

Soil Survey

Bedford County Tennessee

By

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UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Administration
Bureau of Plant Industry, Soils, and Agricultural Engineering
In cooperation with the
Tennessee Agricultural Experiment Station
and the
Tennessee Valley Authority

HOW TO USE THE SOIL SURVEY REPORT

SOIL SURVEYS provide a foundation for all land use programs. The report on each survey and the map that accompanies the report present information both general and specific about the soils, the crops, and the agriculture of the area surveyed. The individual reader may be interested in the whole report or only in some particular part. Ordinarily he will be able to obtain the information he needs without reading the whole. Prepared for both general and detailed use, the report is designed to meet the needs of a wide variety of readers of three general groups: (1) Farmers and others interested in specific parts of the area; (2) those interested in the area as a whole; and (3) students and teachers of soil science and related agricultural subjects. Attempt has been made to meet the needs of all three groups by making the report comprehensive for purposes of reference.

Readers interested chiefly in specific areas—such as some particular locality, farm, or field—include farmers, agricultural technicians interested in planning operations in communities or on individual farms, and real estate agents, land appraisers, prospective purchasers and tenants, and farm loan agencies. These readers should (1) locate on the map the tract with which concerned; (2) identify the soils on the tract by locating in the legend on the margin of the map the symbols and colors that represent them; and (3) locate in the table of contents in the section on Soils the page where each type is described in detail and information given as to its suitability for use and its relations to crops and agriculture. They will also find useful specific information in the sections on Physical Land Classification and Soil Management, and Estimated Yields and Productivity Ratings.

Readers interested in the area as a whole include those concerned with general land use planning—the placement and development of highways, power lines, docks, urban sites, industries, community cooperatives, resettlement projects, and areas for forest and wildlife management and for recreation. The following sections are intended for such users: (1) General Nature of the County, in which physiography, relief, drainage, climate, water supply, vegetation, organization, population, industries, transportation, markets, cultural development, improvement are discussed; (2) Agriculture, in which a brief history and the present status of the agriculture are described; (3) Physical Land Classification and Soil Management, and Estimated Yields and Productivity Ratings, in which the soils are grouped according to their relative physical suitability for agricultural use and their present management requirements are discussed, the present use and productivity of the soils described and suggestions made for improvement.

Students and teachers of soil science and allied subjects—including crop production, forestry, animal husbandry, economics, rural sociology, geography, and geology—will find their special interest in the section on Morphology and Genesis of Soils. They will also find useful information in the section on Soils, in which are presented the general scheme of classification of the soils of the area and a detailed discussion of each type. For those not already familiar with the classification and mapping of soils, these subjects are discussed under Soil Survey Method and Definitions. Teachers of other subjects will find the sections on General Nature of the County, Agriculture, Physical Land Classification and Soil Management, and Estimated Yields and Productivity Ratings, and the first part of the section on Soils of particular value in determining the relations between their special subjects and the soils of the area.

This publication on the soil survey of Bedford County, Tenn., is a cooperative contribution from the—

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SOIL SURVEY OF BEDFORD COUNTY, TENNESSEE ¹

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United States Department of Agriculture in cooperation with the Tennessee Agricultural Experiment Station and the Tennessee Valley Authority

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¹ This report was revised by M. G. Cline and R. J. Turney, Division of Soil Survey, Bureau of Plant Industry, Soils, and Agricultural Engineering.

² The field work for this survey was done while the Division was a part of the Bureau of Chemistry and Soils.

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BEDFORD COUNTY lies within the Nashville Basin in south-central Tennessee, a third of its area extending to a crest elevation of 1,200 feet in the Highland Rim escarpment. In the Nashville Basin, which is sometimes called the Central Basin and is the agricultural section of the county, the chief sources of farm income are from livestock and livestock products, including beef and dairy cattle, hogs, and sheep. Corn, wheat, oats, lespedeza, and alfalfa are leading crops; the principal cash crop is cotton; and fruit is grown for home consumption. Industry combined with agriculture characterizes the county, as many farmers are part-time workers in the 18 or more wood-using plants. Second-growth hardwood forests, redcedar predominating, cover 15 percent of the area. Lumber, staves, and pencils are the principal manufactured products. More cedar pencils are produced in Shelbyville, the county seat and largest town, than in any city in the world, and this town ranks second only to New York in the manufacture of pencils of all types. To provide a basis for the best agricultural uses of the land a cooperative soil survey was begun in 1938 by the United States Department of Agriculture, the Tennessee Agricultural Experiment Station, and the Tennessee Valley Authority, the results of which may be summarized as follows.

SUMMARY OF THE SURVEY

About two-thirds of Bedford County is in the Nashville Basin, or Central Basin physiographic area. This part of the county has an undulating to rolling surface of about 650 feet elevation and is traversed from east to northwest by the Duck River, along which are appreciable areas of bottom lands and alluvial terraces. The remaining parts, in the Highland Rim escarpment area, is hilly to steep, and is thoroughly dissected, with well-developed surface drainage.

The soils of the county are classified in 57 soil types, phases, and miscellaneous land types and represent 28 soil series. The accompanying soil map shows the areal extent and geographic distribution of each of the 57 units of mapping.

The soils differ one from another in color, texture, structure, consistence, fertility, and relief and in conditions of stoniness and erosion. The colors of the surface soils range from dark brown to yellow or gray. Organic-matter content and fertility generally decrease as the color becomes lighter. Colors of the subsoil range from brown to red, yellow, or light gray. The soils that have red or brown subsoils are generally more productive than are those that have gray subsoils.

