Each soil of this division has one or more unfavorable characteristics, such as natural poverty in plant nutrients, scarcity or poor assimilation of organic matter, severe leaching, unfavorable physical properties, stoniness, or injurious erosion. The detrimental effect on the productivity or suitability for cultivation of each of these soils of some one or some combination of such undesirable characteristics is greater than for any of the First-class soils but less than for any of the Third-class soils. The Second-class soils are moderately productive of most of the crops grown in the county. Their physical properties are moderately favorable to tillage and normal circulation and retention of moisture. None of these soils occupies strong relief, and none is extremely stony or severely eroded. Features affecting workability are moderately favorable, and fertility can be conserved by common practices of management. In short, all these soils are reasonably well adapted to most of the important crops of the county. Ten types and phases of the Decatur, Dewey, Talbott, Fullerton, Holston, and Staser series are placed in this class.

Decatur silty clay loam, eroded phase.—Decatur silty clay loam, eroded phase, is the equivalent of Decatur silt loam, slope phase, with approximately two-thirds or more of the silt loam surface soil lost through accelerated erosion.

The surface soil, ranging from 4 to 8 inches in thickness, is reddish-brown silty clay loam, having lost practically all of its original organic matter. The subsoil consists of maroon-red firm dense but brittle silty clay, in most places extending to a depth of 5 to 6 feet. The deeper material is similar to that underlying all Decatur soils.

This soil occupies mild slopes, most of which have a gradient of 8 to 10 percent and nowhere exceeding 15 percent. Drainage, both surface and subsurface, is excellent. The greater part of the small area mapped is in the central red valley, with a few small areas on the Dandridge plain, in close association with other types of the Decatur and Dewey series. A somewhat arbitrary placing of soil boundaries on the map was inevitable in places. Included is a variation of approximately 275 acres, which is underlain by a very uneven rock floor at a depth ranging from 4 to 5 feet, with limestone outcrops rather common. Shale has contributed some material. The principal areas of this variation are near the Holston River north of Jefferson City, in Rocky Valley, and in the valleys south of Bays Mountain.

Crop production is affected by the eroded condition, in that tilth is impaired, the original humus and considerable of the plant nutrients are lost, the rate and capacity of water absorption are decreased, and loss from surface run-off is increased, thereby intensifying susceptibility to further erosion.

In other significant respects this soil is comparable with Decatur silt loam, slope phase. All the land is cleared, and its present use capabilities are, with certain exceptions, similar to those of Decatur silt loam, slope phase. Tobacco is not so well adapted to the eroded phase as to the slope phase, and crop yields are probably 25 percent less than on the slope phase. Acre yields of about 25 bushels of corn, 12 bushels of wheat, from 2 to 3 tons of alfalfa when limed, and 1 ton of other hay may be expected under normal conditions. Fertilizer requirements are about the same for both soils, but problems of management are different. Soil of the eroded phase is more exacting than soil of the slope phase in choice and rotation of crops, tillage methods, and other measures of erosion control. Longer rotations, including a greater proportion of soil-conserving crops, more organic matter returned to the soil, and contour plowing are needed on the eroded phase than on the slope phase.

Dewey silty clay loam, eroded phase.—Dewey silty clay loam, eroded phase, in many respects is similar to the eroded phase of Decatur silty clay loam, the primary difference arising from the character of the lithologic material. It is developed from residual materials weathered mainly from dolomitic or magnesian limestone, rather than high-grade limestone, which gives rise to the corresponding phase of the Decatur soil. The eroded Dewey soil differs from Dewey silt loam, slope phase, primarily in having lost approximately two-thirds or more of its original surface soil by erosion. In other words, the eroded phase of Dewey silty clay loam bears the same relationship to Dewey silt loam, slope phase, that the eroded phase of Decatur silty clay loam bears to Decatur silt loam, slope phase.

The 4- to 8-inch surface soil of Dewey silty clay loam, eroded phase, is reddish-brown silty clay loam, friable when comparatively dry but sticky when wet. The subsoil and deeper material are similar to corresponding layers of Dewey silt loam.

Although areas are distributed in all sections of the county underlain by limestone, the greater part of this soil occurs in the central red valley along the Southern Railway and on the Dandridge plain. It occurs in irregular-shaped areas ranging in size from a very few acres to 200 acres. Drainage is good, and the slope ranges from about 8 to 15 percent. A few chert fragments are scattered over the surface and throughout the soil mass but in most places do not interfere materially with tillage.

Loss of approximately two-thirds or more of the original surface soil by erosion affects crop production on this soil precisely as on the eroded phase of the Decatur soil. The present conditions of tilth, susceptibility to erosion, present use, natural adaptation, yields obtained, fertilizer requirements, and other necessary measures of land conservation (pl. 3, *B*) are about the same for the two eroded soils.

Talbott silty clay loam.—Talbott silty clay loam resembles the Dewey soils in topographic position and somewhat in color. It is differentiated from the Dewey soils primarily in its slighter depth to bedrock and the tougher consistence of the subsoil and substratum.

In the virgin condition, Talbott silty clay loam has a 6- to 8-inch surface layer of gray-brown or yellowish-brown friable silty clay loam, the topmost 2 inches being stained dark with organic matter. The subsoil is tight intractable yellowish-red silty clay or clay, faintly splotched with yellow, extending to a depth ranging from 24 to 30 inches. The material beneath this is variable in color and in content of chert and limestone fragments, but it is consistently heavy textured, plastic, and splotched with yellow, rust brown, reddish brown, and gray, increasingly so with depth to consolidated bedrock.

This soil is underlain by moderately argillaceous limestone. The bedrock floor is jagged and uneven, but its average depth is probably about 5 feet. Depth to bedrock is everywhere much less than in the Dewey soils. Although the tough consistence of the Talbott subsoil probably arises from the argillaceous character of the parent rocks, it is also probable that the shallowness of the soil material has some influence.

The virgin organic material ordinarily is rather rapidly lost under cultivation, largely through erosion, thus changing the surface soil to a lighter and redder color in most places. Tilth also becomes less favorable with increasing time under cultivation. The relief is mild. Most of the slopes range from 8 to 12 percent gradient and nowhere exceed 15 percent. Small scattered outcrops of bedrock are characteristic. Surface drainage is excellent, and internal drainage is fair but moderately slow.

Fairly large areas of this soil are in the central red valley near Talbott and Jefferson City, in Rocky Valley south of New Market, and in other limestone valleys on both sides of Bays Mountain. Practically none is north of the Southern Railway, and only a few small areas occur south of the French Broad River. This soil is closely associated with the less extensive Talbott silty clay loam, eroded hilly phase, with the Dewey soils, and with the more extensive rolling stony land (Talbott soil material). Variations approaching these soils and land types necessarily are included. The degree of toughness of the subsoil varies considerably.

Tightness and impaired permeability of the subsoil and substratum disqualify this for a First-class soil. This physical condition inhibits the absorption and percolation of water, retards the movement of moisture, and ultimately results in a tendency toward extreme alternate wetness and dryness of the surface soil; consequently, crop injury from both wet and dry periods is more severe, and dissipation of organic matter through oxidation and waste in drainage waters is also greater. Restricted absorption of water naturally increases run-off, particularly during heavy rainfall, and this, probably more than any other factor, accounts for the erodibility of this soil.

It is estimated that from 80 to 90 percent of the land has been cleared and put into cultivation. Its natural adaptation, problems of management, and proportion of crops actually grown are about the same as those of the eroded Decatur and Dewey soils. During seasons of normal and well-distributed rainfall, 25 bushels of corn, 12 bushels of wheat, 1 ton of hay, and from 2 to 3 tons of alfalfa an acre may be expected. Yields of all important crops are very sensitive to adverse seasonal conditions. About the same soil amendments are required as on the eroded phases of the Decatur and Dewey silty clay loams.

Talbott silt loam.—The difference between Talbott silt loam and Talbott silty clay loam arises from the more gentle relief of the silt loam, as it occurs on slopes of less than 8 percent. Compared with Talbott silty clay loam, this soil is less eroded and, therefore, has a thicker surface soil, better tilth, and a little higher percentage of organic matter and, probably, of certain other plant nutrients. Owing to the milder slope, it is less susceptible to erosion and less rigid in requirements of crop rotation.

The surface soil, to a depth of 8 or 10 inches, is grayish-brown rather mellow silt loam. The subsoil, substratum, and underlying rock are essentially similar to corresponding layers of Talbott silty clay loam, although the average depth of the jagged bedrock floor is a little greater under Talbott silt loam.

Only a small total area is mapped. The greater part is in the vicinity of Talbott and in Rocky Valley south of New Market, intricately associated with Talbott silty clay loam and smooth stony land (Talbott soil material). Sharp boundary lines separating these soils could not be drawn in all places, and the color of the surface soil, the depth to bedrock, and the degree of tightness in the subsoil differ somewhat from place to place. In many places Talbott silt loam borders Montevallo silt loam, from which it is readily distinguished (pl. 3, *C*). The most important variation consists of an area including about 175 acres in Rocky Valley. This area is nearly level and barely above stream overflow. It is somewhat browner in the surface layer and probably from 10 to 15 percent more productive than normal Talbott silt loam.

It is estimated that the amount of land cultivated, the crops grown, fertilizer used, and soil-management requirements for this soil are about the same as for Dewey silt loam, but average crop yields are estimated to be about 20 percent less on Talbott silt loam.

Fullerton silt loam.—Fullerton silt loam differs from Dewey silt loam, slope phase, primarily in having a lighter colored surface soil, a slightly less red subsoil, and a higher content of chert fragments.

In the virgin state, the 10- to 16-inch surface soil is gray or brownish-gray loose silt loam stained dark in the topmost 2 inches with organic matter. The subsoil is yellowish-red or reddish-yellow moderately firm to somewhat tight silty clay loam that is brittle when dry but moderately sticky when wet. The subsoil extends to a depth ranging from 40 to 50 inches, where it grades into tight silty clay material, dominantly reddish yellow but splotched with bright yellow, brown, and gray.

Compared with Dewey silt loam, the content of plant nutrients is lower and the soil is less productive. The surface rapidly assumes a lighter color when the soil is brought under cultivation. Also, compared with Dewey silt loam, tilth conditions are slightly inferior. Where sufficiently abundant to interfere materially with tillage, the presence of chert fragments is indicated by stone symbols on the soil map.

Fullerton silt loam is developed from materials derived from the moderately cherty beds of Knox dolomite. The relief is not pronounced, the slope gradient ranging from about 8 to 15 percent. The land consists largely of the gentler cherty ridges and lower slopes of the higher and sharper ridges where drainage is well established (pl. 4, *A*). Although surface drainage is excessive in many places, this soil is not quite so susceptible to erosion as Dewey silt loam, and a somewhat smaller proportion has been eroded than of that soil since the land was put under cultivation, owing probably to the presence of more chert fragments.

This is by far the most extensive soil adapted to the growing of crops. An aggregate of 20,672 acres is mapped. Although small areas are scattered in all parts of the county underlain by dolomitic limestone, the greater part of this soil is mapped in a northeast-southwest belt south of Bays Mountain, including the vicinities of Dandridge and White Pine; in a belt parallel and north of Bays Mountain, including Talbott; and northwest of Jefferson City to the Holston River. The areas range in size from a very few acres to about 500 acres.

Fullerton silt loam is geographically closely associated with the Dewey soils, and a great number of transitional areas resembling the latter soils are included. As Jefferson County is near the regional border line between the Fullerton soils to the south and the comparable Frederick soils to the north, the Fullerton soils as mapped approach the Frederick soils, as they are slightly less severely leached, more brown in the surface soil, less cherty, and slightly more productive than normal Fullerton soils farther south.

Another noteworthy variation in Fullerton silt loam is in the consistence of the subsoil and substratum. Several areas on the Dandridge plain just southeast of and parallel to Bays Mountain, north of the mountain in the vicinity of Talbott, and in other places, are characterized by a subsoil that is slightly more tough and intractable and therefore less permeable than is typical of this soil. The subsoil of this variation in general is less cherty than is normal for the Fullerton soils.

Fullerton silt loam is excluded from the First-class soils chiefly because of inherent poverty, which probably is traceable to the parent rock from which the materials accumulated. This soil is low in humus, lime, and mineral plant nutrients, as compared with Decatur silt loam and Dewey silt loam, but higher than the Clarksville soils.

Among the native trees are red oak, black oak, and white oak, although few virgin forests remain on soils suitable for tillage (pl. 2, *B*).

Although this soil is used largely for the production of the general field crops, such as corn, wheat, and hay, more fruit, particularly peaches and berries, is produced than on the Decatur soils. Yields of corn, hay, and tobacco on Fullerton silt loam are probably from 30 to 40 percent lower than on Decatur silt loam and from 15 to 25 percent lower than on Dewey silt loam. The difference in wheat yields on these soils is not great. Under normal conditions, acre yields of 20 bushels of corn, 15 bushels of wheat, 1,100 pounds of tobacco, 2 to 3 tons of alfalfa, and 1 ton of most other hays may be expected. This soil is well adapted to strawberries, although this crop has never been grown extensively in the county. Lespedeza does well, and the new variety, *Lespedeza sericea*, seems to be well adapted. Alfalfa is not nearly so well adapted to this soil as to Decatur silt loam and Dewey silt loam, and liberal applications of both lime and phosphate are essential for successful growth of this crop or red clover.

The following fertilizer recommendations by Director C. A. Mooers (*21*) are based on the results of field experiments and are intended to apply under normal conditions to land including the Fullerton and closely related soils. For corn and small grain, 300 pounds an acre of 5–10–0; small grain to be followed by clover and grass, 400 pounds of 3–10–5; cowpeas, soybeans, and other legumes for hay, 300 pounds of 0–10–6 (only phosphoric acid on new land); tomatoes and potatoes, 500 pounds of 5–10–5; tobacco, 500 pounds of 6–10–5; and meadows and pastures, 300 pounds of 8–10–6.

Fullerton silt loam is not so readily restored to productivity as Decatur silt loam and Dewey silt loam, but it is somewhat less erodible. It is more easily rejuvenated than the Clarksville soils, however, as it is somewhat richer. The underlying rock has weathered to a great depth, in many places from 20 to 40 feet, making the Fullerton soils less sensitive to injury from erosion, and they are more easily built up than soils underlain by bedrock at slight depths, such as the Montevallo and Dandridge soils.

Fullerton silt loam, smooth phase.—The smooth phase of Fullerton silt loam differs from the typical soil in that it occupies smoother slopes of less than 8 percent gradient. Owing to the more level lay of the land, soil of the smooth phase is less eroded, has a deeper surface soil and better tilth, and is richer in organic matter and probably other plant nutrients. Such differences in the two soils are slight, however. The lower layers of the two Fullerton soils, including the underlying formations, are practically identical.

Only a very small area of Fullerton silt loam, smooth phase, is mapped. It is associated with typical Fullerton silt loam in the same parts of the county, and the two soils are used and fertilized similarly. Soil of the smooth phase has an advantage both in crop yields and in the problems of management and conservation. The productivity of soil of the smooth phase can probably be maintained with a 3-year rotation consisting of 1 year devoted to a soil-depleting crop and 2 years to soil-conserving crops, whereas typical Fullerton silt loam probably requires a 4-year rotation. Soil of the smooth phase has practically no erosion problem, as contrasted with typical Fullerton silt loam.

Fullerton fine sandy loam.—The 10- to 18-inch surface soil of Fullerton fine sandy loam consists of loose brownish-gray or gray fine sandy loam. In the virgin state the topmost 1- or 2-inch layer is stained dark with a small quantity of rather poorly combined organic matter, which disappears rapidly under cultivation. The subsoil is moderately firm but friable yellowish-red fine sandy clay extending in most places to a depth ranging from 40 to 50 inches, below which yellow, gray, and brown splotches characterize the reddish-yellow heavy fine sandy clay material.

A stratum of calcareous fine-grained sandstone is associated in many places with the Knox dolomite formation, and this comes near the surface in the northwestern part of the county along the Holston River, where it gives rise to the materials from which Fullerton fine sandy loam is developed. Practically all of the 1,920 acres of this soil occurs in that part of the county. Conspicuous accumulations of fine sand appear in gullies, wagon tracks, and small drainageways; and this condition is characteristic of Fullerton fine sandy loam so far as the soils developed over Knox dolomite are concerned. This soil is associated with the Fullerton and Clarksville soils, and in places the change is gradual between this soil and Fullerton silt loam. The range in slope and drainage conditions is essentially the same as those features of Fullerton silt loam. Sandstone and chert fragments are characteristic over the surface (pl. 4, *B*) and deeper in the soil. They are indicated by stone symbols on the map in areas where they occur in significant quantities.

Although the difference between Fullerton silt loam and Fullerton fine sandy loam is textural and is not great, it is recognized by the farmers. The relatively high proportion of fine sand gives rise to a looser surface soil, and plowing to a given depth requires less power. Porosity of the subsoil and rate of water absorption are increased, but the capacity to retain moisture and probably capillary movement of water are decreased somewhat. At any rate, Fullerton fine sandy loam, locally referred to as "white sandy land," is reported by most farmers to be somewhat more droughty and less durable in productivity. Although no data are available, evidence shows that the white sandy land is not only poorer in inherent fertility but has undergone greater loss through leaching as compared with "red clay land," as Fullerton silt loam is referred to in that locality. It is also reported generally among local farmers that short periods of rest seem to revive the white sandy land more than similar treatment does the red clay land. These differences, however, are slight, and the same crops are grown on the two soils. Yields on the white sandy land probably average only about 15 percent less than those on the red clay land. It is recognized that the red clay land is more tolerant of short crop rotations, and current practice on the white sandy land favors longer rotations including more grass and leguminous crops.

No fertilizer recommendations are available for Fullerton fine sandy loam, but the requirements of this soil probably are similar to those for Fullerton silt loam.

Holston very fine sandy loam.—The surface soil of Holston very fine sandy loam consists of a 10- or 12-inch-layer of light-gray loose very fine sandy loam underlain by pale-yellow friable very fine sandy loam extending to a depth of about 18 inches. In wooded areas the topmost inch is stained slightly dark with a small quantity of poorly combined organic matter. When comparatively dry the 8- to 12-inch surface layer is pulverulent, but a thin layer just beneath this is somewhat firmer. The subsoil is yellow moderately firm friable fine sandy clay or silty clay loam. At a depth ranging from about 3 to 4 feet this layer grades into the fine sandy clay substratum, which is firm, moderately hard when dry, and predominantly red but profusely splotched with yellow and gray.

The scant virgin supply of organic matter disappears soon after the land is put under cultivation and fields assume an almost white appearance, particularly when dry. Owing to the texture, tilth conditions of this soil are very good.

This soil occupies old alluvial deposits on terraces, most of which lie at an elevation of approximately 200 feet, or more in some places, above the present level of the river bed. The land ranges from nearly level to gently sloping, in few places reaching a gradient of 8 percent. Rate of run-off varies with the degree of slope. Drainage, both surface and subsurface, ranges from good to excellent, and erosion presents no serious problem. The terrace deposit everywhere rests on shale formations, which lie at a depth ranging from a few feet to probably as much as 15 feet. The parent materials from which the soil is formed are washed from land underlain by granitic rocks, shales, sandstones, and other rocks and is rather heterogeneous in lithologic character. This terrace deposit has lain in place long enough for soil-forming processes to obscure thoroughly the original identity of the transported materials. Leaching and translocation of materials have advanced to the stage of soil maturity, except where impaired drainage or some other inhibiting factor has intervened. At the base of the terrace material is a gravel stratum of water-rounded pebbles and cobbles, most of which are siliceous.

The greater part of the small area mapped occurs along the French Broad River between Beaver Dam and White Pine, with smaller scattered areas along the Holston River and other parts of the French Broad River.

Holston very fine sandy loam is associated with the Monongahela and Nolichucky soils. The gradational areas between these soils and areas having minor variations in texture and color are included with this soil as mapped. A few areas, one or two along the Holston River and several along the French Broad River, aggregating about 245 acres, are noticeably red in the subsoil. This is the principal inclusion and would have been separated as Waynesboro very fine sandy loam had the total area and significant difference justified the separation.

This soil is considered a Second-class soil rather than a First-class soil chiefly because of the original scarcity of some plant nutrients and depletion of them through long and severe leaching. Field tests indicate strong acidity, and the light color reveals the low content of organic matter. This soil is very responsive to good farming practices, however, and can be built up to a fairly high state of productivity. Some of the more extensive and more typical areas are mapped on one of the largest farms in the county, near Swann Bridge. Here, corn and other staple field crops return high yields. Here, also, are extensive apple orchards and grape vineyards (pl. 4, *C*), which have a generally good appearance, although they are too young as yet to determine the degree of their ultimate success. Applications of lime and phosphate and the growing of sweetclover or other legumes are essential to the successful growth of crops on this soil.

Probably from 85 to 95 percent of this soil has been cleared and put into cultivation. In general, it is used for the production of the staple field crops (pl. 5, *A*), such as corn, rye, hay, and wheat. Some tobacco is grown, but yields in general are low. Alfalfa is not well adapted unless the land is limed and fertilized (pl. 6, *A*). Wheat and lespedeza are better adapted than corn or similar crops. Yields are probably 25 percent lower than on Fullerton silt loam, but tilth and workability favor the Holston soil.

Holston very fine sandy loam, slope phase.—The differences between the slope phase and typical Holston very fine sandy loam are incidental to the steeper slopes, ranging from 8 to 15 percent, characterizing the slope phase. The surface soil is slightly thinner, and the subsoil is more uniformly yellow. Otherwise, the appearance of the two soils is practically the same.

The total area is small. This soil is developed in close association with typical Holston very fine sandy loam. In addition to the minor irregularities, a variation, embracing approximately 552 acres, having a reddish-yellow subsoil is included in mapping. This variation would have been mapped in the Nolichucky series had its extent and agricultural significance justified such a separation.

Probably from 75 to 85 percent of this soil is in cultivation, and the same crops are grown as on typical Holston very fine sandy loam. Crop adaptation and soil amendments required are very similar for the two soils, but yields may be slightly lower on soil of the slope phase. Management problems are greater on soil of the slope phase, as longer rotations, contour plowing, and terracing are necessary on more of the land.

Staser silt loam.—Like the Huntington soils, Staser silt loam occurs only in first bottoms that are subject to periodic flooding. The parent material of the Huntington soils is washed from land underlain largely by limestone, whereas that of the Staser soil is washed from land underlain largely by calcareous shales. The Staser soil is lighter in color, more variable in texture, drainage, and acidity, and is generally less fertile and less productive than the Huntington soils.

Under cultivation the 12- to 18-inch surface soil of Staser silt loam is grayish-brown silt loam that is moderately firm and brittle when dry but rather sticky when wet. The subsoil is brownish-yellow or brown firm silty clay loam. When dry the particles are crushed with greater difficulty than those in the surface soil, but the material is friable, and when wet it is sticky. Faint splotches of yellow and gray appear at a depth of 24 to 30 inches, and the soil material becomes heavier with depth.

Drainage is adequate for such crops as corn (pl. 5, *B*) and hay, but both run-off and internal drainage are moderately slow. The water table is normally higher than it is under the Huntington soils, and the depth to which good drainage extends differs somewhat from place to place. A few small narrow strips, with a total area of less than 50 acres, occurring along the banks of abrupt bends in the streams are sandy. The largest of these are just south of the French Broad River and southeast of Dandridge. A less sandy variation, but still more sandy than the typical silt loam, aggregates about 200 acres. The largest such area is east of Chestnut Hill along and near the head of Clear Creek, and smaller areas are along some of the minor streams associated with the Holston, Nolichucky, Muskingum, and Hanceville soils. These sandier variations are more acid and generally less productive than the typical silt loam, which is nearly neutral or but slightly acid in reaction. A few scattered areas, the largest of which border the Holston River north of Strawberry Plains, are heavier in texture than normal. None of the included variations is large enough to warrant separation on the map.