The slopes range from nearly level to steep. Areas that are nearly level are chiefly on the bottom lands and are of limited extent. Undulating to rolling soils occupy most of the alluvial terraces, most of the inner Central Basin, and a great part of the outer Central Basin. Hilly to steep soils predominate throughout the Highland Rim escarpment. About 15 percent of the county is occupied by poorly or imperfectly drained soils.

The First-, Second-, and Third-class soils are at least fairly well suited to crops that require tillage. The Fourth- and Fifth-class soils are poorly suited to crops requiring tillage. Extreme stoniness, steep slopes, poor drainage, and unfavorable consistence are among the chief factors that limit their suitability for crops.

The relief of about 62 percent of the county is nearly level to gently rolling, about 76 percent is sufficiently free of stone to permit tillage under average conditions, and about 81 percent has lost but little soil material by accelerated erosion. The other 19 percent has lost sufficient material to cause the plow layer to include at least some subsoil.

Fertility differs widely among the soils of the county. About 27 percent is occupied by very fertile soils (the Abernathy, Burgin, Cumberland, Dunning, Egam, Etowah, Hagerstown, Huntington, Lindside, Maury, and Ooltewah series); about 67 percent by moderately fertile soils, and the rest by soils of fair to low fertility (the Baxter cherty), Bodine, Dickson, Frankstown, Guthrie, Robertsville, and Taft series and rough gullied land (Mimosa soil material). All but the most fertile soils of the bottom lands require good management to build up and maintain a good supply of nitrogen and organic matter. Phosphorus and lime are limiting elements of the soils of the Highland Rim escarpment and the inner Central Basin. The Maury soils and some of the related soils on alluvium are well supplied with phosphorus, and much of the remaining part of the outer Central Basin is not so low in this element as the soils of the other parts of the county.

The soils are placed in five groups on the basis of their physical suitability for use in the present agriculture. Agricultural suitability is determined by the productivity, workability, and conservability of the soils. The five groups are as follows:

First-class soils have an aggregate area of 37.1 square miles. Physically these are good to excellent soils for crops that require tillage. They are highly productive of the crops commonly grown and are easily conserved and worked.

Second-class soils have an aggregate area of 77.2 square miles. Physically they are fair to good soils for crops that require tillage. Some one or some combination of the conditions of productivity, workability, or conservability, is poorer for each of the Second-class than for any of the First-class soils.

Third-class soils occupy 135.3 square miles. Physically, these are poor to fair soils for crops that require tillage. Each soil is char-

acterized by productivity, workability, and conservability conditions, one or a combination of which is sufficiently poor to render it poorly suited to crops that require tillage.

Fourth-class soils occupy 222.4 square miles. Physically they are very poor soils for crops that require tillage but are fair to excellent soils for permanent pasture. Each soil of this group is so difficult to work or so difficult to conserve, or both, that management practices necessary for its successful use for crops are, in general, not feasible under present conditions.

Fifth-class soils occupy 4.0 square miles. They are very poor soils for either crops that require tillage or for permanent pasture. Each is sufficiently low in content of plant nutrients or has such poor moisture relations, or both, that common crop and pasture plants produce very little useful vegetation. These soils apparently are best suited physically to forest or similar uses under present conditions.

The generalized map of the county shows the location and extent of areas of five associations of physical land classes, each of which differs from the others in degree of suitability for broad agricultural uses.

The factors of soil formation, the classification of soils in higher categories, and descriptions of soils representing great soil groups are of value to those interested in the morphology and genesis of the soils.

GENERAL NATURE OF THE COUNTY

LOCATION AND EXTENT

Situated in the south-central part of Tennessee, Bedford County is separated from the State of Alabama by Lincoln and Moore Counties on the south (fig. 1). The county is roughly rectangular in outline and contains 476 square miles, or 304,640 acres. The eastern and

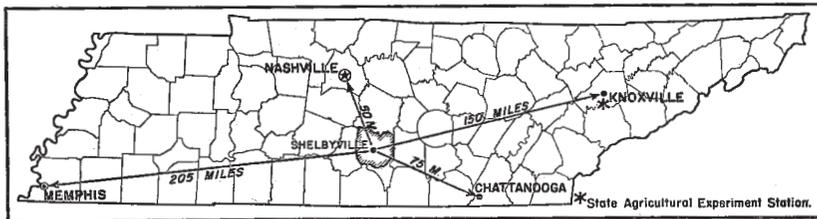
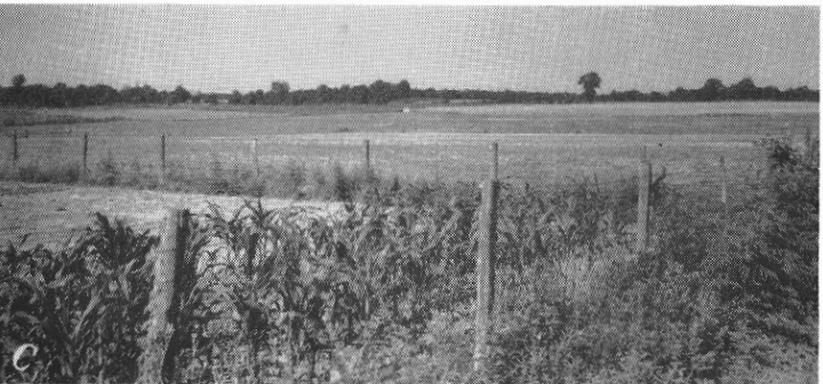


FIGURE 1.—Location of Bedford County in Tennessee.

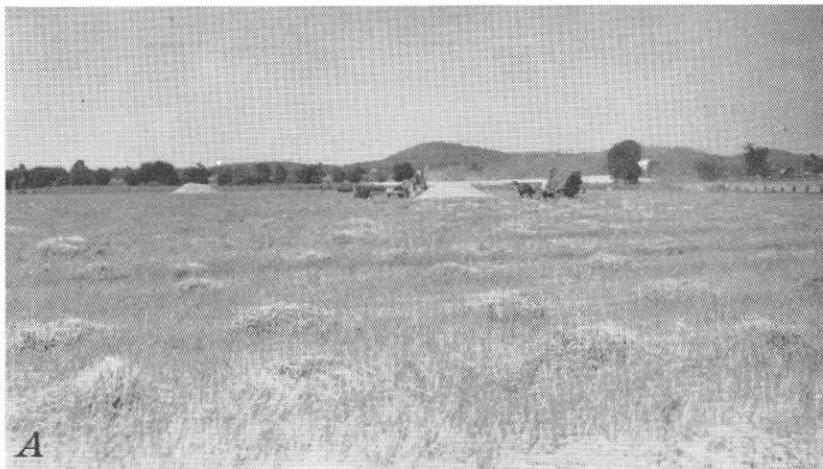
western boundaries are straight lines, the northwestern boundary almost coincides with the northern boundary of the Tennessee River drainage basin, and the southern boundary follows the drainage divide between the Duck and the Elk Rivers. Shelbyville, the county seat, is approximately in the center of the county and is 50 miles south of Nashville, 75 miles northwest of Chattanooga, and 150 miles southwest of Knoxville.

PHYSIOGRAPHY, RELIEF, AND DRAINAGE

Physiographically, the greater part of the county is in the Central Plain of the Nashville Basin, locally called the Central Basin. A small part is in the physiographic province known as the Highland



Soils of the outer Central Basin: *A*, Wooded areas are dominantly rolling stony land (Colbert soil material), the cleared hilly land is Dellrose cherty silt loam, and the smooth land in the foreground is Maury and Mercer silt loams. *B*, The cropped area is Maury and Abernathy soils, the cleared area in the background is Colbert silt loam, and the wooded areas are smooth and rolling stony lands (Colbert soil material). *C*, Hagerstown silty clay loam, eroded phase, is one of the more suitable soils for crop production in the inner Central Basin.



A, small grains, chiefly wheat and oats, fill an important place in the rotations commonly used throughout the county as companion crops to the legume-grass crop. B, Tennessee Walking Horses are bred and raised in the outer Central Basin, where the soils are high in phosphorus content.

Rim (2)³. The Central Basin is below the level of the surrounding Highland Rim and varies in surface relief and elevation. Elevations of the Central Basin range from about 600 to 850 feet;⁴ and of the Highland Rim, about 900 to 1,200 feet.

Figure 2 shows the areal extent and geographic distribution of four physiographic subdivisions of the county. The Highland Rim phisio-

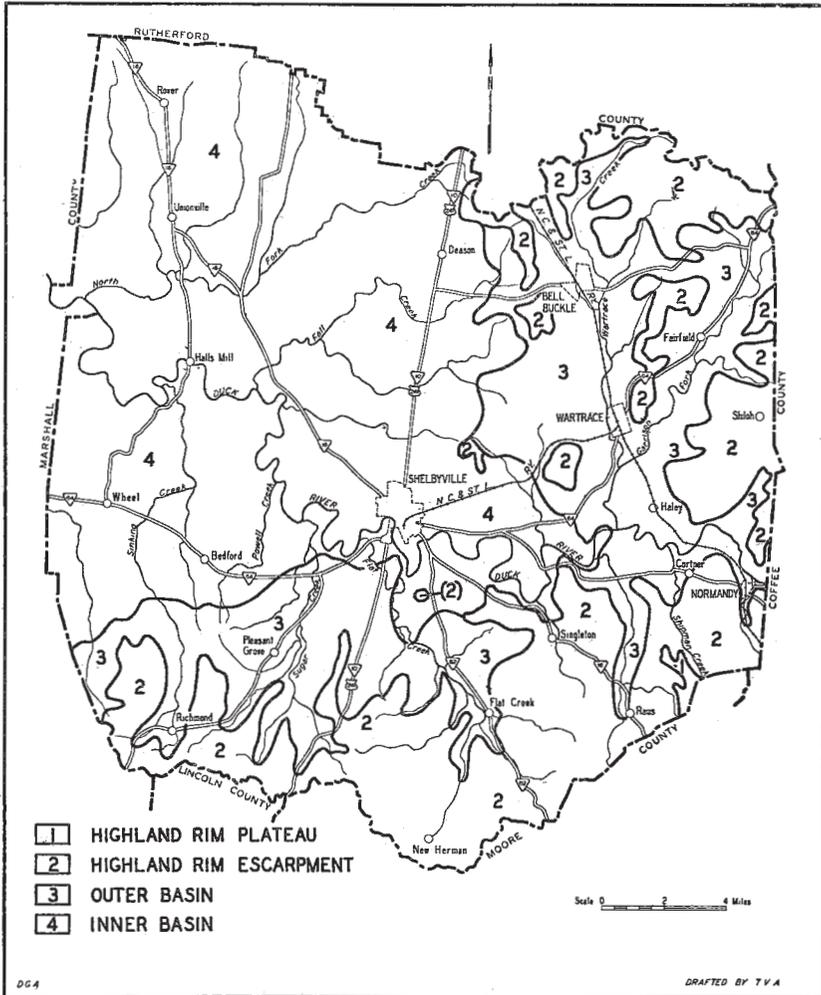


FIGURE 2.—Physiographic subdivisions of Bedford County, Tenn.

graphic division is a narrow, roughly crescent-shaped belt, $\frac{1}{2}$ mile to 5 miles wide along the southern, eastern, and northeastern boundaries of the county, and is divided into the Highland Rim plateau and the Highland Rim escarpment. The rest of the county, which is in the Central Basin, has been divided into the inner Central Basin and the

³ Numbers in parentheses refer to Literature Cited, p. 119.