The largest single area of the typical soil, including nearly one-fourth of the total area, occupies the fairly broad flood plain of Muddy Creek and some of its tributaries south and west of Sandy Ridge. The soil of this area is nearly neutral, or comparatively rich in lime (available calcium). Smaller areas occupy bottom-land strips along both large and small streams, in places where the uplands are underlain by shales.

With the exception of a few narrow bottom-land strips along some of the smaller drainageways, practically all of this land has been cleared and put under cultivation. The same crops are grown as on the Huntington soils, but probably a greater proportion of the Staser soil is devoted to hay and forage crops. Yields, in general, are probably about 25 percent lower than those on the Huntington soils. Some alfalfa is grown on that part of Staser silt loam that is richest in lime.

THIRD-CLASS SOILS

The degree of prominence of one or some combination of such detrimental features as poverty in plant nutrients, undesirable physical properties, shallowness to bedrock, scarcity of organic matter, slope of the land, and conditions of stoniness and erosion, not only determines the class group (Third class) of the following twelve soils but also provides the chief bases on which the soils are separated one from another. Because these detrimental characteristics affect the use capabilities and management requirements of these soils through the conditions of productivity, workability, and problems of conservation, it is equally true that these three factors are more adverse in the Third-class soils than in the First-class and Second-class soils but less adverse than in the Fourth-class and Fifth-class soils. On the bases of differences in internal and external soil characteristics, the Third-class soils include types and phases of the Decatur, Dewey, Fullerton, Clarksville, Dandridge, Montevallo, Leadvale, Hanceville, Jefferson, Monongahela, and Nolichucky series.

Decatur silty clay loam, eroded hilly phase.—The eroded hilly phase of Decatur silty clay loam differs from Decatur silt loam in that it occupies steeper slopes and has lost approximately two-thirds or more of its original surface soil by erosion. It occupies steeper slopes than does Decatur silty clay loam, eroded phase. The surface soils, subsoils, and substrata of the two eroded phases of Decatur silty clay loam are essentially identical, with the probable slight difference that the soil of the eroded hilly phase has undergone more severe erosion.

A very small total area of the eroded hilly phase is mapped in the central red valley along the Southern Railway, especially in the vicinities of Strawberry Plains, New Market, and Jefferson City. This soil is geographically associated with other Decatur soils and the Dewey soils. The relief is characterized by slopes ranging from 15 to 30 percent or more. Natural surface drainage is excessive, and internal drainage is only slightly retarded.

The source of parent materials and the virgin or inherent natural fertility are the same as for Decatur silt loam; but the present impaired condition, owing to erosion, and the natural adaptation and present use are more comparable with those of Decatur silty clay loam, eroded phase. Protection against further erosion involves similar measures on the two eroded Decatur soils but presents a greater problem for soil of the eroded hilly phase because of its steeper slopes. This one significant difference accounts not only for the subdivision of the eroded part of the Decatur soils into two phases but also for the placing of them in different class groups.

Practically all of this soil at some time or other has been cleared and put in cultivation, and probably 75 percent is still in cultivation. The same crops are grown on both eroded Decatur soils, although yields are probably about 10 percent lower on the soil of the eroded hilly phase. Fertilizer needs are probably essentially the same as those for Decatur silt loam, although a little more nitrogen may be required for soil of this phase, as most of the original humus has been lost by erosion. Like the other eroded soils, this soil requires well-planned long rotations, including as many grass and legume crops as efficient management will allow. Measures of conservation and erosion control are even more necessary on the eroded hilly phases of both the Decatur and Dewey soils than on eroded phases occupying gentler slopes. It is advisable to restrict the use of this soil, so far as crops are concerned, to close-growing crops, such as small grains, grass, and legumes, where this can be done consistently with good farm management.

Dewey silty clay loam, eroded hilly phase.—The eroded hilly phase of Dewey silty clay loam resembles the eroded hilly phase of Decatur silty clay loam, from which it differs primarily in the character of the parent soil material and, incidentally, in natural fertility, color, chert content, and susceptibility to erosion. The eroded hilly phase of Dewey silty clay loam differs from Dewey silt loam in slope and in loss of most or all of its surface soil by erosion, and it differs from Dewey silty clay loam, eroded phase, in that it occupies steeper slopes. The surface soils, subsoils, and substrata of the two eroded Dewey soils are essentially the same, although the soil of the eroded hilly phase has lost more by erosion in most places.

Areas of this soil are scattered over all parts of the county underlain by limestone, but the larger ones are in the central red valley, particularly in the vicinity of Jefferson City. This soil is associated with other Dewey soils and, in many places, with the Decatur and Fullerton soils. Minor variations in degree of erosion, texture, and color are included.

In the virgin state, the fertility of this soil equaled that of the other Dewey soils; but, in its present eroded condition, its adaptation, present use, and productivity are very nearly equal to those of Dewey silty clay loam, eroded phase. The two eroded Dewey soils bear the same relation to each other as plant producers as do the two eroded Decatur soils.

Run-off is rapid on this steep hilly soil. Like the hilly Decatur soil, this soil generally should be devoted only to close-growing crops, such as small grains, grasses, and legumes, where consistent with good farm management. Under many conditions and on a great number of farms, the best use is for pasture.

Fullerton silt loam, eroded phase.—Fullerton silt loam, eroded phase, differs from typical Fullerton silt loam in having lost most or all of its original surface soil by erosion.

The 3- to 6-inch surface soil is gray-brown or reddish-brown friable heavy silt loam. The subsoil and substratum are similar to corresponding layers in typical Fullerton silt loam. The small part of this soil still in woodland has a little thicker surface soil, in which the topmost inch or so is stained dark with organic matter.

Like all Fullerton soils, this soil is developed from materials derived from Knox dolomite, or magnesian limestone. It occupies land ranging in slope from about 7 to 15 percent, where natural drainage is very good. As nearly all of the original surface soil has been lost by erosion, run-off is rapid, which results in increased susceptibility to droughtiness and further erosion. Erosion has removed practically all of the original organic matter, tilth conditions have become impaired, and chert fragments have become more abundant on the surface.

Although small areas are widely distributed over nearly all parts of the county underlain by dolomitic limestone, very few are mapped north of the Southern Railway. The larger areas lie between Jefferson City and Colliers Corner and north of Dandridge. This soil is intermingled with other Fullerton soils and grades into the Dewey soils. In many places a tough consistence characterizes the subsoil and substratum.

From 85 to 90 percent of the land has been cleared. A considerable part of it has been abandoned except for pasture, and a small acreage has grown up to brush, sedges, and weeds. The same crops are grown in about the same proportion on this soil as on Dewey silty clay loam, eroded hilly phase. The problem of land management is similar for the two soils. Close-growing crops (small grains, grasses, and legumes) should be the principal crops grown on this soil.

The fertilizer requirements are practically the same as for Fullerton silt loam, except that there is greater need for nitrogen in the eroded soil.

Clarksville cherty silt loam.—The surface soil of Clarksville cherty silt loam, locally referred to as "white gravelly land," consists of a layer of whitish-gray or yellowish-gray cherty silt loam from 8 to 16 inches thick. It is underlain by yellow firm but friable silty clay loam, which becomes tighter, redder, and splotched with yellow and gray with depth. In the virgin state, the topmost inch of soil is stained dark with loosely combined organic matter, which rapidly disappears under cultivation, leaving the plowed soil nearly white when dry. Angular chert fragments, ranging in size from ½ to 5 inches, are scattered over the surface and throughout the entire soil mass. Areas in which these fragments materially interfere with tillage are indicated on the map by chert symbols.

Clarksville cherty silt loam is developed from materials weathered from the poorest grade or most cherty phase of dolomitic limestone (pl. 7, *A*). With some exceptions, this soil occupies slopes and tops of the higher ridges, where natural drainage is well established and the maximum gradient is nearly 15 percent.

Small areas of this soil occur throughout that part of the county underlain by dolomitic limestone. The larger areas are just north and northwest of Jefferson City and southwest of New Market. The total area is small.

In many places Clarksville cherty silt loam grades into areas of the Fullerton soils, with which it is closely associated. A few areas, one southwest of New Market and one about 3½ miles south of Talbott, are less cherty than normal.

Of all the well-drained soils on the uplands underlain by limestone, only Clarksville cherty silt loam is characterized by a yellow subsoil. Field observations and experimental investigations indicate that Clarksville cherty silt loam is the poorest in plant nutrients of all the soils in the county residual from limestone. This deficiency excludes the soil from both the First-class soils and the Second-class soils, despite the fact that most other characteristics are favorable. The fact that probably no more than 50 percent of the land has been cleared, and much of this subsequently abandoned, probably is explained by low natural fertility.

The cultivated areas are devoted largely to the general field crops such as are grown on the Fullerton soils, but yields are much lower and often unprofitable. About 15 bushels of corn, ½ ton of hay, 10 to 12 bushels of wheat, 500 to 600 pounds of tobacco, to the acre, and comparable yields of other staple field crops, are generally reported. Peaches, grapes, strawberries, and Young dewberries (Youngberries) are fairly well adapted to this soil. Wheat, rye, soybeans, cowpeas, lespedeza, and redtop are grown successfully.

Fertilizer recommendations for Fullerton silt loam should apply to this soil with reasonable accuracy, although Clarksville cherty silt loam is poorer in lime, nitrogen, and probably other constituents. Long well-planned rotations that give prominence to leguminous crops are essential, and organic matter should be replenished as often as the cropping scheme allows.

Dandridge silt loam, deep phase.—The deep phase of Dandridge silt loam occurs on the uplands. It is underlain at a depth of about 20 or more inches by shales, which have retained sufficient calcium and magnesium carbonates in a part or all of the upper rock to effervesce freely with 10-percent hydrochloric acid.

The surface soil, to a depth ranging from 8 to 12 inches, is gray or light-gray firm but very friable silt loam. Under a forest cover, the topmost ½ to 1 inch contains a small quantity of organic matter. The subsoil is predominantly yellow silty clay that is firm and slightly hard but brittle when comparatively dry and moderately sticky when wet. Some splotches of gray or brown appear at a depth of 18 or 20 inches, and their numbers increase with depth. Bedrock is reached in most places at a depth ranging from 20 to 34 inches.

The tilth conditions are normally fair in places where the surface soil has not been lost by erosion. Owing to its low content of organic matter and very fine texture, this soil has a tendency to run together and become firm and puddled. The dull-gray (so-called dead gray) or very pale yellowish-gray appearance of this soil in cultivated fields indicates the need of organic matter.

Dandridge silt loam, deep phase, is developed from materials residual from highly calcareous gray or bluish-gray shales, predominantly Athens and Sevier shales. It occurs in areas of milder relief, and few slopes attain gradients of more than 12 percent. Surface drainage ranges from fair to good, but internal drainage is somewhat impeded in many places by the slightly compact character of the subsoil or the presence of bedrock.

This is not an extensive soil. The larger areas are in the vicinities of Kansas School, Ebenezer Church, and Friendship Church. Smaller scattered areas are in nearly all parts of the county underlain by shale, except south of the French Broad River. This soil occurs in association with other Dandridge soils and the Montevallo soils, and small areas of those soils are included in mapping. In a few places the depth to bedrock is as much as 4 feet or more.

Where this soil occurs in association with the redder soils underlain by limestones, it is locally referred to as "white slate land." It is recognized as comparatively low in productivity, largely owing to the low content of both phosphoric acid and nitrogen, rather poor internal drainage, and thinness of subsoil over bedrock. Samples tested by the Tennessee Agricultural Experiment Station indicate that both surface soil and subsoil are strongly acid in reaction.

It is estimated that about 80 percent of this soil has been cleared and put in cultivation to the general field crops. Corn yields about 15 bushels an acre, wheat 12 to 15 bushels, oats 20 to 25 bushels, barley 15 bushels, tobacco 600 to 700 pounds, alfalfa 2 tons, and other hays 1 ton.

The quantities and mixtures of fertilizer required (*21*) and other measures of management are similar to those for Fullerton silt loam.

A, An excellent stand of rye on Holston very fine sandy loam. Rye is well adapted to this soil as a grain, pasture, or green-manure crop and serves effectively as a winter cover crop on the more sloping areas. Note the shortleaf pine in the natural forest in the background. *B*, Dandridge silt loam, hilly phase, in the background, and Staser silt loam in the foreground, a common soil association on farms of the calcareous shale section south of Dandridge. The former soil is used for pasture; the latter for corn, which has yielded as much as 70 bushels per acre on this particular area, hay, and tobacco. "Catwalks" developing on the Dandridge soil warns against overgrazing on such steep areas.

A, A limed well-fertilized field seeded to alfalfa on Holston very fine sandy loam. This soil responds readily to good management. Note the forest of mixed deciduous trees and shortleaf pine in the background. *B*, A landscape of Muskingum, Hanceville, and Jefferson soils with English Mountain in the background. The acreage of tilled land per farm is small and is devoted chiefly to subsistence crops and to a less extent to truck crops that are processed by a local canning factory. *C*, Smooth stony land (Talbott soil material). This land is entirely unsuited to tilled crops but affords good pasture when properly managed.

Montevallo silt loam, deep phase.—This soil is very similar in general appearance to Dandridge silt loam, deep phase, but it apparently has a somewhat more pervious subsoil and lower inherent fertility than that soil. Light-gray or variegated acid shales underlie the Montevallo soil.

The 8- to 10-inch surface soil is light-gray or pale yellowish-gray loose silt loam, the topmost inch of which, in the virgin state, is stained dark with organic matter. The subsoil is yellow moderately firm silty clay or silty clay loam. At a depth ranging from 18 to 24 inches, splotches of gray, reddish yellow, and brown generally appear, and these increase with depth to bedrock, which, in most places, is at a depth ranging from 20 to 30 inches and, in a few places, from 4 to 5 feet below the surface. No part of the shale rock in deep road cuts contains sufficient lime to effervesce with hydrochloric acid.

A small total area is mapped. The larger bodies are within a 4- or 5-mile radius of New Market, the largest areas lying about 4 miles south of that village.

As regards slope, depth to bedrock, use, proportion of land cleared, and variations from the normal, this soil and Dandridge silt loam, deep phase, are about the same. It may be that the Dandridge soil is a slightly better producer of grasses and legumes than the Montevallo soil. Difficulty in building up either is determined largely by the depth to bedrock; the deeper the rock, the less difficult is rejuvenation. The fertilizer (*21*) requirements are essentially the same as those for Fullerton silt loam, and yields of crops are only slightly lower than those obtained on Dandridge silt loam.

Leadvale silt loam.—Leadvale silt loam lies at the bases of slopes and on the outer edges of the bottoms or terraces. The soil material is partly colluvial and partly alluvial, and it has accumulated at the bases of slopes from which it was washed. The Dandridge and Montevallo soils occupy the slopes and contribute the material.

The 10- to 14-inch surface soil is pale grayish-yellow firm but friable silt loam. Under forest cover, the topmost inch or so of soil is stained slightly dark with organic matter. The subsoil is dominantly yellow, firm dense slightly compact silty clay loam. Splotches of bright yellow and brown occur at a depth of 18 to 20 inches and increase in number with depth. The texture generally becomes heavier at this same depth.

Large areas are along the bends of the French Broad River from the mouth of Muddy Creek northeastward to Leadvale. Other large areas border Indian Creek; smaller areas border Sweet Gum Bend of the Holston River and occur along other streams. The soil is not extensive.

The lay of the land is favorable, ranging from almost level to gently sloping. Nowhere does the slope exceed 10 percent. Surface drainage is adequate, although the dense character of the lower part of the subsoil and the substratum retards internal drainage.

This soil is somewhat variable in productivity. Most of it along Muddy Creek is more productive than the rest. The character of the slope land from which the materials have washed, the degree of erosion on such slopes, and internal drainage and moisture conditions largely account for such variations in productivity. Average

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conditions of fertility and productivity are somewhat similar to those of Dandridge silt loam, deep phase, and about the same use is made of the two soils. A little larger proportion of the Leadvale soil has been cleared and put into cultivation.

Hanceville fine sandy loam.—This soil lies at the foot of English Mountain (pl. 6, *B*) on well-drained uplands underlain by fine-grained sandstone, quartzite, and conglomerates.

Hanceville fine sandy loam, to a depth ranging from 10 to 14 inches, is gray or grayish-yellow loose fine sandy loam. This is underlain by a subsoil of brick-red firm but friable fine sandy clay extending to a depth ranging from 3 to 4 feet. The substratum is hard but brittle clayey material and partly disintegrated sandy rock. It is dominantly brownish red and profusely splotched with yellow and gray. Under forest cover the 2-inch surface layer is stained dark with organic matter. The 10- or 12-inch layer immediately below the thin organic surface layer has a faint-yellow cast, and the organic matter soon disappears under cultivation, leaving a gray or faint yellowish-gray color in plowed fields.

A few fragments of sandstone are characteristic over the surface and throughout the soil mass, and areas so stony that tillage is difficult are indicated by stone symbols. Tilth properties otherwise are good.

This is not an extensive soil. It occurs only on the gentler foot slopes of English Mountain, where the gradient ranges from about 10 to 30 percent. Its associations with the Muskingum, Jefferson, and Fullerton soils are so intricate that boundaries had to be placed somewhat arbitrarily in places. Minor included variations resemble Hartsells fine sandy loam.

Like the Dandridge and Montevallo soils, the Hanceville soils are inherently poor in lime, organic matter, and other plant nutrients as compared with the Dewey and Decatur soils. The requirements for soil amendments (*21*) are about the same as those of Fullerton silt loam.

Apples, peaches, grapes, and most vegetable crops are well adapted to this soil, and some of these are grown successfully, but the greater part of the cultivated soil is devoted to such field crops as corn, hay, wheat, and some tobacco. Probably 60 percent of the land has been cleared and put in cultivation. Yields of the important field crops are probably 10 percent lower than on Fullerton silt loam. Crop rotation and other farming practices should be directed with the object of controlling erosion and improving the fertility of the soil.

Jefferson gravelly fine sandy loam.—Jefferson gravelly fine sandy loam is developed from colluvial-alluvial wash deposited near the foot of English Mountain (pl. 7, *B*) and along the heads of small streams originating in the mountains. The materials are washed almost entirely from Hanceville and Muskingum soils.

The 10- to 16-inch surface soil is grayish-brown gravelly loose fine sandy loam. The subsoil is brownish-yellow or reddish-brown gravelly or cobbly friable sandy clay extending to a depth ranging generally from 2 to 4 feet. This rests on a substratum that is extremely variable as to content of water-worn gravel, drainage, color, and texture. In many places the abundance of gravel in the surface soil interferes materially with tillage.

This soil is variable, not only in its characteristics and thicknesses of the different layers, but also in topographic position. A part occupies first-bottom land, a part terrace or second-bottom land along small streams, and a part occurs as deposits at the foot of the mountain from which the materials are washed. Small areas having a red subsoil resemble the Allen soils.

This is not an extensive soil. Probably 50 percent of the land has been cleared and is used largely for the production of corn and hay crops. Less fruit and vegetables are grown on the Jefferson soils than on Hanceville fine sandy loam, but, on the first bottom, corn and hay return higher yields than on that soil. Otherwise, crops and farming practices on these two soils are very similar.

Monongahela very fine sandy loam.—Monongahela very fine sandy loam is closely associated with Holston very fine sandy loam on the older high river terraces. The Monongahela soil differs from the Holston soil largely in having a compact slowly pervious layer in the lower part of the subsoil.

The 10- to 12-inch surface soil is gray loose very fine sandy loam. The subsoil is yellow firm but friable very fine sandy clay extending to a depth ranging from 20 to 24 inches. At this depth is a compact slowly permeable fine sandy clay layer, which, in most places, is prevailingly pale yellow splotched with dull brown and gray.

The content of organic matter is low, and this material is poorly combined even in the virgin state. It disappears rapidly under cultivation, and as a result the plow soil is nearly white when dry. Tilth conditions are good, and the lay of the land is favorable, as the slope nowhere exceeds 7 percent. Surface drainage ranges from good to very good, but internal drainage is somewhat impeded by the compact lower subsoil layer. A small total area is mapped.

Probably about 85 percent of this soil is in cultivation. It is used and handled very much as is Holston very fine sandy loam, but crop yields are estimated to be from 15 to 25 percent lower. Monongahela very fine sandy loam is severely leached and very acid. It needs liberal supplies of lime, organic matter, and complete fertilizer. Erosion is not a serious problem.

Monongahela very fine sandy loam, slope phase.—Like Holston very fine sandy loam, Monongahela very fine sandy loam, slope phase, lies on the old high terraces of the two rivers in the county. It occupies the slopes of the terraces, which lead down to either the underlying residual material or to bottom land.

The 8- to 12-inch surface soil consists of gray or light-gray loose very fine sandy loam, and the subsoil is yellow or brownish-yellow very fine sandy clay. In the virgin state, the topmost inch or two of the soil is stained dark with loose poorly combined organic matter, which dissipates rapidly under cultivation and leaves the plow soil nearly white when dry. The subsoil is thin and rests on a tight slowly pervious substratum at a depth ranging from 20 to 30 inches. The substratum varies in color and texture, but it is consistently tight and slowly pervious. In many places it is residual from the underlying shale formation.

Water-worn gravel and cobbles, locally referred to as "river slicks," are characteristic on the surface and throughout the soil mass. Tilth conditions otherwise are good.

This soil occurs in close association with the Nolichucky, Holston, and other Monongahela soils, and small transitional bordering areas resembling such associatd soils are included in mapping. The most significant variations are probably those of intensity of compactness in the substratum and in its depth from the surface.

Although this soil occurs on nearly all of the higher terraces of the two rivers, the larger areas are along the Holston River in Sweet Gum Bend north of Strawberry Plains, along the French Broad River southeast of White Pine, and in the large river bend south of Nina. The slopes range in gradient from about 8 to slightly more than 15 percent, the greater part being less than 15 percent. Surface drainage is good to excessive, but internal drainage is slightly retarded by the tight substratum.

Developed from materials poor in plant nutrients, this soil is also limited in suitability for the growing of crops by its susceptibility to erosion. This erodibility is due largely to the slowly pervious character of the substratum and the underlying residual material, which is within 3 feet of the surface in most places.

It is estimated that from 50 to 60 percent of this soil has been cleared and put in cultivation, much of which since has been abandoned. Staple field crops are grown. Yields are probably 25 percent lower than on Fullerton silt loam, and the crops on the slope phase of Monongahela very fine sandy loam are much more adversely affected by drought or excessive rainfall. This soil is near the lower range of the land adapted to crops. Where factors other than those of the soil and land favor its use for pasture or forest, it might well be devoted largely to these uses. Where crops are to be grown, close-growing ones should be favored.

Nolichucky very fine sandy loam.—Nolichucky very fine sandy loam occurs in close association with the Monongahela and Holston soils. It differs from Holston very fine sandy loam in having a dominantly red comparatively heavy subsoil and from Monongahela very fine sandy loam in both the color and structure of the subsoil.

In cultivated fields the surface soil of Nolichucky very fine sandy loam is light-gray or grayish-yellow very fine sandy loam about 16 inches thick. The subsoil is light-red, red, or reddish-brown hard stiff but brittle clay or heavy very fine sandy clay. It extends to a depth ranging from 3 to more than 4 feet, where it generally grades into mottled light-red and yellow heavy fine sandy clay or clay. In some places at this depth a large quantity of small rounded quartz or quartzite pebbles and a few rounded cobblestones are mixed with the clay. The land ranges from almost level to sloping. Surface drainage is good, but internal drainage is moderately slow.

Only a small total area is mapped. A few bodies are along the Holston River northeast of Strawberry Plains; but most of this soil occurs along the French Broad River, some south of White Pine, some in the river bends at and east of Dandridge, and some south and east of Shady Grove.

As regards natural adaptation, use, proportions in the various crops, yields, methods of land management, and fertilizer practices, Nolichucky very fine sandy loam is similar to Monongahela very fine sandy loam.

FOURTH-CLASS SOILS

No one of the soils in the three classes discussed so far in this section has such extremely adverse conditions of natural productivity, workability, or erodibility as to be unfit for the production of cultivated crops. Although the Fourth-class soils are characterized by extremely adverse conditions of workability, erodibility, or both, they are at least moderately productive of pasture grasses. Their natural fertility is fair, and their moisture content is moderate to high. Pasture is the best and most extensive use of these soils. Despite their common use, these soils differ widely one from another in development of both internal and external soil characteristics; and they are classified on the bases of such differences in six types and phases of the Dewey, Fullerton, Talbott, Dandridge, and Tyler series; alluvial soils, undifferentiated; and two miscellaneous land types.

Dewey silty clay loam, steep phase.—Under forest cover this soil has a 6- to 12-inch surface soil consisting of brown or reddish-brown silty clay loam. The topmost 2 inches is stained dark with well-combined organic matter. The subsoil is red moderately firm brittle silty clay or silty clay loam, which extends to a depth ranging from 4 to 6 feet. It rests on a substratum of reddish-brown moderately tight silty clay splotched with yellow, gray, and bright red. Here and there, small patches of chert are on the surface and throughout the soil mass.

A small area about 3 miles west of New Market resembles the Decatur soils and would have been so mapped had the total area been sufficient to justify such separation. Other minor variations also are included.

The total area is small. The largest body is about 3 miles southeast of Jefferson City on the road to Dandridge. Small areas are promiscuously scattered in association with other Dewey soils.

As this soil is inherently fertile and productive and retains moisture well, it is well adapted to permanent pasture and will support a vigorous growth of forest. Probably from 30 to 40 percent of this soil has been cleared and put into cultivation to the general field crops, but the use of practically all of the land has been changed to pasture after serious injury from erosion. Such land never should be cultivated but should be planted to close-growing crops, preferably grass, soon after clearing, in order to conserve the virgin fertility and prevent gullying. This soil is rather susceptible to erosion. An acre application of 300 pounds of an 8–8–5 mixture of commercial fertilizer and a moderate application of lime are recommended for pasture land (*21*).

Fullerton silt loam, hilly phase.—Fullerton silt loam, hilly phase, differs from typical Fullerton silt loam in that it occupies slopes ranging from 15 to 30 percent. It occurs in close geographic association with the Dewey, Clarksville, and other Fullerton soils. It is distinguished from the Dewey soils in that it has a grayer surface soil, a lighter colored and lighter textured subsoil, and a large quantity of angular chert fragments on the surface and throughout the soil. It is slightly less subject to erosion than Dewey silty clay loam occupying the same slope and under the same cultural methods.

In virgin forest areas the surface soil of Fullerton silt loam, hilly phase, is brownish-gray mellow silt loam, which extends to a depth ranging from 8 to 15 inches. The subsoil is yellowish-red or light-red firm but brittle silty clay loam or silty clay, continuing to a depth ranging from 40 to 50 inches. The substratum consists of reddish-brown rather tight silty clay splotched with gray, yellow, and bright red. It contains a noticeable quantity of angular chert fragments.

Included with Fullerton silt loam, hilly phase, are several areas that have been cleared and cultivated for a number of years. As a result of this, erosion has removed a large part, in some places all, of the original surface soil and, in places, even a part of the subsoil. Here, the surface soil, where present, is grayish-brown or reddish-brown heavy silt loam. The subsoil and substratum are similar to those in the forested areas. In the extreme northern part of the county along the Holston River the surface soil is gray fine sandy loam or very fine sandy loam. These areas are not separated, because of their small extent and minor agricultural significance. Several areas about 2 miles east of Pleasant Ridge School and in the vicinity of Swann Bridge have subsoils somewhat heavier and less pervious than normal for the Fullerton soils. In this respect these areas resemble Talbott silty clay loam.

Fullerton silt loam, hilly phase, comprises a total area of 22,080 acres, or 11.1 percent of the county. The areas of this soil are well scattered over localities underlain by dolomitic limestone. Some of the largest areas are north of Swann Bridge, around Dandridge, northwest of White Pine, northwest of Jefferson City, along Bays Mountain, and northwest and southwest of New Market.

This soil is well to excessively drained. Probably from 25 to 30 percent of the land has been cleared and cultivated, but a considerable part of the once-cultivated land has been abandoned or placed in pasture or forest because of general deterioration of the soil. The areas under cultivation are devoted chiefly to the production of corn, small grains, and hay crops. Yields average less than those obtained on typical Fullerton silt loam.

A small part of Fullerton silt loam, hilly phase, can be used for farm crops, provided precautionary measures of conservation are taken. Close-growing crops, including small grains, grasses, and legumes, should be favored. The greater part, however, should be used for permanent pasture, and grass should be seeded immediately after the land is cleared of its forest growth. Some of the more seriously eroded areas should be used only for forestry. On the less seriously eroded areas of this soil, lespedeza does well and is grown extensively. It is recommended that 300 pounds of 5–10–5 fertilizer and lime be applied to the land when seeded to a clover and grass mixture.

Talbott silty clay loam, eroded hilly phase.—This soil differs from typical Talbott silty clay loam primarily in the lay of the land and the incidental greater loss of surface soil by erosion. Otherwise, the several layers of the two soils are practically identical.

The 4- to 8-inch surface soil consists of yellowish-brown or reddish-brown firm but friable silty clay loam. The subsoil is yellowish-red tight tough silty clay, in which faint splotches of yellow appear at a depth ranging from 20 to 24 inches. Below this the number of red and gray splotches and the degree of toughness increase with depth to bedrock, which in most places is from 4 to 6 feet below the surface. Practically all of this land has been cleared and is now either cultivated, used for pasture, or lying idle.

Although this eroded hilly soil differs primarily from typical Talbott silty clay loam only in its more rugged relief and the incidental additional erosion, it is much less suitable for growing crops. Because of increased erosion, more bedrock is exposed and more water is lost by run-off than in the typical soil, thus increasing susceptibility to both droughtiness and further erosion. In addition, the workability of the land is less favorable and the problem of conservation is more difficult on the eroded hilly phase. Crop adaptations are more narrow than on the typical soil, and larger rotations, including a generous proportion of legumes and grasses, are required. It is generally more economical to use this land for pasture.

A small total area is mapped, chiefly near Talbott and Dandridge. Smaller areas are scattered in nearly all parts of the county underlain by limestone, except north of the Southern Railway. This soil is associated with the typical Talbott and Dewey soils, and rolling stony land (Talbott soil material), and variations approaching these soils in character are included. Also included in mapping are areas having minor variations in degree of toughness of the subsoil. The small part of this soil still in original forest is less severely eroded.

The parent material is similar to that of typical Talbott silty clay loam. Drainage conditions of the two soils differ only in that run-off is more rapid on the eroded hilly soil, where the slopes range from 15 to nearly 30 percent. Small outcrops of bedrock, which are indicated by symbol on the accompanying soil map, are characteristic, but few are of sufficient extent to interfere seriously with cultivation. Tilth conditions are similar to those of the other eroded soils.

As compared with Dewey silty clay loam, eroded hilly phase, a little smaller proportion of this soil is now in cultivation, but about the same crops are adapted, similar yields are obtained, and similar fertilizer requirements and other measures of management are used. This soil, however, is more susceptible to erosion and a little less productive than the Dewey soil, and most of it is best suited to pasture.

Smooth stony land (Talbott soil material).—Smooth stony land (Talbott soil material) is locally known as "rock land," "limestone rock land," or "glady land." These terms are applied to this character of land because of the numerous outcroppings and ledges of limestone rock. Some of the areas are very stony; that is, too stony for any use except forestry, although perhaps 50 percent or more of the smooth stony land is suitable for the production of grass and affords good pasture (pl. 6, *C*). The depth of the soil material between the ledges and outcroppings of rock varies considerably, the deepest part generally being farthest away from the rock. Most of the soil material resembles that of the Talbott soils. In a few places there is only a thin covering of soil over the rock, and commonly such areas are developed on the more nearly level relief. In general, this smooth stony land is nearly level, and in the more sloping areas the slope does not exceed 7 percent.

Only a small total area of this land is mapped. It occurs in close association with other types of stony land, particularly in Rocky Valley. The principal variation included is an area of about 500 acres in Rocky Valley, which is nearly level and imperfectly drained. This area is more productive of grass than the normal smooth stony land. Other parts of the smooth stony land are well drained.

The use capabilities of both the smooth and rolling stony land (Talbott soil material) are about the same, although better permanent pastures may be expected on the smooth stony land.

Rolling stony land (Talbott soil material).—Rolling stony land (Talbott soil material) is commonly referred to as "rock land" or "limestone rock land." In most places outcropping limestone bedrock occupies from 10 to 50 percent of the surface of this land; and in most places the soil material filling the spaces between the rocks is similar to that of the Talbott soils. The surface soil varies in texture from silt loam to silty clay, in depth over rock from a few inches to several feet, and it also varies somewhat in structure and consistence. The color ranges from yellow to brown and somewhat red. About 400 acres southeast of Talbott consists of brown waxy soil material resembling the Colbert soils in consistence. This variation is locally referred to as "black waxy land." Protrusions of the bedrock rise above the surface less than a foot in most places, but they reach twice that height in many places. Older inhabitants point out areas of such land that have, within their memory, been reduced to this condition by erosion.

A total of 11,840 acres of this land type is mapped. The larger areas are around Talbott and along Bays Mountain. Important areas occur along Shields Ridge, northwest of Dandridge, and in Rocky Valley. This land occupies slopes ranging from about 15 to 30 percent.

The rocky character of this land definitely excludes it from use for cultivated crops, but it is reported to produce earlier spring pasture than any other soil in the county. Bluegrass does well and is good in spring, early summer, and late fall, but it affords scant grazing in midsummer and early fall. A few farmers have resorted to seeding a part of this land to Bermuda grass for midsummer grazing. The rocky surface will not allow the use of mowing machines in suppressing weeds, and this is a handicap in growing pasture.

A noteworthy difference exists between this kind of limestone rock land in the great valley of east Tennessee and that of the central basin section of the State, arising from the fact that the rock strata are severely tilted under the great valley and practically horizontal under the central basin. The rock land of the central basin is more erodible and droughty, owing to the less absorptive character of the land, and as a result there is heavier loss of water by run-off. Because of the horizontal position of the rocks in the central basin, water comes to the surface on slopes, whereas it does so only in a few places in the great valley.

Although no chemical data relating to this land are available, it is assumed that it is fertile and rich in most plant nutrients. Poor physical characteristics, however, reduce its productivity. The soil is young and leaching has been slight, which may account for the early spring crop of bluegrass. The greater part of this land is devoted to permanent pasture, and this seems to be its best use under prevailing conditions. Most of the so-called black waxy land southeast of Talbott will produce nothing but a scant forest growth, mostly of red cedar.

Dandridge silt loam.—Dandridge silt loam differs from Dandridge silt loam, hilly phase, discussed hereafter, primarily in that it occupies gentle slopes of less than 15 percent gradient. It is, of course, less erodible, probably averages somewhat deeper over bedrock, and therefore is slightly more productive than the soil of the hilly phase. Otherwise, these two Dandridge soils are essentially identical.

This is not an extensive soil. For the most part, it occupies ridge tops and areas near the foot of the slopes, where it is intricately associated with the other Dandridge soil.

Although Dandridge silt loam is not nearly so erodible as Dandridge silt loam, hilly phase, it is very susceptible to erosion and also to injury from this cause. For this reason the use of this land should be restricted to close-growing crops and pasture where consistent with farm management. Dandridge silt loam is well suited to bluegrass and certain leguminous crops and is probably about 15 percent more productive than Dandridge silt loam, hilly phase.

Dandridge silt loam, hilly phase.—Dandridge silt loam, hilly phase, is the most extensive soil in the county, 27,840 acres being mapped. It is developed chiefly from materials derived from calcareous shales, and it occupies slopes and ridges produced by deep dissection of a former plain. Nearly three-fourths of the total area occupies slopes exceeding 30 percent. The Dandridge soils are locally referred to as "slate land" or "blue slate land."

This soil differs from typical Dandridge silt loam primarily in that it occupies hills, knobs, narrow ridges, and steep slopes and in that the bedrock is within less than 20 inches of the surface.

Under forest cover the 2-inch surface layer is a grayish-brown loose silt loam stained dark with organic matter. It is underlain by brownish-yellow firm but friable silty clay loam extending to a depth of about 8 inches. The subsoil is brownish-yellow silty clay that is hard when dry and sticky and plastic when wet. At a depth ranging from about 10 to 18 inches the subsoil rests on partly disintegrated calcareous blue shale. In many places the upper part of the shale has lost its carbonates and has assumed a yellow cast.

This soil varies considerably from place to place in texture, color, consistence, and depth to bedrock, which ranges from a very few inches to nearly 2 feet. Several areas about 3 miles northwest of Strawberry Plains are somewhat lighter in texture and more friable than normal, and several areas southeast of Swann Island and south of McMann Island are heavier in texture and more plastic than normal. Such minor variations were not considered sufficiently important to map separately.

With the exception of a large area north and northeast of Strawberry Plains and another west of White Pine, most of this soil is on the dissected shale plain south of the French Broad River. It occurs characteristically in large continuous areas, some of which cover several square miles.

Shallowness of soil over bedrock, rugged and rough terrain, and high susceptibility to erosion are the chief features that exclude this soil from the First-class, Second-class, and Third-class soils.

The calcareous character of the parent material, or inherent fertility of the soil, largely explains the adaptation of bluegrass and legumes. Clovers and other legumes do well under favorable moisture conditions but are very sensitive to dry weather.

Probably from 10 to 15 percent of this soil has been cleared, cultivated a few years, eroded, and abandoned to nearly worthless pasture or has become virtually wasteland. In a few places cultivation is still being attempted, and destructive erosion is conspicuous (pl. 8, *A*). This soil should be devoted to pasture immediately after clearing if the forest cover is to be entirely removed. Some of the steeper slopes and knobs, particularly where the soil is severely eroded and thin over shales, should remain in or be returned to forest.

Tyler silt loam.—The greater part of Tyler silt loam occupies level or depressed positions on old high terraces where the Holston and Monongahela soils predominate. The soil materials consist of old river deposits washed from land underlain for the most part by acid rocks.

The 10- to 16-inch surface soil is nearly white or light-gray silt loam, in places splotched with gray, yellow, and rust brown. The subsoil is dominantly drab to nearly white practically impervious tough plastic silty clay mottled with yellow, gray, and rust brown. Little organic material is preserved, owing probably to a condition of alternate wetting and drying of the surface soil.

Two rather distinct yet minor variations are included. One is the very mild slopes surrounding the depressions and nearly level areas in which the typical soil occurs, and the other is the many small poorly drained depressions scattered throughout the uplands underlain by limestone. These variations have little agricultural or other significance.

The larger areas of this rather inextensive soil are on the French Broad River terraces south of White Pine, and small areas are on other terraces widely distributed in nearly all parts of the county underlain by limestone.

Although this soil could produce moderately good forest, it probably is better used for pasture on most farms, under present conditions. Redtop and lespedeza are fairly well adapted to the better drained areas, but liberal applications of lime and fertilizer probably are necessary for the satisfactory growth of grass.

Alluvial soils, undifferentiated.—Alluvial soils, undifferentiated, occupy poorly drained parts of the first bottoms, mostly those of the smaller streams. Although the greater part of the materials is washed from uplands underlain by limestone, a part is from shale land, which largely explains the "undifferentiated" qualification. The greater part of this land, predominantly silt loam, is characterized by a variety of textural, color, and drainage conditions. A small total area is mapped.

The 10- to 14-inch surface soil of the more nearly uniform areas is mellow brown silt loam, which in places is splotched with rust brown. The subsoil is dominantly brown silt loam or silty clay loam, splotched with rust brown, yellow, and gray, the proportion of gray splotches increasing with depth.

A, Clarksville cherty silt loam, one of the less productive soils derived from limestone materials. Note the gray surface soil and the abundance of chert, which interferes with tillage in many places. *B*, A farmstead of the subsistence type on Jefferson gravelly fine sandy loam in the vicinity of English Mountain.

A, A steep area of Dandridge silt loam, hilly phase, severely eroded by overcropping. Note the eroded hill in the right background, where it would be difficult to establish a grass cover. This is an example of practically destroying possibilities for pasture by wrong use of land. *B*, Rough gullied land (Montevallo soil material), a condition brought about as a result of incorrect land use and soil management. Because of their shallowness and low fertility, the more sloping Montevallo soils probably should be devoted only to forestry. The only remaining tillable acreage is the upper part of the slope where less run-off occurs.

Alluvial soils, undifferentiated, occur in places on small stream bottoms marking the boundary between shale and limestone formations, such as that along Long Creek, where the greater part of these undifferentiated soils are mapped. Several small areas occur in the Holston River bottoms north of Strawberry Plains, and here also the materials are of mixed shale and limestone origin. Although drainage conditions vary widely from place to place, the limited extent of extreme variations do not justify separation on the map.

Although probably 40 percent of this land is cultivated to corn and hay crops (mostly hay), the greater part of the cultivated area is artificially drained and overflow is frequent. Under natural drainage conditions this land is well adapted to the production of grass or to permanent pasture, and most of it is so used.

FIFTH-CLASS SOILS

Like the Fourth-class soils, each of the Fifth-class soils is characterized by some one or a combination of very unfavorable or detrimental soil or land features and therefore is not physically suited for growing cultivated crops. Unlike the Fourth-class soils, however, each of the Fifth-class soils is low in inherent fertility or has unfavorable moisture conditions and is therefore unsuited not only for growing crops but also for pasture. The Fifth-class soils are classified through what virtually amounts to a process of elimination; and, although these soils grow forest trees more slowly than the soils of any other group in the county, they may be thought of as being adapted to forest because they are not well adapted either to crop growing or to grazing. Factors arising from other existing conditions, either of the locality or of the individual farm unit, may overshadow physical land adaptations.

Although all the Fifth-class soils are characterized by features that disqualify them for any of the preceding classes, they differ one from another in many respects, and each possesses its individuality. On the basis of such differences, they are classified and mapped in five distinct soil types and phases of the Fullerton, Clarksville, Montevallo, and Muskingum series and four miscellaneous land types.

Fullerton silt loam, steep phase.—Practically all of Fullerton silt loam, steep phase, is still in forest, the use to which it probably is best suited under existing conditions. It differs from typical Fullerton silt loam primarily in occupying steeper slopes. The soils of the two separations are similar; that is, the surface soil, subsoil, and substratum of this soil are practically identical with the corresponding layers of typical Fullerton silt loam, with the difference that the soil of the steep phase is thinner because of more rapid run-off and normal erosion.

The greater part of this soil is in the northern part of the county and in the Bays Mountain belt.

This soil is ill suited for tilled crops, chiefly because of the steep rough terrain, although natural poverty, chertiness, heavy loss of water by rapid run-off, and therefore erodibility, are factors of consequence. It is not well adapted to pasture, primarily because of steep slope, low productivity, and heavy loss of water by rapid run-off. It occupies slopes of more than 30 percent.

Clarksville cherty silt loam, hilly phase.—Clarksville cherty silt loam, hilly phase, differs from typical Clarksville cherty silt loam primarily in occupying steeper slopes, although other differences, such as a higher proportion of chert, greater susceptibility to erosion, and thinner surface and subsoil layers, characterize the hilly soil.

Practically all of this land is still in forest; and, because of natural poverty, rough terrain, chertiness, and heavy loss of rainfall through run-off, it should and probably will remain in forest.

Only a small total area is mapped. Some of this occurs in the northern part of the county, and most of the rest is in the Bays Mountain belt.

Rough gullied land (Dewey soil material).—Rough gullied land (Dewey soil material) includes mainly Dewey, Decatur, and Fullerton soils occupying slopes ranging from 8 to more than 30 percent. Approximately 28 acres is nearly level land. Erosion reduced the land to a network of gullies. This separation, therefore, is not a true soil but represents a land condition. The individual owner ordinarily cannot afford to reclaim this severely eroded land, as it requires diversion terraces or ditches, revegetation, and seeding for restoration through natural vegetative and other processes.

Small areas are widely scattered throughout the central red valley, on the Dandridge plain, and throughout the Bays Mountain belt. Some of the larger areas are west and northwest of New Market and in the vicinity of Piedmont. Some of the areas in the Bays Mountain belt and on the Dandridge plain are not eroded so severely as those in many other localities.

All this land was once fertile and productive, but it was cleared, put under cultivation with poor practices, and allowed to erode to this extent. It has since been abandoned to nearly worthless pasture or practically idle land, or has become naturally seeded to pine with small proportions of other trees.

In its present condition it is not economical for the owner to attempt the production of pasture, and, through elimination, the land is allocated to forest use. Shortleaf pine and black locust probably are the best adapted trees.

Montevallo silt loam.—Montevallo silt loam is developed from the weathered products of noncalcareous silty shales similar to those underlying Montevallo silt loam, deep phase.

The 4- to 8-inch surface soil is grayish-yellow or light-gray friable silt loam. The subsoil is brownish-yellow firm or slightly sticky silty clay or clayey silt, resting, at a depth ranging from 8 to 18 inches, on the soft shale bedrock from which its parent material is residual. Under a forest cover, poorly combined organic matter stains the topmost inch of soil. In places, splotches of yellow, gray, and brown are present in the lower part of the subsoil.

Like the other Montevallo soils, this soil is inherently poor. Erosion partly explains the slight depth to bedrock on the steeper slopes, which range from 7 to 15 percent. About 200 acres of this soil, however, occupies nearly level land, and here shallowness apparently is not due to erosion. Practically all of this variation is mapped in Rocky Valley. Most of this level land has been cleared and put into cultivation to the general field crops. Yields are very low, and the greater part has been allowed to revert to very poor pasture or is virtually wasteland.

This is not an extensive soil. It is closely associated with the soils of the hilly and deep phases of Montevallo silt loam. In a few places, boundaries separating this soil from Dandridge silt loam are somewhat arbitrarily placed. Largely because of natural poverty in plant nutrients, erodibility, extreme sensitiveness to injury from erosion, and slight depth to bedrock, this soil is best devoted to forestry.

Montevallo silt loam, hilly phase.—The hilly phase of Montevallo silt loam differs from the typical soil primarily in that it occupies steep slopes, and the soil ordinarily is considerably less than 18 inches thick.

In places the surface soil, to a depth ranging from 4 to 8 inches, is grayish-yellow friable silt loam. The subsoil consists of brownish-yellow firm to sticky silty clay and rests on the noncalcareous shale bedrock, from which the parent material is residual. Within the small part cultivated are areas here and there consisting of grayish-yellow shaly silt loam only a few inches thick over shale. Under forest cover the topmost inch is stained dark with poorly incorporated organic matter.