⁴ Elevation data from U. S. Geological Survey topographic maps.

outer Central Basin. Three small outliers of the Highland Rim escarpment are in the outer Central Basin.

The Highland Rim plateau is a nearly level to gently rolling plateau, ranging in elevation from about 1,000 to 1,200 feet, and is the highest land in the county. It represents a very small part of the county.

The Highland Rim escarpment consists of spurs or ridges that extend from the Highland Rim proper and also includes a few monadnocks, or outliers of the same division. The higher points on these spurs and remnants of the Highland Rim are about the same in elevation as on the Highland Rim. This escarpment and the outliers are parts of the Highland Rim that have resisted the geologic erosion that is cutting back into the Highland Rim plateau. The rock formations that cap these remnants are apparently more resistant to weathering and erosion than the underlying formations and consequently have kept the remnants relatively intact. The relief here is much sharper than in the Central Basin, and the elevations range between 200 and 300 feet from the bottom of the V-shaped ravines to the top of the narrow ridges. The slopes are rather long, with a gradient of 20 to 35 percent in most places. This division comprises approximately one-sixth of the area.

The outer Central Basin is in the eastern and southern parts of the county between the Highland Rim escarpment and the inner Central Basin. The Central Basin extends northwestward from near Roseville to the Bedford-Rutherford County line and westward from near Roseville to the Bedford-Marshall County line. The lay of the land, or relief, of the outer Central Basin ranges from undulating to rolling (pl. 1, *A* and *B*), and the differences in elevation range from 50 to 200 feet. The relief is milder than that of the Highland Rim escarpment but stronger than that of the inner Central Basin. The slopes are predominantly less than 15 percent in gradient.

The inner Central Basin lies northwest of the outer Central Basin and is divided diagonally by the Duck River (fig. 2). Its gently undulating to gently rolling (pl. 1, *C*) relief averages about 7 percent in gradient.

Geologic formations of the Highland Rim plateau are of the Mississippian system and consist of a thin capping of the Warsaw formation underlain by Fort Payne chert, which in turn is underlain by a thin lens of Maury green shale or Ridgetop shale that overlies about 5 feet of Chattanooga black shale. Underneath this shale is about a 20-foot bed of the Fernvale formation, which belongs to the Richmond group of the Silurian system.

The Highland Rim escarpment includes the Mississippian formations represented in the Highland Rim section and also some of those of the underlying Ordovician system. Very little or none of the Warsaw formation, which caps the Highland Rim, is evident in the escarpment.

Rocks of the Central Basin belong to the middle and lower Ordovician systems. The outer Central Basin is underlain by middle Ordovician rocks, and the inner Central Basin by lower Ordovician rocks. The Ordovician formations represented in the outer Central Basin include the Leipers, Catheys, Cannon, and Hermitage formations and are overlain by the Fernvale formation of the Silurian

system. The Cannon limestone is perhaps the thickest rock formation exposed in the county. The Hermitage formation underlies the Cannon limestone, and its base marks the line of separation between the outer and the inner Central Basins. These higher Ordovician rocks, have a considerable phosphatic content and in places yield commercial phosphate (12).

The rock formations of the inner Central Basin consist of Lowville limestone, overlain by the Hermitage formation and underlain by the Lebanon limestone. Exposures of Ridley limestone, which underlies the Lebanon limestone, occur in the northwestern part of the county. The "glades," or rock outcrops in the inner Central Basin, consist of Lebanon limestone.

Only a few limestone sinks have formed in the county, and these vary considerably in depth and size. Some are shallow and range from $\frac{1}{10}$ to 5 acres in extent. Others are 75 to 100 feet deep and range from areas about 200 feet in diameter to 50 to 100 acres.

The drainage system of the county is dendritic and, in general, is well developed. The Duck River, which flows northwestward, and its various tributaries drain the county. The general slope is westward. Creeks and small drainageways extend to all parts of the county and give the upland complete surface drainage. Practically every farm is connected with one or more of these drainageways, which afford not only good surface drainage but also an ample supply of water for livestock. The first-bottom land has fair surface drainage in most places. Some of this land, however, lying next to the upland or occupying low positions along streams, has poor surface and internal drainage. Good drainage is maintained by open ditches or tile throughout most of the poorer drained bottom lands.

Land on low terraces near streams has ample surface drainage, and most of it has good internal drainage. Most of the areas that have imperfect or poor internal drainage have been artificially drained.

The stream valleys are comparatively narrow. In the Highland Rim escarpment, the narrow valley floors are 100 to 250 feet below the tops of the ridges. In the Central Basin, however, the valley floors are wider and not so deep, and the streams are 25 to 75 feet below the general level of the surrounding upland.

Elevations in the county range from about 700 to 1,200 feet. The elevations at several places are: Bell Buckle, 837 feet; Wartrace, 817 feet; Haley, 840 feet; Normandy, 825 feet; Shelbyville, 765 feet; the bridge over Duck River at Shelbyville, 731 feet; Dement Bridge, 784 feet; Cortner, 834 feet; Sims Bridge, 713 feet; Warner Bridge, 692 feet; Halls Mill, 688 feet; Palmetto, 770 feet; Wheel, 766 feet; and Bedford, 797 feet.

CLIMATE

The climate of Bedford County is of the humid-temperate continental type. The winters are mild but are broken by short cold spells. The summers are long but are not oppressively warm. The mean winter temperature is 41.2° F., and the mean summer temperature is 77.0°, with a mean annual temperature of 59.6°.