Like other shallow soils over bedrock, this soil is somewhat variable in color, consistence, and even in moisture conditions, especially in the subsoil.

This soil occupies hills, rounded knobs, and narrow winding ridges with steep slopes, most of which exceed a 30-percent gradient. Probably 30 percent of the land has been cleared and cultivated with poor practices long enough to become severely eroded and abandoned. Most of this steeper land remains in partly harvested forest.

This is a fairly extensive soil. The larger areas are developed in the Bays Mountain belt and on the dissected shale plain north of English Mountain, but a few large areas are north of Jefferson City, in Rocky Valley, and in other parts of the county underlain by acid shales.

This soil is not adapted to the growth of crops, primarily because of shallowness, natural poverty, rough terrain, high erodibility, and extreme sensitiveness to injury resulting from erosion; and it is not well adapted to pasture, largely because of steep slopes, low productivity, and large loss of water by run-off. It is used chiefly for forestry. A good stand of Virginia pine is growing on this soil near Jefferson City, and shortleaf pines grow in some places.

Rough gullied land (Montevallo soil material).—As regards condition of erosion, rough gullied land (Montevallo soil material) is similar to that of rough gullied land (Dewey soil material). The soil material of both land types has been practically destroyed by a close network of gullies (pl. 8, *B*). The important difference between the two land types is that bedrock is only a few inches to a few feet beneath the surface in the Montevallo land type, whereas it ranges from 20 to 30 feet beneath the surface of the Dewey land type. The Montevallo soil material is residual from shale, whereas the Dewey soil material is derived from dolomitic limestone. The Montevallo land, therefore, is inherently the poorer of the two types.

A considerable part of this land type is underlain by calcareous shale. This would be separated as rough gullied land (Dandridge soil material) were it not for its small extent and lack of agricultural significance.

The greater part of this land is on the dissected shale plain south of the French Broad River south of Pleasant Hill and in the Bays Mountain belt, but small areas are in nearly all parts of the county underlain by shale. This land should be devoted to forest, probably of pines.

Muskingum stony fine sandy loam.—Like Hanceville fine sandy loam, Muskingum stony fine sandy loam is developed from materials derived from sandstones, quartzites, and sandy conglomerates; but, unlike the Hanceville soil, it has a yellow subsoil, is very stony, and occupies a rougher terrain.

The 10- to 18-inch surface soil is gray loose fine sandy loam; the subsoil is brownish-yellow friable fine sandy clay; and the substratum is moderately hard but brittle to friable fine sandy clay material, in which bright red, yellow, and gray appear in about equal proportions. In the virgin state, as most of this soil is, the 1- to 2-inch surface layer is stained dark with loosely combined organic matter. Loose sandstones from 5 inches to 1 foot or more in diameter are characteristically abundant on the surface and throughout the soil mass. Depth to bedrock differs from place to place but nowhere is more than a few feet.

A variation, including about 400 acres, is less stony than typical. About half of this variation occupies slopes ranging from 15 to 30 percent, and the rest occupies slopes of more than 30 percent. Here and there the subsoil is somewhat red. A part of the area just north of Sandy Ridge is more sandy than the typical soil. Such variations are small in total area and of little significance otherwise.

Muskingum stony fine sandy loam is not extensive. The more stony areas are on English Mountain, and the slope exceeds 30 percent in most places. Probably about 40 percent of the less stony land just north of Sandy Ridge has been cleared and put into cultivation to the important field crops. Yields in general are very low, however, and the soil is eroding rapidly.

Because of a combination of rough relief, inherent poverty, droughtiness, and stoniness, this soil is not well suited to either cultivated crops or pasture, and it is best adapted to forestry.

Rough stony land (Talbott soil material).—Rough stony land (Talbott soil material) differs from rolling stony land (Talbott soil material) in having rougher and steeper relief. The rough stony land occupies slopes of more than 30 percent.

Because of the steeper lay of the land, run-off is heavier, more erosion has taken place, and more of the bedrock has been exposed; therefore less soil material remains than on rolling stony land (Talbott soil material). Such stony land types necessarily vary from place to place, and the strips gradually become broader as erosion removes the soil materials between the rocks.

The greater part of this land type is along the Bays Mountain belt, and areas are scattered in nearly all of the rougher parts of the county underlain by limestone, especially near Dandridge, south and west of New Market, and on Coppick Knob south of Jefferson City.

Owing to the high proportion of the surface occupied by outcrops of bedrock and large loose boulders and to the shallowness of the interstitial soil material, the land supports a rather sparse forest stand consisting largely of red cedar, persimmon, and other drought-resistant species of trees. Most of this land is now in forest, which is probably its best use, as it is poorly adapted to pasture and entirely unsuited to cultivated crops.

Rough stony land (Muskingum soil material).—Rough stony land (Muskingum soil material) occurs only on the steep and extremely rocky slopes of English Mountain, and the total area is small. The slope ranges from about 30 to 60 percent.

Between the rocks the soil material is, for the most part, Muskingum stony fine sandy loam. The rocks consist of rather fine grained sandstones, quartzites, and sandy conglomerates in the form both of outcrops and of large loose boulders. Moss covers the larger rocks and accounts for the local designation of this type as "gray rock land."

The land is occupied entirely by forest consisting principally of deciduous trees, including several species of oaks, hickory, and dogwood, in addition to a few red cedars and pines. This land is best adapted to forestry.

PITS, MINES, AND MINE DUMPS

Areas totaling about 128 acres in this county are designated as pits, mines, and mine dumps. The land has no present use for crops or for permanent pasture, and little or no forest vegetation has been established, as practically all of the excavation has taken place rather recently. More than 90 percent of the total area consists of dumps of the zinc mines in the vicinity of Jefferson City and east of New Market. This dump material is ground dolomitic limestone, which is being used by the farmers of the surrounding area for agricultural purposes; therefore the acreage of land occupied by these dumps at any time in the future will depend upon the rate at which dump is accumulated by the mines and the rate at which the materials are removed for agricultural or other purposes.

PRODUCTIVITY RATINGS AND LAND CLASSIFICATION

In table 6 the soils of Jefferson County are rated according to their productivity for the various crops grown in the county and grouped according to their physical suitability for agricultural use.[12]

The rating compares the productivity of each of the soils for each crop to a standard, namely 100. This standard index represents the productivity, that is, without the use of fertilizers and other amendments, of the more productive soils of that region in the United States where the crop is most extensively grown. An index of 50 indicates that the soil is about half as productive for the specified crop as is the soil with the standard index. Soils given amendments, such as lime or commercial fertilizers, or unusually productive soils of small extent, may have productivity indexes of more than 100 for some crops.

[12] For discussion of this grouping of soils see p. 68 of this section and pp. 26 and 27 of the section on Soils and Crops. This grouping is used also on the soil map accompanying the report.

Table 6.—*Productivity rating of soils and*

Soil [1]	Crop productivity																				
	Corn			Wheat [6]			Oats [6]			Barley			Tobacco [6] (burley)			Timothy and clover			Alfalfa		
	a [3]	b [4]	c [5]	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c
Huntington silt loam	100	100	110	40	40	50	50	50	60	90	90	90	[9]60	[9]75	[9]80	100	100	100	60	70	80
Congaree silt loam	100	100	110	40	40	50	70	70	70	90	90	90	[9]60	[9]75	[9]80	100	100	100	50	70	80
Huntington very fine sandy loam	90	90	100	50	50	50	60	60	60	90	90	90	[9]60	[9]75	[9]80	80	80	80	60	70	80
Congaree very fine sandy loam	90	90	100	50	50	50	75	75	75	90	90	90	60	75	80	80	80	80	50	70	80
Abernathy silt loam	100	100	100	30	30	30	60	60	60	70	70	70	80	90	100	90	90	90	70	80	90
Decatur silt loam	70	80	100	80	90	120	70	80	110	60	70	90	70	100	120	80	90	100	90	100	110
Dewey silt loam	60	70	100	70	80	110	65	75	100	55	65	90	70	100	120	70	80	100	80	95	110
Etowah silt loam	60	70	100	60	70	100	60	75	100	55	65	90	50	80	100	70	80	100	80	95	110
Decatur silt loam, slope phase	60	70	95	70	80	100	60	75	100	55	65	90	60	80	100	70	80	100	70	90	100
Dewey silt loam, slope phase	55	65	90	65	75	100	60	70	100	55	65	90	50	75	95	65	75	100	65	85	100
Staser silt loam	80	80	90	40	40	50	50	50	60	60	60	70	--	--	--	90	90	100	50	60	70
Decatur silty clay loam, eroded phase.	50	60	85	50	55	80	50	55	80	50	55	75	30	40	65	55	65	85	60	80	100
Dewey silty clay loam, eroded phase	50	60	85	50	55	80	50	55	75	45	50	70	30	40	65	55	65	85	55	75	90
Talbott silt loam	50	60	90	60	65	80	55	65	90	45	55	80	30	60	90	60	70	90	60	80	90
Fullerton silt loam, smooth phase	50	60	85	60	70	85	50	60	85	45	55	80	45	75	85	55	65	90	30	60	80
Fullerton silt loam	40	50	80	55	65	85	45	60	85	45	55	80	40	70	85	50	60	85	20	60	80
Fullerton fine sandy loam	40	60	80	50	60	80	40	50	85	35	45	70	40	70	80	40	50	80	20	50	60
Talbott silty clay loam	40	50	80	50	55	80	40	55	85	35	45	70	30	40	60	45	50	80	30	60	80
Holston very fine sandy loam	30	40	70	50	55	70	35	40	60	30	35	50	20	40	50	30	40	70	10	30	50
Holston very fine sandy loam, slope phase.	20	40	60	40	50	60	30	35	50	25	30	40	20	40	50	25	30	60	10	30	50
Decatur silty clay loam, eroded hilly phase.	40	50	75	55	60	70	40	50	75	35	45	65	20	40	50	50	60	80	40	60	80
Dewey silty clay loam, eroded hilly phase.	40	50	65	50	60	65	35	45	70	30	40	60	20	40	50	50	60	75	40	60	75
Fullerton silt loam, eroded phase	30	40	70	40	50	70	40	50	75	35	45	65	20	40	50	40	40	70	30	55	70
Dandridge silt loam, deep phase	40	40	70	50	60	80	40	50	70	35	45	55	30	50	55	50	60	70	30	60	80
Hanceville fine sandy loam	40	50	75	50	70	80	40	50	70	35	45	55	30	50	60	35	40	70	20	40	50
Leadvale silt loam	40	50	70	60	60	70	45	55	65	40	50	55	30	50	60	40	50	60	20	30	40
Nolichucky very fine sandy loam	30	40	60	40	50	65	35	40	60	30	35	50	20	40	50	30	40	70	10	30	50
Montevallo silt loam, deep phase	35	45	60	50	60	80	35	45	60	30	40	50	35	55	00	45	50	65	20	50	60
Clarksville cherty silt loam	20	30	60	40	50	70	30	40	70	20	25	50	20	35	75	20	30	60	10	30	50
Jefferson gravelly fine sandy loam	40	50	70	50	70	80	40	50	65	35	40	45	30	50	60	35	40	60	20	40	50
Monongahela very fine sandy loam	20	30	50	30	40	50	25	30	40	20	25	35	20	35	45	20	25	50	10	20	30
Monongahela very fine sandy loam, slope phase.	20	30	45	30	35	45	20	25	35	20	25	35	10	30	35	20	25	40	10	20	30
Alluvial soils, undifferentiated, drained	60	70	90	30	40	50	40	50	60	50	60	70	--	--	--	80	90	100	30	30	30
Alluvial soils, undifferentiated, undrained.	20	20	30	--	--	--	--	--	--	--	--	--	--	--	--	20	30	40	--	--	--
Dewey silty clay loam, steep phase	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fullerton silt loam, hilly phase	30	40	60	40	60	65	30	40	60	25	35	50	20	40	60	30	40	60	30	50	60
Talbott silty clay loam, eroded hilly phase.	30	40	60	40	50	60	30	40	60	25	35	50	10	30	40	40	50	65	30	50	00
Dandridge silt loam	--	--	--	20	30	40	20	30	40	20	20	30	--	--	--	20	20	30	20	30	40
Dandridge silt loam, hilly phase	--	--	--	30	30	40	30	30	40	--	--	--	--	--	--	30	30	40	30	30	40
Smooth stony land (Talbott soil material).	--	--	--	--	--	--	--	--	--	--	--	--	20	30	30	30	30	30	20	30	30
Rolling stony land (Talbott soil material)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tyler silt loam, drained	20	30	40	20	30	40	20	20	30	10	20	25	--	--	--	20	30	40	--	--	--
Tyler silt loam, undrained	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

[1] Soils are listed in the approximate order of their general productivity under the prevailing current practices and their relative suitability for growing crops, pasture, or forest

[2] The soils of Jefferson County are given indexes that approximate the average production of each crop in percent of the standard of reference The standard represents the approximate average yield obtained without the use of fertilizer or amendments on the better soil types of significant extent in the regions in which the crop is most widely grown Many ratings are the results of estimates, as supporting data are incomplete.

[3] These indexes refer to yields commonly procured without the use of manure, amendments, or beneficial crop rotation (For further details see text, p 66)

[4] These indexes refer to yields procured under commonest practices of management. (For further details see text, p 67)

[5] These indexes refer to yields that may be expected under the best practices of management. (For further details see text, p 67)

classification of land in Jefferson County, Tenn.

Index [3] for —

Lespedeza			Sorghum [6] (sorgo)			Potatoes [6]			Sweetpotatoes [6]			Vegetables [7]			Apples [7]			Peaches [7]			Permanent pasture [7]			Land classification [8]
a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	
100	100	100	[9]80	[9]90	[9]100	[9]50	[9]50	[9]50	60	70	80	70	70	70	--	--	--	--	--	--	150	150	150	
100	100	100	[9]80	[9]90	[9]100	[9]60	[9]70	[9]80	70	70	70	90	100	100	--	--	--	--	--	--	100	100	120	
90	90	90	[9]80	[9]90	[9]100	[9]55	[9]60	[9]70	60	70	80	80	90	90	--	--	--	--	--	--	130	130	140	
90	90	90	[9]80	[9]90	[9]100	[9]65	[9]75	[9]85	75	80	90	90	100	100	--	--	--	--	--	--	90	90	110	
90	90	90	[9]80	[9]90	[9]100	[9]60	[9]70	[9]80	70	80	80	70	80	80	--	--	--	--	--	--	140	140	140	First-class soils (good to excellent cropland.)
90	100	110	[9]70	[9]70	[9]70	80	90	100	80	90	100	80	90	100	80	90	100	80	90	100	90	90	150	
80	90	110	[9]75	[9]75	[9]75	80	90	100	80	90	100	80	90	100	80	90	100	80	90	100	90	90	130	
80	90	110	75	75	75	80	95	110	80	95	110	80	90	100	70	80	100	80	90	100	70	70	110	
75	85	100	[9]70	[9]70	[9]75	80	90	100	80	90	100	80	90	100	80	90	100	80	90	100	80	80	140	
70	80	100	[9]70	[9]70	[9]75	80	90	100	80	90	100	80	90	100	75	85	100	80	90	100	70	70	130	
80	80	90	70	80	90	[9]50	[9]50	[9]50	50	60	70	60	70	70	--	--	--	--	--	--	120	120	130	
65	75	90	[9]65	[9]65	[9]75	65	75	90	65	75	90	65	70	80	70	75	90	70	75	85	70	70	110	
65	75	90	[9]65	[9]65	[9]75	65	75	90	65	75	90	65	70	80	70	75	90	70	75	85	70	70	100	
60	70	90	55	60	70	50	60	70	50	70	80	40	60	70	50	60	70	40	50	60	65	75	120	
65	75	100	70	75	80	70	75	90	70	75	90	65	75	80	55	60	85	65	75	90	60	65	110	Second-class soils (fair to good cropland).
60	75	95	70	75	80	70	75	90	70	75	90	60	70	80	50	60	85	60	70	85	55	65	100	
50	60	70	55	65	80	60	70	90	60	70	90	60	70	90	55	60	85	65	75	85	40	50	95	
50	60	80	35	45	60	40	50	60	40	50	70	30	40	60	40	50	60	35	45	55	30	40	85	
40	50	65	50	60	80	50	60	80	50	60	90	50	60	90	40	50	60	40	50	60	30	40	60	
30	40	60	45	55	70	45	50	70	45	55	80	45	55	80	40	60	70	40	50	60	20	30	50	
50	60	80	[9]40	[9]50	[9]60	40	50	60	40	50	60	30	40	50	30	40	60	30	40	60	30	40	90	
50	60	80	[9]40	[9]50	[9]60	40	50	60	40	50	60	30	40	50	30	40	60	30	40	60	30	40	85	
45	60	80	50	60	70	50	60	75	50	60	80	45	55	65	40	40	70	50	60	75	40	50	90	
40	50	60	40	50	60	30	40	50	40	50	60	40	50	60	30	30	40	30	30	40	40	40	70	
40	50	60	55	65	85	60	70	90	60	70	90	60	70	90	50	60	85	50	60	85	30	30	50	Third-class soils (poor to fair cropland).
40	50	55	30	40	50	40	45	50	40	50	60	30	40	50	20	20	30	20	20	30	50	50	80	
30	40	60	50	60	80	50	60	80	50	60	90	50	60	90	30	40	60	40	55	65	30	30	60	
35	45	55	40	50	60	40	50	60	40	50	60	40	50	60	30	30	40	30	30	40	30	30	60	
30	40	70	40	50	70	30	40	65	40	50	60	30	40	60	40	50	65	50	50	75	30	30	60	
35	45	55	50	60	80	55	65	80	55	65	80	55	65	80	45	55	80	40	45	75	30	30	50	
30	30	40	40	50	60	35	40	60	40	50	60	30	40	50	20	30	40	30	35	45	20	20	40	
20	30	40	40	50	60	30	35	50	30	40	50	30	40	50	20	30	50	30	40	50	20	20	50	
90	90	90	[9]50	[9]50	[9]50	[9]50	[9]50	[9]50	60	60	60	40	40	40	--	--	--	--	--	--	100	100	110	
20	30	40	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	80	80	100	
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	20	20	40	50	75	
40	50	70	40	50	70	40	50	60	40	50	60	30	40	50	40	50	70	40	50	70	40	50	80	
40	50	70	30	40	50	30	40	50	30	40	50	20	30	50	25	35	50	25	35	50	40	40	75	Fourth-class soils (generally best suited to pasture).
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	60	60	80	
30	30	40	20	20	30	--	--	--	--	--	--	--	--	--	20	20	30	20	20	30	50	50	70	
30	30	30	30	30	30	--	--	--	--	--	--	--	--	--	30	30	30	30	30	30	60	60	80	
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	50	50	70	
30	40	50	30	50	60	20	20	30	20	20	30	--	--	--	--	--	--	--	--	--	30	30	60	
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	30	30	50	

[6] Wheat, oats, alfalfa, burley tobacco, sorghum, potatoes, and sweetpotatoes are rarely grown on soils of the first bottoms. For this reason yield data are extremely scarce, and the indexes in the table were arrived at inductively.

[7] These indexes for vegetables, apples, peaches, and pasture are largely comparative for the soil types of this and adjoining counties as substantiating yield data are particularly scarce for these items. Although not based on quantitative yield data or used strictly in reference to the standards, it is believed they are fairly comparable.

[8] This is a grouping of the soil types and phases according to their relative physical-use adaptation. (For further details see text, p. 68.)

[9] The quality of these crops is relatively somewhat inferior, taking the average of the county as a standard.

TABLE 6.—*Productivity rating of soils and*

Soil	Crop productivity																				
	Corn			Wheat			Oats			Barley			Tobacco (burley)			Timothy and clover			Alfalfa		
	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c
Fullerton silt loam, steep phase																					
Clarksville cherty silt loam, hilly phase.	20	30	40	30	40	50	30	40	60	20	30	40	10	30	40	20	30	50	20	40	50
Montevallo silt loam				10	10	20										10	10	20			
Montevallo silt loam, hilly phase																					
Rough gullied land (Dewey soil material).																					
Muskingum stony fine sandy loam																					
Rough stony land (Talbott soil material).																					
Rough stony land (Muskingum soil material)																					
Rough gullied land (Montevallo soil material).																					

NOTE.—Absence of an index indicates, according to position, either that the crop is not commonly grown

The following tabulation sets forth some of the acre yields that have been set up as standards of 100. They represent long-time average yields of crops of satisfactory quality.

Crop:

Crop	Unit	Yield
Corn	bushels	50
Wheat	do	25
Oats	do	50
Barley	do	40
Apples	do	200
Potatoes	do	200
Sweetpotatoes	do	150
Timothy and clover	tons	2
Alfalfa	do	4
Lespedeza	do	1½
Burley tobacco	pounds	1,500
Sorghum	gallons	100
Pasture	Cow-acre days[1]	100

[1] Cow-acre days is a term used to express the carrying capacity of pasture land. As used here, it is the product of the number of animal units carried per acre multiplied by the number of days the animals are grazed without injury to the pasture. For example, the soil type able to support 1 animal unit per acre for 360 days of the year rates 360, whereas another soil able to support 1 animal unit on 2 acres for 180 days of the year rates 90. Again, if 4 acres of pasture support 1 animal unit for 100 days, the rating is 25.

The soils of Jefferson County differ widely in productivity and in their response to different methods of management. In the long run, the potential productivity of a soil under feasible farming practices is more significant than that intangible quality sometimes called natural or inherent productivity. For this reason, the productivity of the soils of Jefferson County is rated in three ways, according to different kinds of treatment (table 6, columns a, b, and c, under each crop listed).

In column a, the indexes refer to expected yields without special practices to rehabilitate, maintain, or increase productivity. No manure or commercial fertilizers and no lime or other amendments are used, and no special effort is made in the selection and rotation of crops or to return organic matter to the soils.

classification of land in Jefferson County, Tenn.—Continued

Index for —																								Land classification
Lespedeza			Sorghum (sorgo)			Potatoes			Sweetpotatoes			Vegetables			Apples			Peaches			Permanent pasture			
a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	30	40	50	Fifth-class soils (generally best suited to forest).
35	45	60	30	40	60	30	40	50	30	40	50	20	30	40	30	40	60	35	45	60	35	40	70	
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	20	20	30	
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	20	20	30	
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	20	20	50	
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	20	20	30	
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	30	30	40	
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	10	10	30	

because of poor adaptation or that amendments are not commonly used.

In column b, the indexes refer to expected yields under present prevailing practices of soil management. The present general practice on the soils of the uplands is to make moderately heavy to heavy applications of complete commercial fertilizers for tobacco and vegetables, and light applications, or on some farms no application, for corn and small grains to be followed by hay crops. Phosphate alone or phosphate and potash are frequently used on corn and small grains. Lime is used on the uplands by some farmers, and the quantity of lime and phosphate used is increasing rapidly. Neither terracing nor contour tillage is a common practice. Crops are rotated, but generally speaking, neither their selection nor their rotation is well adjusted to soil needs. On the soils of the bottom lands the prevailing practices for many crops are the same as those employed in column a, although some crops, such as tobacco and vegetables, are fertilized.

In column c, the indexes refer to yields that may be expected under the best practices of soil management. Little of the land is being managed in this way, and the indexes in this column are largely estimates. Although accurate or mathematical data are not sufficient to support adequately these indexes, it is hoped that by comparing them with the indexes of columns a and b the relative responses of each soil to management practices will be brought out. The term "best practices of management" refers to the choice and rotation of crops; the use of commercial fertilizers, lime, and manure; proper tillage methods; the return of organic matter to the soil; and mechanical means of water and erosion control where necessary, carried on with the object of maintaining and increasing soil productivity but not to an extent that would make farming unprofitable. On some of the fertile soils of the first bottoms, such as Huntington silt loam, the best feasible practices for several crops are the same as the prevailing practices; in fact, the more intensive farming practices produce little response in the way of increased yields, and the indexes in columns a, b, and c are identical.

The soils are listed in table 6 in what is thought to be the approximate order of their general adaptability to the important crops of the present agriculture under current practices. For lack of more definite data, this is done chiefly on the basis of information acquired through field observation, local literature, and consultations with farmers in the county and competent agricultural specialists in the State.

In the column headed Land Classification, the soil types, phases, and miscellaneous land types are grouped, according to their relative physical suitability for use, as follows: First-class soils, Second-class soils, Third-class soils, Fourth-class soils, and Fifth-class soils. The purpose of this grouping is to provide information as to the relative physical adaptation of the various soils in the present agriculture of the locality. Information on a number of additional factors is necessary in order to make more definite recommendations for land use; and specific recommendations to apply on any one farm would require knowledge and consideration of a number of factors applying to that specific farm.

It may be said that, in general, under present conditions, First-class soils constitute good to excellent cropland; Second-class soils, fair to good cropland; Third-class soils, poor to fair cropland; Fourth-class soils, poor land for crops but better suited for pasture; and Fifth-class soils, land best suited to forest, although some may be used for crops and pasture.

Ratings for the unprotected conditions from flooding are the only ones given to the soils of the flood plains, as no areas are definitely protected by dikes or levees. Since the floods usually occur in the winter and early spring, they affect only the winter crops to any great extent.

Factors influencing the productivity of land are mainly climate, soil (including drainage and relief), and management. Crop yields over a long period of years furnish the best available summation of those factors contributing to productivity, and they are used whenever available. In Jefferson County most of the productivity ratings are based largely on observations, interviews, local available literature, and local expert advice. Because of a lack of definite information and yield data by soil types in some instances, the indexes in table 6 represent inductive estimates rather than established yields. This is especially true of the indexes for sorghum, potatoes, sweetpotatoes, vegetables, apples, and peaches.

Productivity tables do not present the relative roles that soil types, because of their extent and the pattern of their distribution, play in the agriculture of the county. The tables give a characterization to the productivity of individual soil types. They cannot picture the total quantitative production of crops by soil areas without the additional knowledge of the acreage of the individual soil types devoted to each of the specified crops.

Economic considerations have played no part in determining the productivity indexes, so the latter cannot be interpreted into land values except in a very general way. Distance to market, relative prices of farm products, and other factors influence the value of land.

GENERALIZED LAND CLASSIFICATION

The soil map of Jefferson County shows graphically the extent and distribution of the 43 soil types and phases, 1 complex, and 7 miscellaneous land types that cover the county. As these 51 units of mapping are differentiated on the bases of both internal and external soil characteristics significant to land use, each unit possesses individuality significant to land use capabilities and management requirements for agricultural purposes. With such detailed physical land data assembled and graphically recorded in the form of a soil map, a large number of simple land classification maps for specific purposes can be interpreted readily from the soil map. Figure 2 is an example of such a land classification interpreted from the soil map. This land classification map is of necessity somewhat schematic because of its small scale.

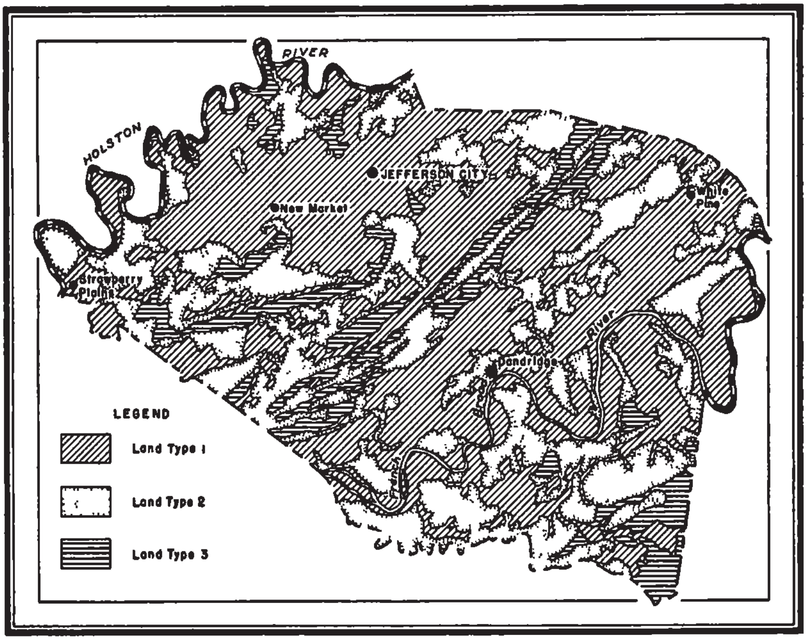

FIGURE 2.—Sketch map showing a general classification of the land in Jefferson County, Tenn.

Figure 2 shows the land of Jefferson County divided into three types. For convenience these may be referred to as Land Type 1, Land Type 2, and Land Type 3. These land types are differentiated chiefly on the bases of productivity, workability, and problems of conservation. Land Type 1 consists predominantly of soils characterized by relatively favorable conditions of productivity and workability and a minimum problem of conservation. Land Type 2 consists predominantly of soils characterized by moderate to high productivity but unfavorable conditions of workability or problems of conservation, or both. Land Type 3 consists predominantly of soils of low to very low productivity and unfavorable conditions of workability or very difficult problems of conservation, or both.

Land Type 1 is composed chiefly of First-class, Second-class, and Third-class soils, previously discussed. Although small areas of Fourth-class and Fifth-class soils necessarily are included because of the generalized character of the map, probably more than 90 percent of the land of this type is physically adapted to crops requiring tillage. It is estimated that about one-half of the total area of the county is included in this type. The larger areas and the greater part of the total of Land Type 1 lies in the central red valley along which the Southern Railway follows, on the Dandridge plain, which extends in a northeasterly direction and includes Dandridge and White Pine, and roughly along the Holston and the French Broad Rivers. Most of the larger farms of the county consist predominantly or entirely of Land Type 1. The greater part of the corn, wheat, tobacco, and alfalfa is produced on this land type, and practically all of the dairy farms are located predominantly on Land Type 1.

Land Type 2 consists predominantly of Fourth-class soils, according to the soil grouping discussed previously. About one-half of this land is used for pasture, and it is thought advisable, so far as the physical character of the land is concerned, to devote considerably more to that use where consistent with feasible farm management. Probably 25 or 30 percent of this land type is now in forest, some of which is second growth, and a considerable part of this is thought to be physically adapted to permanent pasture. Probably 25 percent of this land type is now being cultivated, some of which is not well adapted physically to crops requiring tillage. Although this land type is well distributed in all parts of the county, the larger continuous areas are south of the French Broad River. Other large areas lie between White Pine and Jefferson City and south of New Market. Generally speaking, small farms more nearly approaching the subsistence type are associated with Land Type 2. This land type is thought to cover approximately one-third of the area of the county.

Land Type 3 consists chiefly of Fifth-class soils previously described in this report. The greater part of this land is in forest, and it is thought that the physical character of most of it suggests this use under present conditions. Although there are a number of exceptions because of the generalized character of the map, this land type consists chiefly of soils low in fertility, and most of it occupies strong and rugged relief. A part of the land is severely gullied, and a part is extremely stony. Although a few comparatively small bodies are scattered over the county, the larger areas of Land Type 3 occur on English Mountain and Bays Mountain. Few farms, if any, are situated entirely on this land type, but part-time and subsistence farms are more generally associated with it. It is estimated that this land type occupies about 15 percent of the county.

Boundary lines separating these land types are generalized. Within each land type indicated on the map, small areas conform to the other two land types. This applies particularly to Land Type 1, more than 5 percent of which may be composed of small isolated areas consisting largely of soils representing Land Types 2 and 3. Similar inclusions, but to less extent, are in Land Type 2. Land Type 3, however, includes little land physically adapted to pasture or cultivated crops.

The above discussion is concerned with the predominant physical character prevailing in the respective areas delineated. This land classification map is not to be taken directly as a recommendation for land use, as factors other than those of the physical character of the land are involved in such recommendations.

LAND USES AND SOIL MANAGEMENT

Proper use of land is a basic problem in the agriculture of the county. Although other factors exist, the physical character of the land largely determines its use capabilities. In a previous section the various soil types and phases have been grouped according to productivity and physical suitability for use.

Past use of land in this county was guided with considerable regard for the physical character of the land. This was inevitable. Nevertheless, wrong use of the land has been too frequent. An obvious example of wrong land use is the attempt to cultivate the Dandridge soils, locally referred to as slate lands, chiefly in the southern part of the county. In the natural wooded state of these soils, sufficient humus accumulated to produce moderately favorable conditions of both tilth and productivity. This so-called virgin fertility tempted farmers to clear and cultivate this land. These soils are shallow over rock, occupy rough land, and are very susceptible to erosion. Under cultivation, erosion became very active, the virgin fertility was not durable, and the soils deteriorated rapidly. A large part of this land, particularly south of the French Broad River, has been cleared and cultivated long enough to impair severely its productivity. Much of it is now either idle or furnishes nearly worthless pasture. This is a striking example of destroying the value of good forest or grass land within a few years through wrong use for cultivated crops.

Not all the land in the county now producing crops is naturally adapted to this purpose from the point of view of permanent land use. On the other hand, a part of the land now used as pasture, and even some in forest, is physically adapted to growing cultivated crops.

The accompanying soil map indicates that First-class, Second-class, and Third-class soils, which include 98,368 acres, or 49 percent of the total land area, are predominantly physically adapted to the growth of cultivated crops; that the Fourth-class soils, including 72,704 acres, or 37 percent of the total land area, are naturally adapted to the growth of grasses or to pasture; and, largely through process of elimination, that the Fifth-class soils, including 28,608 acres, or 14 percent of the total land area, are physically adapted only to forestry.

Although the specific recommendations for land use and soil management on individual farms should be made only after full consideration of the physical character of the land, of the surrounding social and economic conditions, and of other conditions arising on the farm, it is true, nevertheless, that soil management can be discussed in a general way in relation to the physical character and the management needs of the various soil types and phases.

The term "land use," as used here, refers to broad uses of land such as for (1) cultivated crops, (2) permanent pasture, and (3) forestry. The problem of land use adjustment is logically followed by that of soil management. The term "soil management" refers to such practices as (1) choice and rotation of crops; (2) application of lime, commercial fertilizers, and manure; (3) tillage practices; and (4) mechanical control of water on the farm. The soils of Jefferson County differ greatly in their requirements concerning these measures of management; that is, they differ widely in features affecting productivity, workability, and soil and water conservation, all which have a direct relationship to management requirements.

In general, probably the most important management problem is the choice and rotation of crops, although all the problems are important and interrelated. For convenience in this discussion, crops may be divided into (1) clean-cultivated or intertilled crops, (2) close-growing crops that require preparation of the land by plowing but no further cultivation, (3) permanent pasture, and (4) forest.

Although each soil separation mapped has its individual use capability and required management practices, for convenience the soils may be placed in a small number of groups in which the members of each group are comparatively closely related in these respects. All the soil types and phases considered physically adapted to crops are placed in five groups on the basis chiefly of their management requirements. For convenience, these will be referred to as groups 1, 2, 3, 4, and 5. Soils considered unsuitable for crop growing are discussed as a miscellaneous group.

GROUP 1

The Huntington, Abernathy, Congaree, and Staser soils of group 1 are fertile, productive, easily worked, and present practically no problem of conservation and erosion control. These soils are the most physically suited of any soils in the county to the most intensive use; that is, cultivated crops are successfully grown year after year in most places, and in general only very short crop rotations are necessary in order to maintain productivity.

With few exceptions, the Huntington, Abernathy, and Staser soils are rich in lime (available calcium). The Congaree soils are distinctly acid in reaction, but very little lime has been applied to them for the production of general crops. As a rule, neither chemical fertilizer nor manure is applied to any of these soils for the production of the common field crops. A considerable acreage of the Congaree soils, however, is used for the commercial production of vegetable crops including English peas, lima beans, snap beans, carrots, beets, cabbage, turnip greens, and sweet corn.[13] These special crops are rotated among themselves in a rotation that includes crimson or red clover every 3 or 4 years. Three tons of ground limestone an acre has been applied to the Congaree soils used for these special crops. Commercial fertilizers generally are applied annually, and applications of manure are made at intervals of 3 or 4 years. The following quantities and mixtures of fertilizer are in general use:

[13] Information on soil management furnished by James Murray, agricultural agent for a canning company in the State.

For peas, lima beans, and sweet corn, 200 pounds of 4–10–4; for carrots and beets, 800 pounds of 4–12–8; for cabbage 800 pounds of 4–8–4; and for snap beans, 200 pounds of 4–8–4 (*13*, *16*, *17*, *18*).

The Huntington, Congaree, Abernathy, and Staser soils can be tilled under a rather wide range of moisture conditions. As these soils occupy almost level first bottoms and depressions, they present practically no problem in relation to contour tillage, erosion, or loss of water.

GROUP 2

The silt loam types of the Decatur, Dewey, Talbott, Etowah, and Fullerton soils make up group 2. All these soils are developed from limestone materials and occupy mild slopes ranging from 4 to 12 percent. Fullerton fine sandy loam is a similar soil developed over calcareous sandstone. Erosion is not severe, and the original surface soil is still thick enough to constitute practically all of the plow layer.

Although the management needs of these several soil types are by no means identical, in general they are similar. These soils are devoted to the general farm crops, including corn, wheat, barley, hay (clover, lespedeza, alfalfa, and grass), and tobacco. Observation and experience indicate that these soils can be conserved under a rotation including a cultivated crop once in 2 or 3 years when other management requirements are met. The reaction is everywhere acid, and applications of 1 to 2 tons of limestone increase the yields of most crops, particularly alfalfa and clover. Phosphorus and nitrogen are generally deficient, and the more successful farmers apply commercial fertilizers and replenish the nitrogen through the growing of legume crops, supplemented with manure. These soils can be tilled over a moderately wide range of moisture conditions without serious injury.

It is extremely important that tillage of these soils, particularly on the stronger slopes, follow contours. Whether terraces or other mechanical means of water control are necessary depends largely on the choice, rotation, and disposition of crops as well as on tillage and fertilization practices. On the steeper slopes proper terracing will prove advantageous in most places, particularly where short rotations are practiced.

GROUP 3

The eroded phases of Decatur silty clay loam and Dewey silty clay loam, Talbott silty clay loam, and Fullerton silt loam, eroded phase, are all developed from weathered limestone materials. These soils occupy slopes ranging from about 8 to 15 percent and are moderately to severely eroded. A sufficient amount of the original surface soil has been eroded so that the heavy subsoil materials are being brought to the surface by tillage. Practically all of the important crops of the county are grown on these soils, although tobacco is not well adapted and very little is grown.

Because of the fact that these soils have been eroded, their problems of management are distinctly different from those of the soils of group 2. Loss of most of the original surface soil has impaired tilth conditions, decreased the rate of water absorption, and increased the rate and amount of water lost in run-off. So far as management of these soils is concerned, this condition has restricted the range of adaptation to crops, narrowed the moisture range of tillage, necessitated more care in the selection of crops and planning of rotations, and increased the hazard of water losses and injury to plant production during periods of low rainfall. These conditions discourage the growth of clean-cultivated crops, making it essential to keep the soil under close-growing crops, such as small grains, grasses, and legumes, particularly alfalfa, as much of the time as good farm management will allow. On some of the more successful farms, much of these soils, particularly on the stronger slopes, is devoted almost entirely to such crops. Where cultivated crops, such as corn, are included in the rotation, they should not be grown more often than once in 4 or 5 years when consistent with good farm management.

These soils are poor in humus and therefore in nitrogen, and, where well managed, grasses and legumes take a prominent place in the rotation, in order to assist in replenishing these materials and improving tilth conditions. These crops also serve to reduce the loss of water and soil material by run-off and to increase the absorptive capacity of the soils. Because these soils are deficient in both calcium and phosphorus, the growth of grasses and legumes and their beneficial effect on the chemical and physical character of the soils are greatly increased by applications of lime and phosphate (*18*). Limited experimental investigation and experience indicate that applications of potassium are more effective on the Fullerton than on the Decatur, Talbott, and Dewey soils.

Previous erosion has made these soils more susceptible to future erosion and also more susceptible to injury from a given amount of erosion. It is, therefore, necessary to take every precaution in tillage practices along with careful choice and rotation of crops. Contour tillage is essential, and since the tilth conditions of these soils have been injured by loss of the original surface soil, farmers have found it advantageous to plow these soils in the autumn when consistent with farm management. It seems that the physical character or tilth condition of the plowed soil is improved to a great extent by winter freezing and thawing where fall plowing is practiced. Thorough consideration should be given the problem of terracing, particularly on the longer and steeper slopes.

GROUP 4

The eroded hilly phases of the Decatur, Talbott, and Dewey silty clay loams and Fullerton silt loam, hilly phase, are similar to the respective soils in group 3 so far as the soil profiles and soil materials are concerned, but all the soils of group 4 occupy steeper slopes, ranging from about 15 to 30 percent. These soils, like those in group 3, have been moderately to severely eroded with one exception—Fullerton silt loam, hilly phase. So far as the physical suitability of these soils is concerned, clean-cultivated crops should not be grown. Whether the soils should be devoted to the production of close-growing crops, such as small grains, grasses, and legumes, or to permanent pasture will be determined largely by other factors, chiefly those arising from the operating problems of the individual farms.

The eroded hilly phases of the Decatur and Dewey soils are more nearly adapted to the production of close-growing crops than are the hilly Talbott and Fullerton soils; this difference applies particularly to alfalfa. Like the soils in group 3, these soils are poor in humus and therefore in nitrogen, also in calcium and phosphorus, with some question regarding the degree to which the Decatur soils are deficient in phosphorus. Indications are that the Fullerton soils are distinctly deficient in potassium, but this deficiency is not quite so marked in the Dewey and Talbott soils.

Applications ranging from 1 to 3 tons of limestone to the acre usually give good results, particularly along with applications of phosphate. The Fullerton soils require heavier applications of both lime and phosphate than do the other soils of this group. Where adequate applications of lime and phosphate are made, the deficiency of nitrogen can be met through the proper choice, rotation, and disposal of the crops. Where these soils are to be devoted to crops that require tillage, judicious tillage practices are necessary to conserve soil and water. Maintenance of productivity requires the utmost caution in all essential management practices, including choice and rotation of crops, judicious application of fertilizers and amendments, and contour tillage within a narrow moisture range. The advisability of constructing terraces or hillside ditches on these steep slopes is doubtful.

In most places where the conditions and requirements of the individual farms will allow, these soils, particularly the Talbott and Fullerton, are better adapted to permanent pasture.

GROUP 5

The fifth group of soils, based on management problems, includes the Holston, Nolichucky, Monongahela, Leadvale, Hanceville, and Jefferson soils, the deep phases of Dandridge and Montevallo silt loams, and Clarksville cherty silt loam.

As regards management, these soils differ from the first four groups primarily in that they are very low in fertility and natural productivity. With only one exception, the Clarksville, these soils are developed from materials weathered from sandstones and shales, whereas practically all of the soils in the first four groups have developed from materials weathered from limestone. With the exception of the Leadvale soil, which is variable in lime content, all these soils are extremely poor in lime. The soils of this group are poor in humus, phosphorus, potassium, and nitrogen. Although the loss of water by run-off and of soil by erosion is a problem on some of these soils, generally speaking, the problem of conservation is primarily that of increasing and maintaining fertility. In these soils the problem of water control has to do with water conservation in some places, and in others it applies to artificial drainage.

The slope phases of the Holston and Monongahela soils and those parts of the Nolichucky, Leadvale, Hanceville, Jefferson, Dandridge, and Montevallo soils that occupy the stronger slopes should be managed, at least in part, to reduce soil and water losses by retarding run-off, whereas the more nearly level areas of the Holston, Monongahela, and Leadvale soils can be improved in places by artificial drainage.

Heavy applications of lime, particularly when accompanied by applications of phosphate, directly or indirectly, give marked increases in yields of crops on all these soils, with the probable exception of Leadvale silt loam. Generally speaking, these soils are responsive to needed fertilizers and other amendments and to management practices in general. So far as is consistent with operating limitations of the individual farms, the choice and rotation of crops for these soils should be planned to increase the fertility. Such a rotation would include frequent leguminous crops, and the return to the soil directly or indirectly in the form of manure as much of the vegetation as is consistent with good farm management. Generally speaking, the physical character of these soils is such that erosion is very active on the slopes when the soil is unprotected, and it is essential to give close-growing crops a more prominent place in the rotation and to practice contour tillage. Although little terracing has been done, some terracing would effectively supplement other measures of soil and water conservation, particularly on the sloping areas of the Jefferson, Hanceville, Holston, and Nolichucky soils. Clarksville cherty silt loam is somewhat less susceptible to erosion, but this soil is no exception in regard to low fertility and low productivity. Limited experimental work indicates that the Clarksville soils are very responsive to liberal applications of lime and phosphate, and that productivity can be greatly increased through the use of such amendments associated with the proper selection and rotation of crops. On a few farms, sweetclover has been given a prominent place in the rotation on the Holston soils, with very favorable results.

MISCELLANEOUS GROUP

The rest of the soils in this county are physically unadapted or poorly adapted to growing crops that require plowing or cultivation. So far as the character of the soils is concerned, parts of them are well or comparatively well adapted to permanent pasture, but others are adapted only to forestry.

The soils unadapted for crop use but suitable for permanent pasture include Dandridge silt loam; Dandridge silt loam, hilly phase; Tyler silt loam; alluvial soils, undifferentiated; Dewey silty clay loam, steep phase; and smooth and rolling stony land (Talbott soil material).

Of these, the Tyler soil is deficient in lime, generally extremely low in fertility, poorly drained, and characterized by a comparatively impervious subsoil. This soil produces some pasture grass without treatment—a sufficient quantity, it is thought, to justify its use as permanent pasture. Although experimental data are lacking, in all probability liberal applications of lime, phosphate, and probably other fertilizer materials could be used profitably for pasture production. Artificial drainage is another management problem deserving of consideration.

Alluvial soils, undifferentiated, consist of several intermediately and poorly drained alluvial soils. These soils are not very poor in lime, and they produce excellent grasses in their present condition. The management problem here consists almost entirely of water control through drainage and the prevention of overflow.

Dewey silty clay loam, steep phase, is well adapted to permanent pasture but should not be cultivated, as it is susceptible to rapid erosion where not well covered by vegetation. It is inherently fertile and retains moisture well. The growth of grass may be improved by applications of lime and fertilizers.

The smooth and rolling stony lands (Talbott soil material) are characterized by small limestone outcrops, which are sufficiently numerous to prohibit tillage operations. The proportion of the surface occupied by rock and also the depth of the soil material over rock varies greatly from place to place, and these are significant features in determining the degree to which these land types are adapted to pasture production. Part of this land is probably too stony to allow its use as permanent pasture, and in many places the land is being used as partly wooded pasture. Indications are that rather thinly spaced walnut and black locust trees do not retard the growth of grass and probably improve it. Bluegrass is naturally adapted, and the earliest pastures are generally provided by this stony land. In a few places phosphate and lime have been applied and results have proved favorable. White clover does well as a companion to the grass, and this mixture would probably be improved even more by applications of lime. On a few farms a part of the pasture has been seeded to Bermuda grass, which supplements bluegrass, particularly during midseason. As outcrops prevent mowing, the weeds are generally kept down by judicious application of amendments and grazing.