The mean annual rainfall of 50.78 inches is well distributed throughout the year, the heaviest seasonal rainfall, 14.14 inches, occurring in

spring, and the lightest, 9.63 inches, in fall. The average annual snowfall is 7.6 inches.

Although there are no available data on local variations in temperature and precipitation, apparently such variations exist. So far as 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 relation to mountains. Frosts frequently occur in valleys and depressions when vegetation on the ridges shows no injury. The early fall and late spring frosts in the lower elevations invariably do greater damage to vegetation than in the higher. Winter-killing of perennials, small grains, and other winter crops by heaving caused by freezing and thawing is most frequent on slopes made wet by seepage.

The average frost-free season is 197 days, extending from April 10 to October 24, which is ample time to grow and mature practically any of the southern field crops. Frosts have occurred as late as May 2 and as early as September 30, but these unusually early and late frosts are seldom severe. The grazing period extends from late February to late November.

Although temperatures below zero have been recorded in the county, the winters are seldom severe enough to hamper farm activities. The most disagreeable climatic feature probably is the sudden changes in temperature. Snows occur practically every winter, but they remain on the ground only 3 or 4 days at a time. Rye, wheat, crimson clover, alfalfa, barley, and other winter crops are grown with little risk of being winter-killed.

TABLE 1.—Normal monthly, seasonal, and annual temperature and precipitation at Palmetto, Bedford County, Tenn.¹

[Elevation 770 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total for the driest year	Total for the wettest year	Average snowfall
	°F.	°F.	°F.	Inches	Inches	Inches	Inches
December.....	41.6	77	-3	4.98	3.23	6.24	1.8
January.....	40.2	76	-12	4.68	2.57	3.50	1.9
February.....	41.9	78	-18	4.16	4.96	5.98	2.9
Winter.....	41.2	78	-18	13.82	10.76	15.72	6.6
March.....	50.6	88	1	5.33	5.19	7.11	.6
April.....	58.9	90	22	4.38	1.40	12.51	(²) 0
May.....	67.5	96	32	4.43	6.56	5.24	0
Spring.....	59.0	96	1	14.14	13.15	24.86	.6
June.....	75.2	102	43	4.43	1.01	3.70	0
July.....	78.3	108	49	4.58	1.05	9.33	0
August.....	77.6	107	48	4.18	2.41	4.78	0
Summer.....	77.0	108	43	13.19	4.47	17.81	0
September.....	72.8	107	32	2.96	1.71	4.67	0
October.....	61.5	96	24	3.39	3.08	.82	(²) .4
November.....	49.7	86	3	3.28	3.50	1.49	.4
Fall.....	61.13	107	3	9.63	8.29	6.98	.4
Year.....	59.6	³ 108	⁴ -18	50.78	⁵ 36.67	⁶ 65.37	7.6

¹ Data from U. S. Weather Bureau records.

² Trace.

³ In July 1930.

⁴ In February 1899.

⁵ In 1930.

⁶ In 1912.

The prevailing winds blow from the southwest. Wind storms and hailstorms may be expected but they are infrequent.

Table 1, compiled from the records of the United States Weather Bureau station at Palmetto, gives the normal monthly, seasonal, and annual temperature and precipitation, which may be considered as fairly representative of climatic conditions in the county.

WATER SUPPLY

An ample water supply for both human and animal needs is furnished by springs, wells, small streams, and rivers. The Highland Rim escarpment relies almost wholly on numerous large springs for water. These are dependable, but in protracted dry weather their supply is reduced. The water supply of Bell Buckle and Wartrace comes from Cascade Springs, in Coffee County. For the Central Basin water is obtained from springs and from bored wells 40 to 200 feet deep. Water for livestock comes largely from streams and springs; but during summer droughts, when the streams dry up, it is obtained from wells.

Streams and other water used in recreation are the Duck River, Garrison Fork, and Flat and Fall Creeks. The Duck River is perhaps the most popular stream in the county for fishing.

VEGETATION

The area now included in Bedford County was originally covered with forest, consisting of white oak, chinquapin oak, hackberry, black walnut, hickory, chestnut, beech, sycamore, redcedar, locust, willow, and other less important species. Cane, sassafras, sumac, honeysuckle, trumpet vine, redbud, dogwood, blackberry and other small plants comprised the smaller vegetation. Practically all the original forest has been cut and used for lumber, fence posts, fence rails, pencil wood, and fuel. Some forest remains in places where the land is unsuitable for other uses; the principal species are white and black oaks, redcedar, hickory, hackberry, and locust. Redcedar still predominates over much of the Central Basin, but is now confined almost entirely to land that is too rocky or too severely gullied for cultivation.

Kentucky bluegrass and Bermuda grass have practically displaced the native grasses, chiefly broomsedge and similar grasses, but in pastures that have not been properly managed broomsedge predominates and is considered a pest. Johnson grass, which is a pest in some parts of the State, is used in this county for hay, especially where the growth is luxuriant. Plants commonly regarded as detrimental to crops and to bluegrass pasture are ragweed, ironweed, thistle, wild onion, cheat, and cocklebur.

ORGANIZATION AND POPULATION

Bedford County, created by an act of the General Assembly on December 3, 1807, was named in honor of Thomas Bedford, who later became a lieutenant colonel in the United States Army during the War of 1812. Its size was reduced in 1809 by an act authorizing the formation of Lincoln County, and again in 1836 and 1837, by the

formation of Coffee and Marshall Counties, respectively. In May 1810, the county seat was established at Shelbyville on a tract of 100 acres donated by Clement Cannon, who according to local reports settled near the present site of Shelbyville in 1805 or 1806 and was probably the first settler in the county. Other early settlements were made in the vicinity of Thompson Creek and Garrison Fork near Fairfield (3).