Dandridge silt loam and Dandridge silt loam, hilly phase, are developed from weathered shale materials that are partly or entirely calcareous. These soils are shallow over rock, generally less than 18 inches thick. In most places they have been cleared and placed under cultivation, with the result that they are moderately or severely eroded. Where erosion is not too severe, these soils naturally support a good cover of bluegrass, but it is rather difficult to establish a satisfactory grass cover in places where the soils have been severely eroded. The chief problem in the use of these soils for pasture in their present condition is the conservation of soil and water. As the soils are shallow and occupy steep slopes, terraces or hillside ditches probably would be inadequate as a means of conserving soil and water, but the judicious use of amendments would assist greatly in establishing a sufficient grass cover to conserve the soil and reduce the loss of water. Small scattered areas that have been reduced to a network of destructive gullies and mapped as rough gullied land are unadapted to pasture.

In Jefferson County the land is used by farm operators in farm units. The use to which the land is put is finally determined, not only by the physical capabilities of the land and the general regional social and economic conditions, but also by a number of other factors on each farm, such as its environment, its operator, and the operator's facilities and resources.

WATER CONTROL ON THE LAND

Water control on the land consists of practices having to do with regulation of run-off and with the maintenance of favorable soil-moisture conditions. These practices include: (1) Control of run-off, (2) artificial drainage, (3) irrigation, and (4) protection from floods. In this county only the control of run-off and artificial drainage are important at present. Protection of bottom lands from floods by means of dikes or similar devices is practiced but little. Irrigation is of no importance at present, although it doubtless would increase production of crops in dry seasons. Its use to supplement rainfall might prove economically feasible at times, especially on gardens and on small areas of high-priced crops, such as vegetables, fruits, and tobacco.

Run-off control is more important than artificial drainage in Jefferson County, at least from the viewpoint of acreage affected. The problem of run-off control exists in some degree on most of the cleared uplands and terraces, or on about 100,000 acres, or half of the total county area, whereas only about 6,000 acres, or 3 percent of the total county area, need artificial drainage to establish suitable moisture conditions for tilled crops. The soils needing attention to run-off control are distributed on the uplands and terraces throughout the county. Soils needing drainage are restricted to stream flood plains and flat or depressed positions on the uplands and terraces and include the Tyler soils and alluvial soils, undifferentiated.

These two types of water control are essential to the welfare of farming in this county. Adequate control of run-off would have a far-reaching effect upon soil conservation and crop production, particularly as it is needed on at least three-fourths of the cleared land area. Artificial drainage would greatly broaden the adaptability of the Tyler and, particularly, the alluvial soils, undifferentiated. These soils, under natural drainage conditions, are suitable only for pasture and forest; but if artificially drained, practically all of them would be well adapted to growing corn, hay, and most of the other important crops of the county.

CONTROL OF RUN-OFF

The term "control of run-off" as used here refers to prevention of rapid and excessive flow of water from the fields, pastures, and forests where it falls. A certain amount of run-off takes place on sloping land even under a dense cover of vegetation, but when land is cleared and cultivated or otherwise stripped of protective covering it is subject to much more rapid run-off, with loss of moisture needed by crops and more or less loss of soil by erosion.

Most of the excessive run-off and erosion that has occurred in Jefferson County has been due to unfortunate choice of land for crop growing, to use of tillage practices not well adapted to the character of soil or the lay of the land, or to overgrazing or other practices that leave sloping lands unprotected. The remedies are proper land use and good soil management. Lands with excessive slopes or otherwise subject to very rapid run-off should be used, as far as practicable, for forests; lands with somewhat less slope may be safely used for pasture;

lands with still less slope may be used largely for close-growing crops; and only rather gently sloping land where run-off is not rapid should be used frequently for intertilled crops. In general, crop rotations should be so adjusted that the more sloping lands under cultivation will be in grasses, legumes, and cover crops as much of the time as possible. Use of lime, manure, and fertilizers to increase the fertility of the soils and promote vigorous growth of vegetation is also important. If steep erodible land is to be cultivated, certain mechanical means of controlling run-off and erosion should be resorted to. These include contour tillage, terracing, and strip cropping. More complete discussions of land use and soil management are included in the sections on Soils and Crops and Land Uses and Soil Management.

Among the beneficial effects of control of run-off are the following: (1) A more uniform and adequate supply of moisture for growing crops; (2) control of soil erosion; (3) improved tillage conditions, particularly in dry periods; (4) better conditions for biological (bacterial) activity; and (5) improved conditions for the formation of humus. Not only is control of erosion a direct result of water control, but the other beneficial effects make further conservation and control of water easier.

The first permanent settlements were made in Jefferson County soon after the Revolutionary War. Most of the land suitable for cultivation has been cleared about 100 years. During this time erosion has been active. An average of almost 50 inches of rain falls annually. The prevailing lay of the land is undulating to hilly, and it is estimated that more than 90 percent of the acreage of the cultivated uplands has become sufficiently eroded to injure productivity or workability, in many places both. About 3 percent of the area of the county has been reduced to a close network of destructive gullies, incapacitating the land for crops or pasture. A great deal of the land physically adapted for cultivation has been eroded to the extent that ordinary tillage brings up heavy subsoil material. About 8 percent of the county's area is characterized by limestone outcrops sufficiently numerous to prevent feasible tillage, and it is reported by old residents that some of these very stony areas have resulted from removal of the original stone-free surface soil by erosion.

As is evidenced by accelerated erosion, failure to control run-off has been rather common on many of the important agricultural soils of the uplands, including the Decatur, Dewey, and Fullerton soils. These soils, particularly the Decatur and Dewey soils, are for the most part characterized by relatively favorable productivity and workability. Consequently, these soils—which are prevalent in the central red valley, through which the Southern Railway runs, and the Dandridge plain—were among the first to be put under cultivation nearly 150 years ago; and, as they were productive, they have been used a great deal for intertilled crops, which use does not lend itself well to measures of run-off control. Many of the less productive soils, particularly those associated with rugged land or extreme stoniness in the Bays Mountain belt, the English Mountain belt, and over a considerable part of the dissected shale plain south of the French Broad River, and the Holston hills south of the Holston River have remained in forest. Consequently run-off has been controlled to a considerable extent by the natural vegetative cover.

It should be emphasized that accelerated soil erosion in Jefferson County cannot be dealt with as an isolated problem as it is simply a conspicuous result of improper land use and soil management. Needed adjustments in land use and soil management are not, however, always easy to make.

The farmer who attempts to readjust the use and management of his land to effect the control of water and erosion is confronted with a number of problems, over some of which he as an individual has no control. Among the factors to be dealt with are the size and type of farm; the physical character of the land, including the soil pattern of the farm; the surrounding social and economic conditions, such as transportation, market, church, and school facilities; the immediate demand for a cash income to meet taxes, indebtedness, support of family, and other expenses; the relation between prices of farm products and of other commodities; the farm operator's facilities and resources for operating purposes, including buildings, farm equipment, seed, kind and number of livestock, cash credit, and other items; the farm operator's ability, aptitude, versatility, preferences, and other characteristics; community cooperation, farm machinery, drainage, water disposal, marketing, buying, farm tenure, labor conditions, and other economic features.

The farmer, as an individual, has full or partial control over some of these; over others he has little or no control, except collectively. A full solution, then, requires individual-community-State-National action embracing all the problems and influences affecting agriculture.

DRAINAGE

The discussion of drainage here is restricted to those soils whose natural drainage is inadequate for crop use. A total of about 6,000 acres in the county is in need of artificial drainage. About two-thirds of this is definitely too poorly drained in the natural state for crop use. The remaining one-third is sufficiently drained to allow the growth of some intertilled crops, yet inadequately drained. Artificial drainage would materially improve the productivity of these soils and broaden their adaptability. The imperfectly drained and poorly drained soils are closely associated. They lie mostly on the flood plains, particularly of Long Creek, and on the old terraces of the larger streams, chiefly along the French Broad River.

The feasibility or advisability of draining these soils can hardly be discussed for the 6,000 acres as a whole. Artificial drainage has been established in a small percentage of these soils. The advisability of installing artificial drainage varies a great deal from place to place, depending upon a number of factors, particularly the character of the soil and the engineering problems involved.

No adequate studies have been made as to the engineering phase of the problem. For this reason no complete discussion of this part of the problem is attempted. It might be added, however, that by far the greater part of these poorly drained soils both on the alluvial plains and on the terraces are underlain by shale; also, the channel of Long Creek is relatively shallow, and much of the Tyler soil occupies slightly depressed areas on the broader terraces, where in some instances drainage outlets are not easy to provide.

Other conditions affecting the feasibility of artificial drainage exist on the individual farms. Among these are the kinds of soils and the soil pattern. So far as the soils are concerned, there is a decided difference in the potential productivity and use suitability between the Tyler soils and the alluvial soils, undifferentiated. Relatively speaking, whether poorly drained, imperfectly drained, or artificially drained, the alluvial soils, undifferentiated, are much more productive than are the Tyler soils. Other significant factors being nearly the same, it is therefore much more desirable to drain the alluvial soils, undifferentiated, artificially.

A significant difference between the alluvial soils, undifferentiated, and the Tyler soils is that the internal drainage or movement of water in the former is free or adequate, whereas the Tyler soils are less pervious and have poorer internal drainage. Other factors being nearly constant, these differences in internal drainage would require a closer spacing of tile or ditch lines under the Tyler soils as compared with the alluvial soils, undifferentiated.

Briefly, as compared with the alluvial soils, undifferentiated, the Tyler soils are in general not only more difficult and more expensive to drain but are also less productive and more restricted in their adaptation even when artificially drained. Generally speaking, from the viewpoint of the soils, it may be stated that the installation of artificial drainage is more advisable for the alluvial soils, undifferentiated, than for the Tyler soils.

FORESTS [14]

The first settlers in this part of the great valley of east Tennessee found the country densely wooded. This section (*2*) was considered a common hunting and fighting ground by the Indians, as it abounded in such game as elk, buffalo, bear, deer, turkeys, and many kinds of small animals. In the early days, much of the timber, even choice logs in excess of those needed in the construction of the first houses, was rolled into piles and burned as the land was gradually cleared for crops. At a later period some fine poplar logs were rafted on the rivers to Knoxville. Records (*8*) show also that much maple sugar was transported by boat, indicating that the sugar maple was plentiful in the original forest. As the best quality long-bodied timber grew on the more productive soils, trees necessarily were disposed of regardless of market and use in order to clear the way for agriculture.

The proportion of forest land now is relatively small, slightly less than one-fourth of the total land area. Furthermore, forest land is owned largely as a part of the farms. Woodland on farms in 1929, according to the Federal census, showed an average return of $3.73 an acre. According to the census, the average amount of woodland per farm decreased from 28 to 20 percent of the farm land area between 1910 and 1935. Clearing has gradually encroached on the farm woodland, particularly on the more productive soils, such as those of the Decatur, Dewey, and Fullerton series (pl. 2, *B*).

[14] This section was prepared by G. B. Shivery, extension forester, University of Tennessee.

The distribution of forest is largely an expression of soils and such soil conditions as erosion, relief, and stoniness. Forest is most common on stony land, Clarksville soils, hilly and steep phases of the Montevallo and Fullerton soils, the more sloping Monongahela and Nolichucky soils, the gullied Dewey and Montevallo soils, and the steep, rough, stony, and rocky phases of the Muskingum soils. Bays Mountain and Shields Ridge have a relatively large proportion of woodland, owing mostly to steep relief and stoniness.

The high, steep, and stony English Mountain is conspicuous for its heavy forest. The Muskingum soils on the northern exposure and on the crest of that part of English Mountain in this county support a variety of hardwoods, such as the common oaks, including scarlet oak and blackjack oak, also sourwood, several species of hickory (shagbark or scalybark, mockernut, pignut, and bitternut), locust, black gum, redbud, shortleaf pine, Virginia pine, and other scattered species. Many dead chestnut trees are still standing.

The forest of the county in general is hardwood or deciduous, although red cedar, shortleaf pine, Virginia pine, and a few pitch and white pines are present. Predominating hardwoods, in the few places where they grow on slopes ranging from 2½ to 15 percent on the Decatur, Dewey, and Fullerton soils, are white oak, black oak, northern red oak, shagbark hickory, dogwood, second-growth poplar, and some black walnut, accompanied by a few linden and black gum and a number of less important associates. Clarksville cherty silt loam is characterized by the presence of sourwood and post oak. The Holston, Monongahela, and Nolichucky soils support a mixture of good quality white oak, black oak, northern red oak, southern red oak (Spanish oak), shortleaf pine, and dogwood. Such species of trees as black gum, red maple, beech, sweetgum, some shortleaf pine, and even willow oak and holly grow on the associated and poorly drained Tyler silt loam.

Red cedar is conspicuous on land underlain by limestone and calcareous shales at slight depths, such as the smooth, rolling, and rough stony lands (Talbott soil material), Dandridge silt loam, and Dandridge silt loam, hilly phase. Shortleaf pine reseeds itself wherever erosion has not been severe and a few large trees of cone-bearing age grow. Many relatively small trees of about the same age grow in clumps on abandoned badly gullied and even less severely eroded areas of the Decatur, Dewey, and Fullerton soils. Virginia pine adapts itself to still more difficult sites and has been observed in pure stands on Montevallo silt loam, hilly phase, and to less degree on Dandridge silt loam. Dandridge silt loam and Montevallo silt loam produce high-quality shortleaf pine in a mixture with hardwoods, mainly post oak. Long-lasting locust posts are obtained from rough stony land (Talbott soil material) and other land underlain by limestone on Bays Mountain. Black or yellow locust produces durable material for fence posts on much of the land underlain by limestone, which was once in cultivation and has since been turned out or abandoned.

No permanent wood-using industries are in the county aside from the desultory sawing in a few small mills, which have a burst of activity when demand and the presence of logs on an available tract coincide. As far back as 1912, only nine sawmills, all small (*24*), were cutting in the county, no one of which produced as much as a million board feet a year. At that time a veneer mill at Dandridge purchased high-grade pine and poplar logs. The current marketing practice is to truck the few choice clear logs to nearby cities or permanent wood-using centers and to depend on the small portable mills to process the rougher small timber largely for local needs, with a limited quantity of cross ties and dimension stock for outside markets. The local demand consists largely of pine lumber for farm use and oak lumber for bridge building. The few mills that operate when conditions are favorable are forced to saw to fill specific orders, in order to avoid unmarketable surplus. It is a noteworthy fact that the mere presence of scattered timber in a county causes local prices to be within reach of the people in contrast to prices at least twice as high in a section devoid of a local supply and dependent on higher grade material shipped in from a distance. Prices paid in central Illinois, for instance, show just such a contrast. Locust posts for fences likewise keep down costs on the farm.

No old growth or virgin timber remains. The principal commercial species of trees are mixed oaks with some yellow poplar, native yellow pine, hickory, dead chestnut, and other hardwoods. The supply of timber is badly depleted, and the woodland consequently falls far short of supplying maximum benefits. The present average rate of growth is low, much less than the results of measurements taken on two sample one-fourth acre plots of even-aged shortleaf pine. On Dewey silty clay loam, eroded hilly phase, a 30-year-old stand, 2 miles northeast of New Market, grew at the rate of 232 board feet an acre a year. A 45-year stand on similar previously cropped and abandoned land classified as Fullerton silt loam, hilly phase, 1 mile north of Piedmont, shows an annual growth of 219 board feet an acre.

The woodland is of two general types: (1) Cut-over hardwood, and (2) second-growth thickets coming in on previously cropped, eroded, and abandoned land. The cut-over hardwood forest contains many cull trees, which hinder the development of promising young trees by overtopping. Farm woodlands can be materially improved by using such inferior trees for fuel and other minor farm needs. Such improvement resolves itself into systematic cutting and use of crooked trees, short bushy-crowned ones, unsound culls, slow growers, and poor varieties, and in reserving the straight tall well-crowned individuals that are free from defects for growth into a crop of timber.

The second-growth thickets are composed largely of shortleaf pine with Virginia pine on the drier and more difficult sites. Shortleaf pine seeded by natural means displays a remarkable ability to catch up in places where the mineral soil is exposed, provided seed trees are present and so spaced that proper seed dissemination can be effected by the wind at the time the cones open during the early fall. Such stands can be improved by judicious thinning during their early life, in that the rate of growth is increased and risk of damage from the southern pine beetle is decreased. Erosion in such thickets is checked, and the process of accumulation of litter and humus begins to rebuild the soil.

Occasions arise when it is necessary to resort to the planting of forest trees, particularly on Fifth-class soils. Shortleaf pine is most favored for Muskingum stony fine sandy loam and rough stony land (Muskingum soil material), also for Montevallo silt loam and rough gullied land (Montevallo soil material). Black locust is suited to rough gullied land (Dewey soil material), severely eroded Dandridge soils, and the steep and eroded hilly phases of the Fullerton soils. Clarksville cherty silt loam, hilly phase, as a general rule, has not been cleared and consequently is not in need of planting. Plantings of shortleaf pine should, therefore, be used on those soils underlain by sandstone or yellow noncalcareous shales. Black locust will serve as the pioneer species on soils underlain by limestone or calcareous shales. Commercial species, such as the oaks, black walnut, and yellow poplar, can be introduced or will come in naturally as the soil is stabilized and improved by the black locust and the normal addition of litter and organic matter.

On the rough gullied land, advance preparation should be made prior to the actual planting of the seedlings. Each particular situation presents a specific problem. Mechanical structures of the check-dam type are needed in most of the large gullies, along with diversion ditches so located as to empty the normal accumulation of water into these improved permanent drains. A straw mulch, with a cedar brush matting, beneath which is a suitable grass mixture, is secured in place, in order to prevent a continued loss of soil until the locust and other vegetation has become established. Severely eroded areas of this kind must then be fenced against livestock, in order to give the vegetation an opportunity to become well established.

Forest has important indirect benefits aside from production of wood products, especially on critical areas of land subject to erosion. An experiment conducted for a period of 1 year (*3*) by the University of Georgia shows a soil loss from an exposed-subsoil or badly eroded plot of 112,316 pounds an acre, whereas from a wooded area only 115 pounds an acre was lost. The 115-pound loss from the wooded area is attributed largely to disturbance of the plant root systems by insertion of a galvanized iron band used to enclose the area. Results of the erosion station near Statesville, N. C.,[15] show a loss of only 0.0021 ton of soil and 0.122 percent of the rainfall from virgin woodland. Furthermore, a companion woods plot burned twice yearly shows progressively larger increases both in erosion and in percent of run-off. Therefore, both erosion control and maximum absorption result from complete forest cover, as old-growth forest soil (*1*) is more porous and absorbs water much more readily than the soil in cultivated fields. Where the forest cover is maintained properly, second-growth forest preserves the soil porosity unless the land is overgrazed or the litter is destroyed by fire.

Fire control is necessary not only to satisfactory forest production but also to maintain maximum soil porosity and erosion control. Prevention of overgrazing is necessary for similar reasons. Indiana experiments prove that such grazing does not pay, as woodland graz-

[15] BARTEL, F. O., and SLATER, C. S. PROGRESS REPORT OF THE CENTRAL PIEDMONT SOIL AND WATER CONSERVATION EXPERIMENT STATION, STATESVILLE, N. C., 1930–35. U. S. Soil Conserv. SCS–ERS–6, 134 pp., illus. 1938. [Mimeographed.]

ing under intensities (*4*) of 2, 4, or even 6 acres allowed per animal unit without supplementary feeding resulted in serious deterioration of the animals over a 6-month season. The timber-producing capacity is destroyed gradually by the repeated browsing and final elimination of tree reproduction, so that the natural regeneration of the stand is prevented. Trampling of the soil, disturbance of humus, and resulting interference with soil porosity lessen water absorption.

MORPHOLOGY AND GENESIS OF SOILS [16]

Jefferson County lies in the northern part of the region of the Red and Yellow Podzolic soils (*25, p. 1058*). In the mature soils, the color of the A horizon ranges from the dark reddish brown of the Decatur to the light gray of the Clarksville, and that of the subsoil from the deep maroon red of the Decatur to the light brownish yellow of the Clarksville.

Except for the alluvial and colluvial materials, the parent materials are the residues of decomposition and leaching of consolidated sedimentary rocks—limestones, dolomites, calcareous and acid shales, and calcareous and acid sandstones—all which were deposited during the early part of the Paleozoic era. The Knox dolomite, which consists of dolomite, dolomitic limestone, and nearly pure limestone, underlies the Talbott, Decatur, Dewey, Fullerton, and Clarksville soils. In some places the Decatur soils are underlain by the Holston marble. The Sevier and Athens shales underlie most of the Montevallo and Dandridge soils, and the Erwin quartzite underlies the Hanceville and Muskingum soils. Other formations, which underlie only a small part of the soils, are Tellico sandstone, Chickamauga limestone, Nolichucky shale, Maryville limestone, Rogersville shale, and Rutledge limestone (*26, 27*). Along the Holston and French Broad Rivers are extensive old terraces on which the soil parent material consists of old alluvial deposits. In most places these deposits contain some quartz gravel and pebbles, and rounded sandstones. At the foot of English Mountain colluvial deposits of sandstones underlie the Jefferson soils.

Table 7 shows the classification of the soils of Jefferson County, the parent material from which they are derived, their color, and their dominant relief.

A soil is the product of five main factors, namely, climate, vegetation, parent material, relief, and age. Climate and vegetation are the active forces that attack the parent material and gradually form a soil. Relief is a conditioning factor that, in most places, largely controls natural drainage and therefore influences the effectiveness of climate and vegetation. If climate and vegetation have not had the opportunity to operate long enough to produce a soil that is in near equilibrium with its environment, the soil is considered young or immature; and it is in this regard that age manifests itself as an important factor. Alluvial soils, for example, are considered to be very young, so young that climate and vegetation have not had time to produce any apparent results.

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[16] This section was prepared by A. C. Orvedal, Division of Soil Survey, Bureau of Plant Industry, U. S. Department of Agriculture

Table 7.—*Classification of the principal soils of Jefferson County, Tenn.*

		Parent material (parent rocks)		B horizon	A horizon	Dominant relief	Soil
ZONAL SOILS	Red and Yellow Podzolic soils	Limestones or dolomites.	Argillaceous limestone	Yellowish-red silty clay; sticky and plastic.	Light-brown silt loam or silty clay loam.	Undulating and rolling	Talbott silty clay loam.
			High-grade limestone and dolomite.	Maroon-red silty clay	Brown silt loam	do	Decatur silt loam.
				Brownish-red silty clay	Grayish-brown silt loam.	Rolling	Dewey silt loam.
			Siliceous dolomite and limestone.	Yellowish-red silty clay loam.	Brownish-gray silt loam	Rolling and hilly	Fullerton silt loam.
				Yellowish-red fine sandy clay.	Brownish-gray fine sandy loam.	Hilly	Fullerton fine sandy loam.
				Brownish-yellow light clay loam.	Whitish-gray cherty silt loam.	do	Clarksville cherty silt loam.
		Shale	Calcareous shale	Brownish-yellow silty clay.	Yellowish-gray silt loam.	Undulating and rolling.	Dandridge silt loam, deep phase.
			Acid shale	do	do	do	Montevallo silt loam, deep phase.
		Sandstone		Red fine sandy clay	Grayish-yellow fine sandy loam.	Rolling and hilly	Hanceville fine sandy loam.
		Old alluvium (stream terraces).	Alluvium derived mainly from limestone.	Reddish-brown clay loam	Light-brown silt loam	Gently rolling	Etowah silt loam.
			Alluvium derived mainly from sandstone	Red very fine sandy clay	Light-gray very fine sandy loam.	Rolling	Nollchucky very fine sandy loam.
				Yellow very fine sandy clay.	Light-gray very fine sandy loam.	Undulating and gently rolling.	Holston very fine sandy loam.
				Yellow very fine sandy clay; sticky and plastic; slightly mottled.	do	Rolling	Monongahela very fine sandy loam.
INTRAZONAL SOILS	Planosols	do		Bluish-gray silty clay; highly mottled.	Light-gray silt loam; mottled.	Level	Tyler silt loam (poorly drained soil).

AZONAL SOILS	Lithosols	Shale	Calcareous shale	Shallow soil, 1 to 15 inches deep; brownish-yellow silty clay loam mixed with considerable shale.	Hilly and steep	Dandridge silt loam.
			Acid shale	Shallow soil, 1 to 18 inches deep; grayish-yellow to brownish-yellow silt loam to silty clay, mixed with considerable shale.	do	Montevallo silt loam.
		Sandstone		Mainly disintegrated sandstone; brownish-yellow fine sandy loam mixed with numerous sandstones.	do	Muskingum stony fine sandy loam.
	Alluvial soils	General alluvium (stream bottoms).	Alluvium derived mainly from granite, gneiss, and schist.	Brown silt loam; well drained; contains considerable mica.	Level	Congaree silt loam.
			Alluvium derived mainly from limestone and dolomite.	Brown silt loam; well drained	do	Huntington silt loam.
			Alluvium derived mainly from calcareous shale and sandstone.	Light-brown silt loam; well drained	do	Staser silt loam.
			Alluvium derived from limestone, dolomite, shale, and sandstone.	A miscellaneous separation which embraces the poorly or imperfectly drained soils occurring in the small stream bottoms.	do	Alluvial soils, undifferentiated.
		Local alluvium (local wash and some colluvial material).	Washed mainly from Decatur and Dewey soils.	Reddish-brown or brown silt loam or silty clay loam.	Level to undulating	Abernathy silt loam.
			Washed mainly from Dandridge and Montevallo soils.	Grayish-yellow or brownish-yellow silt loam or silty clay loam.	do	Leadvale silt loam.
			Wash and colluvium from Muskingum soils and sandstone-rock land.	Brownish-yellow fine sandy loam or fine sandy clay; stony. / Grayish-brown fine sandy loam; stony.	Undulating to rolling	Jefferson gravelly fine sandy loam.

Over the entire area of Jefferson County the climate is essentially the same, except probably on English Mountain in the southeastern corner. In other words, the climate is the same over the entire valley section, which embraces the Talbott, Decatur, Dewey, Fullerton, Clarksville, Dandridge, Montevallo, and all the soils occurring on river terraces and in the stream bottoms. Because the climate is uniform over practically the entire area, local differences in these soils cannot be explained by climate. The common characteristics of the well-developed well-drained soils, such as the sequence in shade of color from the A horizon through the C horizon, however, probably are a function primarily of climate aided by vegetation.

The forces of climate alone do not bring about the development of soils. Operating alone, they could only produce the parent material from which soils are developed. Without living organisms soil materials would not have many of the more important characteristics of soil; they would be merely residual or transported products of rock weathering, although some of them might have definite layers produced by differential weathering, leaching, eluviation, and illuviation. Of the living organisms influencing soil development, plants and micro-organisms are the ones of primary importance. The general type of vegetation is, to a large extent, controlled by climate and in this way climate exerts a powerful indirect effect on the soils. A well-developed soil is the result of the concomitant influence of both climate and vegetation on the parent material. Where the variation in vegetation is significant, the general type of soil varies accordingly. In Jefferson County the same general type of native vegetation grew on all the well-developed well-drained soils. Although there probably were differences as to density of the stands and the relative proportion of each species, the general chestnut-oak-hickory association prevailed over the entire area. Because no marked differences in vegetation were manifest on the well-developed well-drained soils, the differences in the development of these soils cannot be accounted for by differences in vegetation.

Directly and indirectly, climate tends to produce similar soils from different kinds of parent material and if it were not for the inhibiting factors of parent material itself, relief, drainage, and, in some places, vegetation, the same type of soil would prevail over the entire area. Some common characteristics of the well-developed well-drained soils may be noted. Under forest vegetation they all have a dark A_1 horizon and an A_2 horizon that is lighter in color than either the A_1 or the B; a B horizon that is generally uniformly colored yellow or red and is heavier textured than the A_1 or the A_2 horizons; and a C horizon that is generally heavy textured and light red mottled with yellow and olive. Under the Dandridge and Montevallo soils, however, the C horizon is yellow mottled with red, gray, and olive.

According to some recent analyses by this Bureau of a number of soils of Jefferson County, the silica content decreases and the alumina and iron oxide contents increase with depth. The content of organic matter is moderate in the A_1 horizon, less in the A_2 horizon, and very low in the B and C horizons. All the soils are low in bases, particularly calcium and magnesium; and they are also low in phosphorus. In comparison with numerous analyses of soils in the United States given in part 3 of the Atlas of American Agriculture, the soils of the limestone valley section of Jefferson County are high in manganese, particularly in the A_1 and A_2 horizons (*9*). The manganese content of these soils is highest in the surface layer, and it decreases as the depth increases. In general, the ignition loss is comparatively low, indicating that the bound water content is not high. They are all medium, strongly, or very strongly acid in reaction. In general, the amount of silt decreases and the amount of clay increases with depth from the A_1 horizon through the C horizon; and the colloid content is low in the A horizon, much higher in the B horizon, but highest in the C horizon.

The above paragraphs have brought out the characteristics that all the well-developed well-drained soils have in common under similar climatic and vegetative conditions, irrespective of parent material or relief. These characteristics, therefore, can be considered as those imposed by the forces of climate and vegetation. They can, therefore, be considered zonal characteristics, and all soils that exhibit them can be considered zonal soils.

Throughout the entire county, a striking and consistent correlation exists between the soil type and the consolidated rock underlying the parent material. A less striking and less consistent correlation exists between the type of soil and the slope of the land. The present relief, however, is mainly a function of the consolidated rocks, which differ in rate of weathering and content of insoluble minerals.

The underlying rocks of this section are responsible for the relief, which itself is an important factor in determining the local differences in soils. In other words, the consolidated rocks not only exert a powerful direct influence on the soils, but also a powerful indirect influence by determining to a large degree the character of the relief. To illustrate: The extensive areas underlain by fairly high-grade limestone or dolomite are generally undulating to gently rolling; extensive areas underlain by highly siliceous limestones and dolomites are generally strongly rolling or hilly; and extensive areas underlain by shales are generally hilly or steep. Therefore, through their direct and indirect influence, the consolidated rocks that give rise to the parent materials of these soils constitute the main factor in the development of different types of soils in the county. In the humid section, soils occurring in broad depressions or in level or nearly level areas are generally poorly or imperfectly drained. In the limestone valley section, however, where the underlying rocks are limestone or dolomite, subterranean drainage is very good and the general relationship of drainage condition to relief does not exist. This good subterranean drainage probably is due to the marked dip that all the rock strata have and to numerous subterranean caverns and crevices. Where the underlying rocks are limestones with a marked dip, internal drainage of the soils apparently is just as good in nearly level areas as in hilly areas. This excellent subterranean drainage on all slopes greatly reduces the influence of relief on the soils and allows the consolidated rocks to dominate the other factors in determining the local soil differences. In other words, the different responses of the different rocks to the forces of the same climate and vegetation are responsible for the different types of well-developed well-drained soils in the county.

In Jefferson County, limestones and dolomites give rise to parent materials that, in turn, give rise to five series of soils; namely, Talbott, Decatur, Dewey, Fullerton, and Clarksville. In going from Decatur to Dewey to Fullerton to Clarksville, the color of the surface soil changes from dark reddish brown to light gray and the color of the subsoil from dark red to light brownish yellow. Generally speaking, the quantity of chert in the solum varies in the same sequence, the Decatur having least and the Clarksville most; and, in a general way, the dominant relief of these soils likewise varies in the same sequence, the Decatur occupying the mildest and the Clarksville the strongest relief. The range in slope for the soils of each series overlaps considerably the slope range of the soils of adjoining series in this association. The Talbott also belongs in this chain, in a position ahead of Decatur. Its variation from the Decatur, however, is in a different direction. The Talbott is much shallower and has a more plastic and sticky subsoil. The profile relationships among the Talbott, Decatur, Dewey, Fullerton, and Clarksville soils are shown in figure 3. The soils are arranged in a logical sequence according to their variations in characteristics. The arrows indicate the degree in which the different characteristics are developed, each arrow pointing from the soil or soils in which the characteristic is least prominent to that in which it is most prominent.

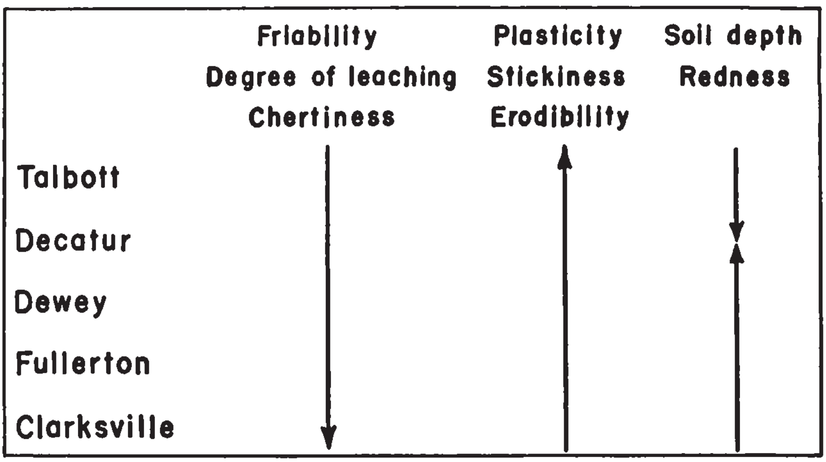

FIGURE 3.—Diagram showing the profile relationships in the Talbott, Decatur, Dewey, Fullerton, and Clarksville soils in Jefferson County, Tenn.

The internal characteristics and relationships of the soils of these five series are shown in figure 4 by diagrammatic sketches of their profiles.

As the surface geology of this section of the country is characterized by very old formations that were faulted and folded a long time ago, it is fairly safe to assume that the present relief is a product of natural geologic weathering and erosion. Supporting this assumption is the fact that mountaintops are capped with the most resistant rocks and the valley floors are underlain by the least resistant rocks (*6*). In general, the mountains are capped with sandstones, conglomerates, and quartzites; the valley floors are underlain by limestones or dolomites; and the ridges or plains intermediate in altitude between the mountaintops and the valley floors are underlain by shale. For example, the area in the vicinity of

New Market is underlain by limestones and dolomites. Just south of the highway is an extensive area, predominantly of Talbott soils or smooth stony land (Talbott soil material). This is in the lowest part of the valley. Northward toward the highway, the land increases in altitude, and Decatur and Dewey soils are reached. Continuing northward the altitude gradually increases and Fullerton and Clarksville soils are present. Although this sequence in altitudes—Talbott in the lowest positions, Dewey and Decatur in the intermediate, and Fullerton and Clarksville in the highest—may not everywhere be manifest where these soils occur side by side, it is evident in so many places that it may be considered a normal relationship.

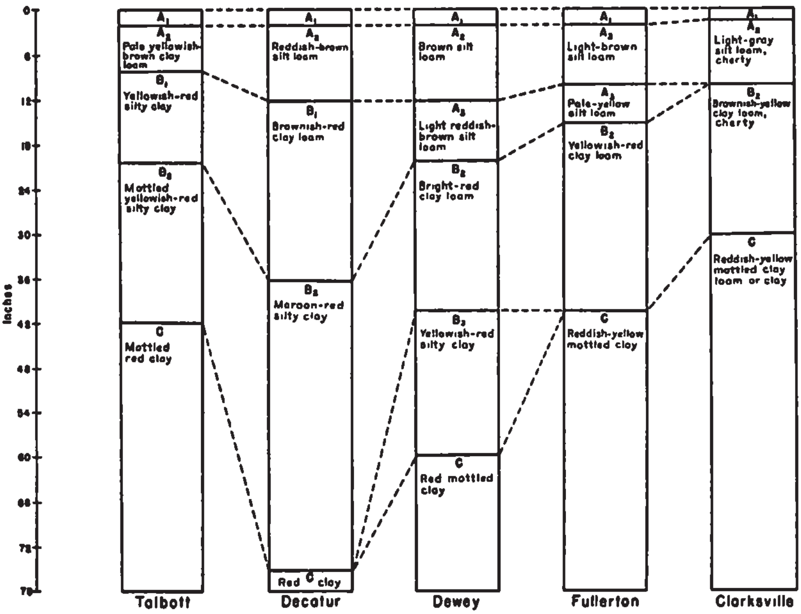

FIGURE 4.—Diagram showing typical profiles of the Talbott, Decatur, Dewey, Fullerton, and Clarksville soils.

On the assumption that this whole section was a peneplain before the present relief developed, it follows that the limestone underlying the Talbott soils was the most soluble and most easily weathered of all the limestones and dolomites in Jefferson County. Because the covering at present is less over the rock underlying the Talbott than it is over the rocks underlying the Decatur, Dewey, Fullerton, and Clarksville, it is reasonable to assume that the limestones underlying the Talbott had the smallest proportion of insoluble material. Although the rock floor is very uneven and rough, the average depth to bedrock probably increases in going from Talbott to Decatur to Dewey to Fullerton to Clarksville. The conclusion from this would be that the content of insoluble impurities of the underlying limestones and dolomites increased in the same sequence. The insoluble impurities are mainly silica, alumina, and ferric oxide.

Although some surface erosion has taken place, the differences in average depth to bedrock cannot be explained on this basis except for the Dandridge, Montevallo, and Muskingum soils. In the Decatur, Dewey, Fullerton, Clarksville association, the depth to bedrock is more or less in direct opposition to what would be expected if differential natural erosion were responsible; that is, when the predominating slopes of the soils of the respective series are taken into consideration. Considering the high rainfall, the streams in the limestone valley section are comparatively few, and many of them sink into underground channels. Sinks everywhere dot the landscape, and much drainage water escapes through them. This condition indicates that the present relief is mainly due to differential dissolution and leaching of the underlying rocks; and, if this is true, the present covering over the rocks is the insoluble residue left after hundreds of feet of limestones and dolomites have been dissolved and leached out. The deepest covering would, therefore, be expected where the limestones and dolomites had the highest concentrations of insoluble impurities. As the covering became thicker and thicker, it served as an increasingly effective sponge in reducing the amount of water leaching through the underlying rocks, and hence as the higher altitudes are approached there is an increase in content of insoluble impurities. Therefore the Talbott soils are the shallowest to bedrock and at the same time occupy the lowest position in the valley, and the Clarksville soils are the deepest to bedrock and occupy the highest position, with the Decatur, Dewey, and Fullerton soils between these two extremes.

As already pointed out, the Talbott soils are underlain by nearly pure limestone. A description of a typical profile of Talbott silty clay loam is as follows:

A_1. 0 to 2 inches, friable grayish-brown mellow silty clay loam slightly stained with organic matter.

A_2. 2 to 8 inches, pale yellowish-brown silty clay loam. The color is not uniform but is a mingling of light shades of yellow, reddish brown, and gray. The material readily falls apart into soft crumbs of various sizes and shapes. The darker aggregates are firmer than the light-colored ones. Roots are numerous.

B_1. 8 to 24 inches, tight tough plastic and sticky silty clay, which is yellowish red, with some minglings of olive, ocher yellow, and red. The material is difficult to disrupt and break into angular aggregates of various sizes, many of which are firm. They are red on the outside and yellow or olive on the inside and have shiny or glossy surfaces. Fine roots are few, but large roots are fairly numerous.

B_2. 24 to 42 inches, heavy silty clay similar to that in the layer above but more highly variegated with olive, yellow, red, and brown. When crushed the material becomes reddish yellow. It differs from the overlying material in that it is not quite so tough and is slightly brittle. Although the material is disrupted with difficulty, the disrupted pieces break readily into angular aggregates with glossy surfaces.

C. 42 to 72 inches, red very plastic clay highly mottled with reddish brown, rust brown, yellow, gray, and olive. The clay contains a few chert and limestone fragments. This material continues down to bedrock, which in this sample was reached at a depth of 72 inches. Bedrock is high-grade but slightly argillaceous limestone.

The rock floor is very uneven and jagged, but in most places it is only a few feet below the surface. Rock outcrops occur in many places on all areas of the Talbott soil. Most of the stony land in the valley has Talbott soil between the outcrops where the depth to bedrock allows a soil to develop. As a result of this variable depth to bedrock, the layers below the A_2 horizon vary greatly in thickness and in many places are almost entirely absent.

Partly because of the heavy character of the subsoil of the Talbott soils, they are very susceptible to erosion even on mild slopes; and, after being cleared of the forest cover, much of the soil has eroded so that in many areas the present profile is truncated and practically devoid of an A horizon.

The limestone underlying the Talbott soils is very low in insoluble impurities, and consequently the residual material from dissolution and leaching is relatively little. Apparently, the quality of the residuum is responsible for the heavy tough character of the Talbott soils.

Most of the Talbott soils have gently rolling relief, but some of them are hilly. It is not improbable that some of the Talbott soils on the steeper slopes are developed from rocks, which, on gentle relief, would give rise to the Dewey soils but have not done so, owing to natural erosion. Under a forest vegetation it is unlikely that rapid erosion took place.

The Decatur soils are the darkest red soils in the valley, and they also have the deepest solum. Of the Talbott-Decatur-Dewey-Fullerton-Clarksville association, the Decatur soils have the best combination of soil characteristics for plant growth. A description of a typical profile of Decatur silt loam is as follows:

A_1. 0 to 2 inches, dark-brown smooth mellow very friable silt loam which crumbles readily to soft granules and contains many small roots, some insects, and a little leafmold.

A_2. 2 to 12 inches, reddish-brown soft smooth very friable silt loam. The material crumbles readily to small soft granules that are very easily crushed.

B_1. 12 to 36 inches, brownish-red friable silty clay, which crumbles easily to soft granular aggregates that are readily crushed to a somewhat lighter colored smooth uniform slightly plastic mass. Some of the aggregates are dark brown. Numerous tiny black concretions and a few tiny chert fragments are present. In exposed cuts, the material in this layer is dark red.

B_2. 36 to 50 inches, maroon-red silty clay containing numerous tiny black concretions and a few tiny chert fragments. This material is moderately firm and tight in place, but displaced pieces break down readily to subangular aggregates ranging from one-fourth to one-half inch in diameter. All the aggregates have shiny surfaces, and many are coated with black. Under moderate pressure they break down to a lighter colored fairly smooth rather plastic moderately sticky mass.

B_3. 50 to 80 inches, a layer in which the material is very similar to that above, except that not so many aggregates have black coatings, concretions are fewer, and the consistence is a little tighter and more firm.

C. 80 to 100 inches +, heavy plastic sticky tight clay that is considerably lighter red than the overlying material and contains a few yellow and olive mottlings.

Table 8 gives the results of mechanical analyses of samples of the surface soil, subsurface soil, and subsoil of Decatur silt loam.

TABLE 8.—*Mechanical analyses of Decatur silt loam*

Sample No.	Depth	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
	Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
402518	0- 2	2.1	5.1	4.1	6.7	5.7	50.4	25.9
402519	2-12	.7	3.2	3.2	4.7	4.7	46.2	37.3
402520	12-36	.7	2.5	2.4	3.0	3.5	37.6	50.3
402521	36-72	.6	2.1	1.9	2.6	3.0	25.4	64.4
402522	72-96	6	.7	.4	.5	2.3	17.9	77.7

Although the parent material of the Decatur soils comes from high-grade limestones and dolomites, it contains more insoluble impurities than the parent material of the Talbott soils. Most of the Decatur soils have undulating to gently rolling relief. Rock outcrops are rare, except in severely eroded areas. The Decatur soils have the darkest A horizon of any of the well-developed soils in the valley, which is probably due, at least partly, to organic matter. Because the Decatur soils are the most productive of the well-developed soils in the valley, it is reasonable to expect that they supported the most luxuriant vegetation; and the natural result of this would be a dark-colored A horizon. It is likely that undergrowth in the forest was heavy and that this helped to develop the granular structure of the A horizon. This luxuriant growth would also tend to inhibit erosion of the surface soil and develop a friable consistence of both the surface soil and subsoil.

In Jefferson County a small area is underlain by marble. This has given rise to a soil similar to the Decatur in morphology and has been classified as a Decatur soil.

The Dewey soils are developed from limestones and dolomites higher in insoluble impurities, particularly silica, than the rocks underlying the Decatur soils. Following is a description of a typical profile of Dewey silt loam:

A_1. 0 to 3 inches, dark-brown soft mellow silt loam, which breaks readily to soft granules. It is high in organic matter and contains a few small chert fragments.

A_2. 3 to 12 inches, light-brown friable mellow soft silt loam containing a few small chert fragments. Roots are well distributed throughout this layer.

A_3. 12 to 18 inches, light reddish-brown friable heavy silt loam, which breaks readily to small soft granules. The granules are easily crushed to a smooth mass. The material is moderately sticky when wet and contains a few chert fragments.

B_2. 18 to 40 inches, brownish-red fairly friable but slightly brittle silty clay loam, which breaks to irregular-sized subangular aggregates. The aggregates are glossy on the surface and are fairly easily crushed to a smooth yellowish-red mass. The material is only slightly plastic when wet. Small black round concretions and chert fragments are numerous.

B_3. 40 to 60 inches, bright-red fairly stiff tight silty clay, which here and there contains a mingling of yellow. The material is difficult to disrupt, but the displaced pieces break readily to angular and subangular aggregates of various sizes, which, with moderate pressure, can be crushed to a smooth reddish-yellow moderately plastic sticky mass. Chert fragments are common.

C. 60 to 72 inches, heavy stiff plastic and sticky clay. This material is reddish yellow and is highly mottled with red, yellow, and olive. As in the above layers, the displaced material breaks into more or less angular aggregates.

In general, the relief of the Dewey soils is rolling, but it is undulating and even hilly in large areas. As this soil is very productive of agricultural crops, it is reasonable to assume that it supported a luxuriant vegetation before it was cleared, and this at least partly accounts for the brown color of the A horizons. As on the Decatur soils, the undergrowth in the forest on the Dewey soils also was probably heavy.