The first land grants in what is now Bedford County were made between 1785 to 1790 by North Carolina to soldiers for military services in the Revolutionary War. These ranged from a hundred to several thousand acres. From about 1800 to 1810, other grants were made by Tennessee. The early settlers came from eastern Tennessee, North Carolina, Virginia, Kentucky, and Alabama. In later years, after other settlers had arrived, the large land grants were divided and sold.

Bedford County was the most populous county in the State until its size was reduced by the formation of Coffee and Marshall Counties. Of the population (Federal census of 1940) of 23,151, 16,614 is rural; the rural density population is 34.4 persons to the square mile. The county is fairly uniformly settled, the smallest population being in a narrow strip lying north and south of the Duck River in the west-central part.

Shelbyville, the county seat and largest town (1940 population, 6,537), has about 30 small industries that manufacture a variety of articles; and furnishes a market for locally grown hay and grain and for dairy and poultry products.

Other incorporated towns and their population (1940) are: Wartrace, 522; Bell Buckle, 355, and Normandy, 163. Each of these is located on a trunk line of the Nashville, Chattanooga & St. Louis Railway, and besides being a shipping point, each is a trading center for the surrounding country. Other trading centers are Haley, Raus, Singleton, Flat Creek, Richmond, Pleasant Grove, Bedford, Wheel, Unionville, Rover, Deason, and Fairfield.

INDUSTRIES

As the large number of small industries in Shelbyville give some of the farmers part-time work, Bedford County may be considered an agricultural-industrial county in which agriculture predominates. The industries, except a tire-cord mill, are owned and financed largely by local people. Three pencil factories, a graphite plant, two garment factories, a saw-handle factory, and a harness and horse-collar factory are perhaps the largest industries and employ the greatest number of people, many of whom live on farms. Other manufactures include mattresses, commercial feeds, metal shingles, and paper cartons. Three mills that grind both corn and wheat, two cotton gins, and a few small sawmills operate in different parts of the county. Electric power is furnished by a local hydroelectric plant and by electricity transmitted from Chattanooga.

TRANSPORTATION AND MARKETS

Adequate transportation facilities are supplied by railroad, truck, and motorbus lines. The Nashville, Chattanooga & St. Louis Rail-

way traverses the eastern part of the county in a north-south direction, and is connected with Shelbyville by a branch line from Wartrace. This railroad is within easy reach of most farmers in the east half of the county, and the Louisville & Nashville Railroad, which crosses the adjoining Marshall County, is available to farmers in other parts. Terminals in Nashville and Chattanooga connect with railroads that extend to northern and southern markets.

United States Highway No. 241 crosses the center of the county in a north-south direction, and a State highway traverses the county in a northwest-southeast direction, about half of its extent being hard-surfaced. Another State highway enters the county at the northeast corner, extends southward to Wartrace, and thence westward through Shelbyville across the county. A State highway connects Shelbyville with Lynchburg, the county seat of Moore County. In addition to these Federal and State highways, the county has a network of good graded and gravel roads that lead from the rural communities to highways and local markets. Reports in 1940 showed 655 farms on hard-surface roads; 1,111 on gravel, shell, or shale roads; 567 on improved dirt roads; and 478 on unimproved dirt roads.

The agricultural products are consumed on the farms or sold mainly at local markets. Cotton is sold to local ginners; wheat is marketed in the county and in Nashville; hay is grown primarily for feed on the farms; milk is processed at large plants locally and outside the county; and hogs and lambs are marketed in Nashville. Wool is usually pooled and sold at auction to northern buyers. Mules and Tennessee Walking Horses are sold mainly to southern dealers in livestock, but some go to the North.

CULTURAL DEVELOPMENT AND IMPROVEMENT

The prevailing condition of buildings, the general farm improvements, and the extent of modern rural home conveniences are in general an expression of the character of the soil and the condition of the land. In the Highland Rim escarpment, especially in the vicinity of Richmond, Pleasant Grove, Flat Creek, Normandy, Wartrace, and Bell Buckle where the soils are more productive, the buildings are generally in good repair, the farms are well equipped with machinery, and the farm dwellings have modern improvements. These conditions are also common on farms that consist of soils on first bottoms and terraces along the Duck River. In parts of the county where the soils are less productive, the farm buildings, equipment, and home improvements are not so good.

Throughout the county, however, the people enjoy comfortable homes that probably are above the average in improvements and conveniences. This is particularly the case in recent years since the erection of rural electric facilities in practically every community.

In 1940 electric distribution lines were within a quarter of a mile of farm dwellings on 1,177 farms, and on 714 farms the dwellings were lighted by electricity, 704 obtaining their current from a power line and 10 from home plants. In the same year, telephones were on 635 farms.

Telephone service is available in practically all the rural communities, rural mail routes serve all parts of the county, and schools and

churches are conveniently located. The county has 51 schools for whites and 18 for Negroes, of which 4 are 4-year high schools for white pupils, 3 are 2-year high schools for white pupils, and 1 is a 4-year high school for colored pupils. In addition, there is a private school for boys at Bell Buckle.

General farm improvements, equipment, machinery, and buildings vary according to the productivity, workability, and conservability of the soils. Tractors, motortrucks, grain binders, and other heavy farm machinery are used in all parts of the county. Such machinery, however, is more useful on the smoother lands than on the rugged land of the Highland Rim escarpment. On 147 of the farms reporting in 1940 there were 161 motortrucks and 164 tractors. In the same year 1,579 farms reported having 1,712 automobiles. In 1930, there were 43 electric motors and 77 stationary gas engines on farms in the county.

The quality of the work animals is in general very good, but it varies according to the physical condition of the land in the different parts of the county.

Practically all the land is fenced with woven wire, barbed wire, or rail, or in places with mockorange shrubs or locust trees that have been topped to form a hedge 2 to 4 feet high. The quality of the fences varies from very poor to very good, but it averages fair. As most of the farm income is derived from livestock and livestock products, good fences are essential. The condition of the fences probably reflects the farm income.

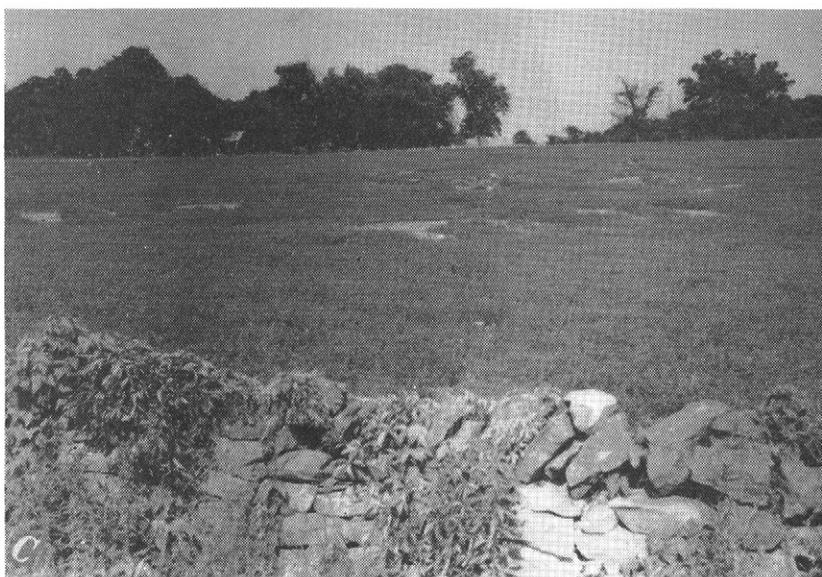
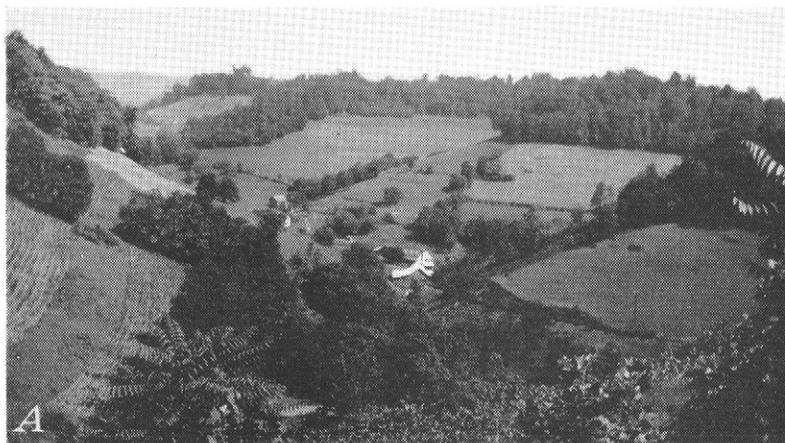
AGRICULTURE

Soon after the first settlement in Bedford County was made in 1805 or 1806, near the present site of Shelbyville, the pioneers rapidly cleared the land and made their homes mainly near the larger streams.

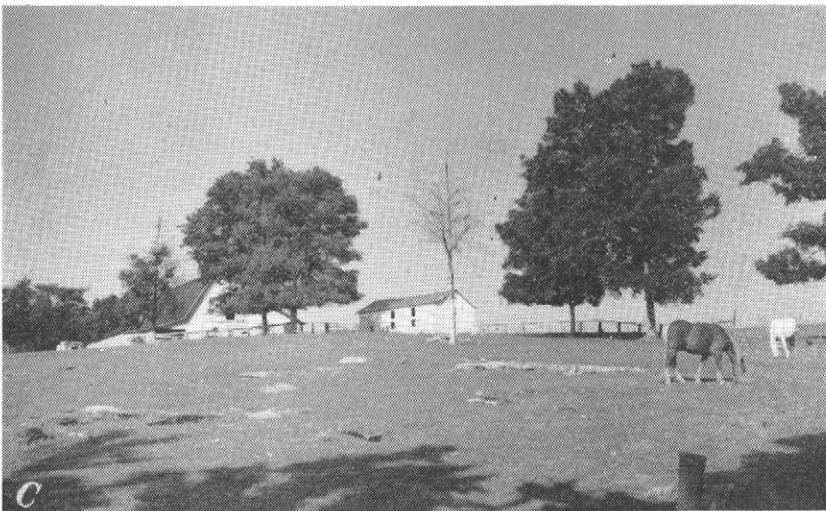
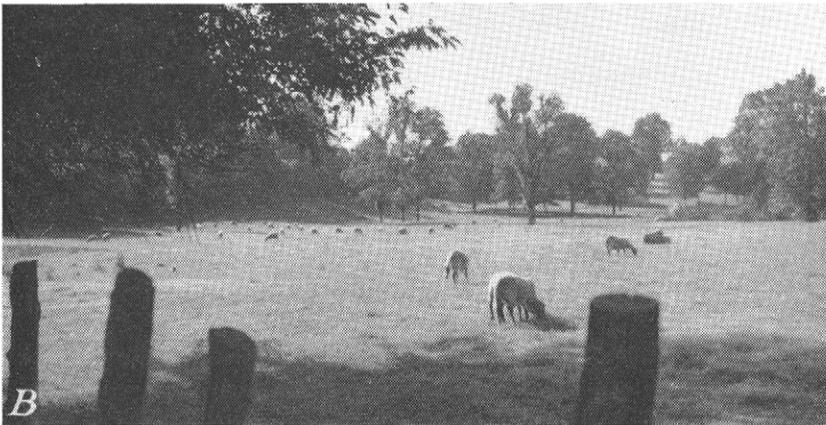
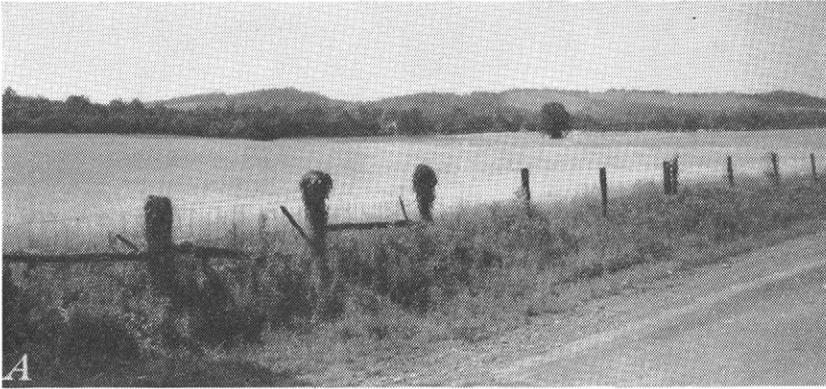
Authentic information about the early agriculture is meager. Apparently it was similar to that followed elsewhere, consisting primarily of growing subsistence crops and home supplies. Prior to 1880 the important crops were corn, wheat, oats, rye, and potatoes; minor crops, hay and tobacco; and some mules, beef and dairy cattle, and hogs were raised. Before the construction of the Nashville, Chattanooga & St. Louis Railway, the livestock was driven to markets in Nashville, Birmingham, Ala., and Georgia, and the farm products were transported by raft on the Duck, Tennessee, and Mississippi Rivers to New Orleans or were hauled by wagon to Nashville and thence by boat on the Cumberland River.