The Fullerton soils are derived from dolomites high in impurities, particularly silica. Silica occurs in two forms—as chert and as fine sand grains in the dolomite. Two types and several phases of these soils are mapped. Fullerton fine sandy loam, which occurs mainly in the northwestern part of the county, is underlain by sandy dolomites and sandy limestones, with thin strata of calcareous sandstones. Typically, the relief of most areas of the Fullerton soils is rolling and hilly, comprising low ridges or dome-shaped hills. Judging by the abundance of dead chestnut trees and the frequent local name of "chestnut ridge" where the Fullerton soils and also the Clarksville soils occur, it is reasonable to suppose that chestnut trees were originally numerous on these soils. The Fullerton soils, particularly where they contain considerable chert, are not nearly so susceptible to erosion as the Dewey, Decatur, and Talbott soils on corresponding slopes. Following is a description of a typical profile of Fullerton silt loam:

A_1. 0 to 2 inches, dark-gray silt loam stained dark with organic matter. Roots and chert fragments are numerous.
A_2. 2 to 10 inches, brownish-gray soft mellow friable silt loam containing a few chert fragments.
A_3. 10 to 15 inches, pale-yellow very friable heavy silt loam containing a few chert fragments.
B_1. 15 to 40 inches, yellowish-red or salmon-colored silty clay loam, with a few mottlings of ocher yellow. Although the material is friable, it is slightly brittle and hard in place; and, when wet, it is moderately sticky and plastic. Displaced pieces easily break into irregular-sized and irregular-shaped aggregates, which with moderate pressure crush to a slightly gritty mass. Chert fragments, some of them large, are generally abundant.
C. 40 to 70 inches, reddish-yellow, mottled with some ocher yellow, olive, gray, and red, tight plastic and sticky clay, which has a more angular structure than the material in the layer above.
C. 70 to 84 inches +, tight tough plastic sticky clay, which is reddish yellow, highly mottled with ocher yellow, gray, olive, and red.

In some places the B horizon of Fullerton silt loam is heavier textured and more plastic and sticky than that described above.

Fullerton fine sandy loam has a brownish-gray fine sandy loam surface soil, about 7 inches thick, underlain by light brownish-yellow heavy fine sandy loam to a depth of about 14 inches. This material grades into yellowish-red friable fine sandy clay, which, in turn, grades into light-red moderately tight plastic and sticky heavy very fine sandy clay at a depth of about 24 inches. This continues to a depth of about 50 inches, where mottled stiff tight plastic sticky clay is reached.

The Clarksville soils are associated with the Fullerton soils, but they come from dolomite higher in impurities, particularly chert, than the Fullerton soils. Like the Fullerton, the Clarksville soils occupy rolling and hilly areas on low ridges. They differ from the Fullerton soils primarily in being lighter colored in both the A and B horizons. The Clarksville soils in Jefferson County contain much red in the lower part of the B horizon and in the C horizon and for that reason are not considered typical Clarksville, which are predominantly yellow throughout the B horizon. Following is a description of a profile of Clarksville cherty silt loam as developed in Jefferson County:

A_1. 0 to 1½ inches, gray loose cherty loam stained dark with organic matter.
A_2. 1½ to 10 inches, pale yellowish-gray loose friable silt loam that contains considerable gritty material and chert fragments.

B_2. 10 to 20 inches, pale brownish-yellow silty clay loam, which is friable but has a suggestion of brittleness. It breaks readily to successively smaller particles until a uniform slightly gritty mass forms. It contains numerous chert fragments and a few tiny black concretions.

B_3. 20 to 26 inches, a gradational layer of fairly friable slightly brittle silty clay loam. The color is a mingling of ocher yellow, brownish yellow, brownish red, and light red. The material breaks readily to angular and subangular granules, some of which are firm, red on the outside, and yellow on the inside. The crushed material is light reddish yellow.

C_1. 26 to 50 inches, silty clay loam of mingled light-red, brownish-red, brownish-yellow, and olive colors. The material is hard and firm in place. Displaced pieces are rather brittle although moderately friable. They break readily to angular aggregates ranging from one-eighth to one-fourth inch in diameter. The red ones are firm. The crushed material is fairly smooth and yellowish red.

C. 50 to 70 inches, stiff tight sticky and plastic clay. The prevailing color is light reddish yellow, but mottlings of red, yellow, olive, and gray are numerous.

The Dandridge and Montevallo soils have similar profile characteristics and a similar position on low ridges or plains above the valleys that contain Talbott, Decatur, Dewey, Fullerton, and Clarksville soils. The main differences between them arises from differences in their parent materials. The Dandridge soils are formed from calcareous shale and the Montevallo from acid shale. The Montevallo soils are shallow yellow soils. They occupy predominantly hilly or steep relief and are very susceptible to erosion. The Dandridge soils are more productive than the Montevallo soils.

To a depth of 2 inches, Dandridge silt loam is grayish-brown loose silt loam stained dark with organic matter. This material is underlain by brownish-yellow firm but friable silty clay loam that continues to a depth of about 8 inches. Below this is a layer of brownish-yellow silty clay, which is hard when dry and sticky and plastic when wet. This layer is variable in depth. At a depth ranging from 10 to 18 inches, it rests on partly disintegrated calcareous bluish-gray shale. In many places the calcium carbonate has been leached from the upper part of the shale, and here the shale is yellow.

A deep phase which occurs on undulating or gently rolling relief is mapped. This soil is more than 20 inches thick. The 8- to 12-inch surface soil is light yellowish-gray silt loam. It is underlain by brownish-yellow only moderately friable silty clay, which continues to a depth of 18 or 20 inches. Below this depth mottlings and shale fragments are common. Bedrock generally lies at a depth ranging from 20 to 34 inches.

In Montevallo silt loam bedrock in most places is within a depth of 18 inches. The 4- to 8-inch surface soil is grayish-yellow or light-gray friable silt loam. It is underlain by brownish-yellow silty clay that extends down to the shale bedrock.

A deep phase of Montevallo silt loam also is mapped, in which the bedrock generally lies between 20 and 30 inches below the surface. The surface soil, to a depth of 8 or 10 inches, is pale yellowish-gray silt loam. Underlying this and continuing to a depth of about 18 inches is brownish-yellow silty clay. A mottled layer intervenes between this layer and the acid shale bedrock.

Shallowness of the Montevallo and Dandridge soils is explained mainly by (1) the resistance of shales to weathering and (2) their strong relief favoring erosion. The deep phases normally develop where the relief is much milder and erosion is less severe than is typical. The typical Montevallo and Dandridge soils remain comparatively young, as erosion removes the soil material so rapidly that it does not lie in place long enough for distinctive horizons to develop. In the deep phases, however, the soils are more mature and have fairly well defined soil horizons.

The Muskingum and Hanceville soils are formed from disintegrated sandstones, quartzites, and conglomerates. They occur only in the extreme southeastern part of the county. The Muskingum soils occupy very hilly, steep, and generally very stony areas, whereas the Hanceville occupy much milder relief and are less stony. Hanceville fine sandy loam has a grayish-yellow fine sandy loam surface soil, about 12 inches thick, which is underlain by red firm but friable fine sandy clay. This continues to a depth ranging from 36 to 48 inches, below which yellow and gray mottlings are numerous. Muskingum stony fine sandy loam has a poorly developed profile and lacks consistent horizon differentiation. In general, the 10- to 18-inch surface soil is gray loose fine sandy loam, which is underlain by light fine sandy clay or heavy fine sandy loam. The predominating color is brownish yellow, but in some places the material is yellowish red.

Another soil associated with the Muskingum and Hanceville soils is Jefferson gravelly fine sandy loam. This is a gravelly and stony soil derived from colluvial or local alluvial beds of material that has rolled down from English Mountain. The surface soil, to a depth ranging from 10 to 16 inches, is grayish-brown loose gravelly fine sandy loam, and underlying this is gravelly and cobbly brownish-yellow or reddish-brown sandy clay extending to variable depths.

Owing to the steep slopes and resistant underlying rocks, the Muskingum soils are young and undeveloped. They are azonal soils consisting mainly of weathered and disintegrated sandstone. The same is true of the Jefferson soils. With them, however, relief is not the inhibiting factor, but the relative youth of the deposits is responsible. In time, the Jefferson soils might be expected to develop into soils similar to the Hanceville soils, which exhibit the most advanced development of the soils of these three series. The Hanceville soils have developed under conditions more favorable to the operation of soil-forming forces than have the Muskingum soils.

The soils on stream terraces are classified in five series: Etowah, Nolichucky, Holston, Monongahela, and Tyler. The Etowah soils have yellowish-brown or reddish-brown B horizons; the Nolichucky have somewhat red B horizons; the Holston and Monongahela have yellow B horizons; and the Tyler are highly mottled with gray, olive, blue, and yellow. The Etowah soils come from alluvium derived mainly from limestone, and the Nolichucky, Holston, Monongahela, and Tyler come from old alluvium derived mainly from noncalcareous material. All these soils have lain in place long enough for soil horizons to develop. The Monongahela and Tyler soils have developed heavy compact subsoil layers and may be considered as Planosols. Quartz pebbles and rounded sandstones occur in them all, although they are scarce in the Tyler soils. The Etowah soils, as a rule, are developed on the younger and lower terraces,

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whereas the Nolichucky, Holston, and Monongahela soils are on the higher and older terraces. The typical association is Etowah soils with soils in the first bottoms and Nolichucky soils with Holston soils. The relief of the Etowah soils is mainly undulating, whereas that of the Nolichucky soils is gently rolling.

In a typical profile of Etowah silt loam, the surface soil is light-brown friable silt loam to a depth of 14 inches, where it is underlain by reddish-brown friable silty clay that continues to a depth of about 40 inches. Below this the material generally is brown friable fine sandy clay mottled with yellow and gray.

A typical profile of Nolichucky very fine sandy loam has a grayish-yellow surface soil about 6 inches thick. This passes, through a 3-inch gradational layer of yellow heavy very fine sandy loam, into red rather stiff only moderately friable heavy very fine sandy clay. This material continues to a depth of about 50 inches, where it is underlain by mottled red and yellow heavy fine sandy clay or clay. The typical Nolichucky soil that occurs elsewhere than in Jefferson County has a lighter textured and more friable subsoil. The Nolichucky is an older soil than the Etowah and has been more thoroughly leached; hence the difference in color of the surface layers of the two soils.

The Holston soils have developed on old alluvium derived chiefly from noncalcareous material. They occur mainly in undulating or gently rolling areas, but some occupy nearly level areas. A typical profile of Holston very fine sandy loam, as it occurs in this county, has a light-gray friable loose surface soil 12 inches thick, underlain by pale-yellow friable heavy very fine sandy loam that continues to a depth of 18 inches. At this depth the material is yellow fairly friable very fine sandy clay that continues to a depth of 36 inches, where it rests on relatively hard fine sandy clay, which is dominantly red but is profusely mottled with yellow, gray, and olive.

Associated with the Holston soils are extensive areas of Monongahela very fine sandy loam. This soil is similar to the Holston soil but differs in that it has a compact and tight heavy clay loam layer beginning at a depth of about 24 inches in most places. In this county most of the Monongahela soil occupies stronger relief than the normal Holston, although the reverse is thought to be the normal relationship. The fact that most of the Monongahela soils overlie shale, which, in many places, is close to the solum, accounts for the development of these soils on relatively strong relief. The shale substratum has impeded internal drainage to the extent that an imperfectly drained soil has developed.

Tyler silt loam is a poorly drained soil derived from the same kind of material as the Holston, Monongahela, and Nolichucky soils. Its typical occurrence is in depressions or low places within areas of the Holston and Monongahela soils. Its silt loam surface soil ranges from 10 to 16 inches in thickness and is light gray mottled with gray, yellow, and rust brown. This is underlain by tough heavy plastic silty clay that is very highly mottled with many different colors, chiefly gray, yellow, red, blue, and olive.

The Tyler, Monongahela, Holston, and Nolichucky soils constitute a catena of soils, which in the main owe their differences to differences in drainage conditions. The Tyler soil is definitely poorly drained, and normal soil development has been impeded by a fluctuating water table near the surface. The variegated colors are due to poor aeration and reducing conditions much of the time. The Monongahela and Holston soils are fairly well drained now, but they probably developed under restricted or imperfect drainage. Comparatively recently the drainage has been improved, owing possibly to dissection and a lowering of the water table. The Nolichucky soil has developed under conditions in which both drainage and aeration have been good.

The soils in the creek and river bottoms are mapped as Huntington, Congaree, and Staser soils, and as alluvial soils, undifferentiated. All these are azonal soils. They are extremely young—so young that practically no development of a profile has taken place—and they have essentially the same characteristics as the unaltered alluvium. The Congaree and Huntington soils are well-drained brown friable soils. The alluvium giving rise to the Congaree soils comes mainly from rocks containing considerable mica—granites, gneisses, and schists. The alluvium giving rise to the Huntington soils is derived mainly from soils developed on limestones and dolomites, and they contain little or no mica. The Staser soils also are brown, but a lighter brown than the Huntington or Congaree soils. The alluvium giving rise to the Staser soils comes chiefly from soils developed on calcareous shales and, to a less extent, from soils developed on sandstone. The separation, alluvial soils, undifferentiated, includes a number of different soils, mainly Philo, Lindside, Atkins, Dunning, and Melvin. All are either poorly or imperfectly drained. The alluvium giving rise to the Philo and Atkins soils comes from sandstones and shales, and that giving rise to the Lindside, Dunning, and Melvin soils comes from limestones and dolomites.

The Abernathy and Leadvale soils occur in sinks and other depressions and at the foot of rather long or steep slopes. The parent materials are local accumulations washed down from the adjoining hillsides. Like the soils in the bottoms, the Abernathy and Leadvale soils are azonal. They are too young for climatic and vegetative forces to have affected them significantly since the deposition of their parent material, and they are directly related to the soils or materials in the upland from which they are washed. The Abernathy soils are brown or reddish-brown soils consisting of material washed in from the Decatur, Dewey, and closely related soils. The Leadvale soils are dominantly grayish yellow or yellow soils consisting of material washed from the Montevallo and Dandridge soils and their underlying shales.

SUMMARY

Jefferson County is in the northeastern part of Tennessee in the great valley of the eastern part of the State. The total land area is 199,680 acres, or 312 square miles.

The relief is characterized by a small segment of English Mountain, Bays Mountain, a central valley, and plains that are in part thoroughly dissected. The elevation above sea level ranges from 800 to 3,700 feet, with an average elevation of about 1,150 feet. The county is drained by the Holston and French Broad Rivers.

The climate is temperate and continental. Its salient features are its moderate winters with short erratic cold spells, mild summers with cool, pleasant evenings, and a well-distributed mean annual precipitation of nearly 50 inches, including about 10 inches of snow. The average frost-free season is 212 days.

The first white settlements were made about 150 years ago, and the county has always been dominantly agricultural. The agriculture has developed from typical pioneer farming to its present form of widely diversified farming. Corn, wheat, lespedeza, clovers, alfalfa and other hay, tobacco, and vegetables are the most important crops. Oats, barley, rye, sorgo, peaches, apples, pears, cherries, and berries are less important crops. The livestock enterprise consists chiefly of dairying and poultry raising. The raising of beef cattle, swine, sheep, and goats are less important branches. Diversified farming is a natural response toward the adjustment of agriculture to even more diverse soil and land conditions.

The soils of this county differ widely in characteristics and conditions, many of which influence productivity and use adaptation. Some of these are color, texture, structure, consistence, depth, content of organic matter, fertility, slope, or lay of the land, and conditions of stoniness, erosion, and moisture. Largely upon the bases of such differences, the soils of the county have been classified and mapped into 51 unit separations including 24 soil types, 19 soil phases, 1 complex, and 7 miscellaneous land types.

Of the total county area, silt loams occupy 65.4 percent, fine and very fine sandy loams 10.6 percent, silty clay loams 11 percent, and miscellaneous land types 13 percent. Less than 4 percent of the land requires artificial drainage for cultivation. The proportions of the land rendered unsuited for cultivated crops largely because of strong relief, stoniness, and severe erosion are 35 percent, 8 percent, and 5.5 percent, respectively. About 11.4 percent of the land is nearly level, 22.5 percent is practically stone free, and about 15 percent is injured a little or not at all by erosion. Taking the average of the great valley of east Tennessee as a standard, about 23 percent of the First-class, Second-class, and Third-class soils (those soils generally suitable for growing crops) in Jefferson County is relatively high in natural fertility and productivity, about 48 percent is medium, and about 29 percent is relatively low. Virtually all soils of the uplands are acid in reaction. Tilth conditions are good on the First-class, Second-class, and Third-class soils.

Inasmuch as soil characteristics, both external and internal, affect land use and soil management through the three conditions of productivity, workability, and durability, the soil types and phases in Jefferson County are grouped in five classes according to their relative physical suitability for agricultural uses as determined by these three conditions. For convenience these classes are referred to as First-class soils, Second-class soils, Third-class soils, Fourth-class soils, and Fifth-class soils.

The First-class soils are characterized by good to excellent productivity and workability, and they can be conserved with relative ease. They include the soils of the Huntington, Congaree, Abernathy, and Etowah series and the silt loams of the Decatur and Dewey series and their slope phases. These soils occupy a total of 23,744 acres, or 11.9 percent of the county.

Some one or some combination of the conditions of productivity, workability, or durability is materially less favorable for the Second-class soils, but not sufficiently unfavorable to render them physically unadapted to cultivated crops. They include Staser silt loam, Talbott silt loam, Talbott silty clay loam, eroded phases of the Decatur and Dewey silty clay loams, Fullerton silt loam and its smooth phase, Fullerton fine sandy loam, and Holston very fine sandy loam and its slope phase. Second-class soils include a total of 47,680 acres, or 24 percent of the county.

The Third-class soils are less suitable for crops requiring tillage than are the Second-class soils, owing to less favorable productivity or workability or a greater problem of conservation. Most of the Third-class soils, however, are now used for growing crops, for which they are considered physically adapted, provided good soil management is practiced. Third-class soils include a total of 26,944 acres, or 13.5 percent of the county. They include eroded hilly phases of Dewey and Decatur silty clay loams, Fullerton silt loam, eroded phase, Clarksville cherty silt loam, deep phases of Dandridge and Montevallo silt loams, Leadvale silt loam, Hanceville fine sandy loam, Jefferson gravelly fine sandy loam, Monongahela very fine sandy loam and its slope phase, and Nolichucky very fine sandy loam.

The Fourth-class soils are moderately productive, but they are characterized by adverse conditions of workability or durability or both. A considerable acreage of these soils is used for permanent pasture for which use they are generally physically adapted. Fourth-class soils occupy 72,704 acres or 36.3 percent of the county. They include Dewey silty clay loam, steep phase; Fullerton silt loam, hilly phase; Talbott silty clay loam, eroded hilly phase; smooth stony land and rolling stony land (Talbott soil material); Dandridge silt loam and its hilly phase; Tyler silt loam; and alluvial soils, undifferentiated.

The Fifth-class soils are low to very low in productivity and possess adverse conditions of workability or durability, or both. These soils are very poorly physically adapted, if adapted at all, either to crops requiring tillage or to permanent pasture, and, through elimination, a good use for them is forestry. Most of these soils are now in forest. Fifth-class soils occupy 28,480 acres, or 14.2 percent of the county. They include Fullerton silt loam, steep phase; Clarksville cherty silt loam, hilly phase; rough gullied land (Dewey and Montevallo soil materials); Montevallo silt loam and its hilly phase; Muskingum stony fine sandy loam; and rough stony land (Talbott and Muskingum soil materials).

The best available data indicate that more than 65 percent of the total land area of the county has been cleared and put into cultivation at one time or another. The 1930 census indicates that crops were harvested from only about one-half of this land in 1929. Although no definite data are available as to just what extent wrong use of land is responsible for this broad difference in the amount of land cleared and that yielding crops, general observations bear out the fact that wrong land use has played a prominent part. It is apparent that a very large acreage once cleared and put into cultivation was physically unadapted to such use. On the other hand, some land physically adapted to crop use is still being used for pasture or forestry. The proper adjustment of land use is probably the present basic agricultural need of the county. Once land use is properly adjusted, it is equally necessary that proper measures of soil management follow.

Each soil and land unit in Jefferson County has been described and its relationship to agriculture discussed. Productivity ratings of each soil for the main crops of the present agriculture have been tabulated and discussed. A small generalized land-classification map giving the extent and areal distribution of significant land types has been prepared and briefly discussed. Land Type 1 consists largely of land suitable for crop growing; Land Type 2 is mostly best suited for grazing; and most of Land Type 3 is adapted only to forestry.

In the section on Land Uses and Soil Management the soils of the county are grouped on a basis of management requirements for convenience in discussing the soils in this connection. For this purpose the soils are grouped as follows: Group 1 includes the Huntington, Abernathy, Congaree, and Staser soils; group 2 includes the silt loam types of the Decatur, Dewey, Talbott, Etowah, and Fullerton series and Fullerton fine sandy loam; group 3 includes the eroded phases of Decatur and Dewey silty clay loams, Talbott silty clay loam, and Fullerton silt loam, eroded phase; group 4 includes the eroded hilly phases of the Decatur, Talbott, and Dewey silty clay loams and Fullerton silt loam, hilly phase; group 5 consists of the Holston, Nolichucky, Monongahela, Leadvale, Hanceville, and Jefferson soils, deep phases of Dandridge and Montevallo silt loams, and Clarksville cherty silt loam; and a miscellaneous group includes the rest of the soils and land types, which are considered physically poorly adapted to crop growing. For convenience in discussing the land uses and soil management, the crops and other vegetal cover are grouped as follows: 1, Clean-cultivated (intertilled) crops; 2, close-growing crops that require preparation of the land by plowing but no further cultivation; 3, permanent pasture; and 4, forest.

The forests of the county are discussed, beginning with the early white settlements and leading up to and including the present time. The relationships between the production of forest and the soils and, to less extent, the place of forestry in the agriculture of the county are discussed.

The section of the report on Morphology and Genesis of Soils deals with the soils from the point of view of the soil scientist, particularly in connection with soil classification. The aim of this section is to meet the needs of the soil student or soil scientist rather than those of the layman.

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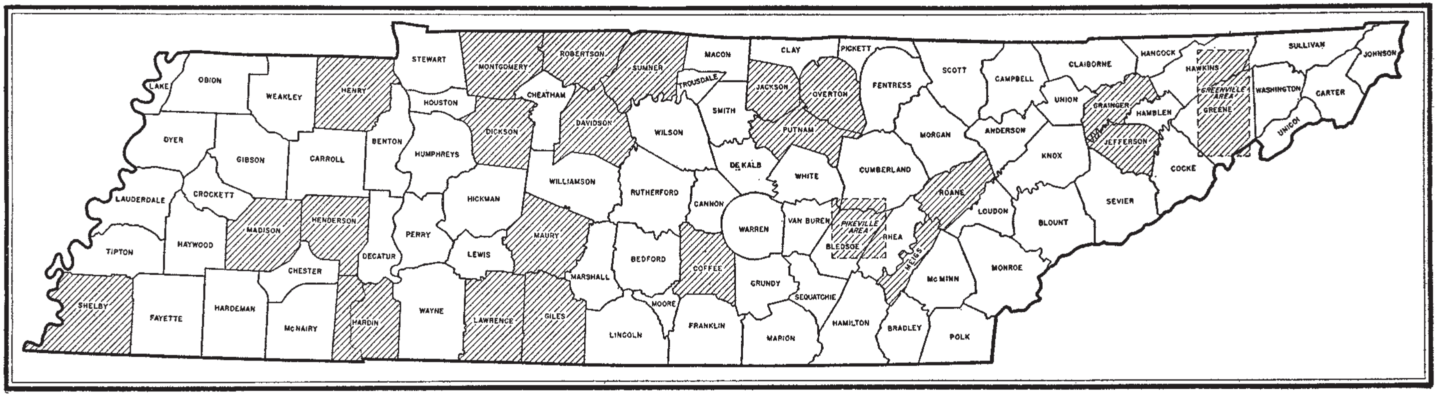

Areas surveyed in Tennessee, shown by shading.

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