During the period from 1870 to 1875, Killibrew (6), from a personal survey, reported that the farms ranged in size between 50 and 100 acres and that there was one farm of 500 acres. The 1880 census reported 2,965 farms in the county. Referring to the crops, Killibrew (6, p. 627) wrote that "Fortunately for the appearance of the county there is very little cotton grown." In 1873, a total of 2,338 bales of cotton was produced.

During this period, Bedford County ranked fifth in the production of hogs. The favorite type was a cross-breed of Berkshire and native hogs. In 1874, the hogs raised had an estimated value of \$550,000 and were ready for marketing when they weighed about 350



A, Dellrose soils occupy much of the steep valley slopes of the Highland Rim escarpment. *B*, Smooth, relatively fertile bottom lands. Lindside silt loam is on the first bottom land; and Wolftever silt loam is on the second bottom. *C*, Colbert silty clay loam, eroded rolling phase, used for alfalfa.



A, Huntington silt loam, one of the soils best suited for intensive use. B, Lindside silt loam, shallow phase, used as pasture for sheep. C, Rolling stony land (Colbert soil material), used as pasture

pounds. Many mules and horses were raised for export. The mules were raised for work animals, and the horses primarily for riding. There were fewer buggies in this county at that time than in any other county in the State.

Shortly after the Civil War, many Shorthorn sires were introduced and crossbred with the native cattle. The farmers preferred grade cows for milk production. Practically every farmer kept a small flock of sheep; and nearly every flock was intermixed with the Cotswold breed, as a result of the introduction of that sheep a few years earlier. One of the greatest menaces to sheep raising during that period was from sheep-killing dogs, which caused from one-fourth to one-third of the losses.

The early farmers were apparently interested in organizing and improving their agricultural pursuits. Killibrew mentions the Bedford County Agricultural and Mechanical Association, which erected the fairgrounds, and also the farmers' club, which had been in existence for several years prior to 1874.

In the earlier days the soils were referred to as "mulatto soils" and "red soils." In his report, Killibrew gives yields of wheat as 15 to 20 bushels an acre, corn 40 bushels, sweetpotatoes 75 bushels, cotton 700 pounds, and timothy hay 1½ to 2 tons.

The early agricultural implements were more or less crude compared with the machinery of the present time. It appears, however, that the pioneer settlers were alert in making improvements, as may be inferred from the Tilford plow, patented by J. N. Tilford, of Murfreesboro, Tenn.

CROPS, LIVESTOCK, AND PRODUCTS

No important changes have been made in the crops grown, livestock raised, and in the general agricultural practice since the earlier days of agriculture. Practically the same crops are grown now as prior to 1880, except for hemp, which was discontinued, and lespedeza, which was introduced about 1920. Red clover was formerly the most important legume crop; but leaching and erosion reduced the fertility of the soil, and blight damaged the clover so much that it is no longer commonly grown except on land that is fertilized and limed and on which blight-resistant seed is planted. Lespedeza has replaced red clover on most farms and its production has become widespread, as it is adapted to a wide range in soil conditions, makes good hay and seed crops and pasture, and helps to build up the soil.

Corn, wheat, oats (pl. 2, A), and hay, mainly lespedeza, are the leading crops. Some alfalfa is grown for hay. Table 2, compiled from the Federal census reports from 1880 to 1940, inclusive, gives the acreage of the principal crops grown in the county in stated years.

TABLE 2.—*Acreage of the principal crops and numbers of fruit trees grown in Bedford County, Tenn., in stated years*¹

Crop	1879	1889	1899	1909	1919	1929	1939
Corn:							
For grain.....	Acres 68,492	Acres 61,480	Acres 64,266	Acres 59,189	Acres 59,329	Acres 46,682	Acres 39,595
For other purposes.....					1,823	4,216	895
Oats:							
Threshed.....	6,270	10,962	3,838	11,182	5,320	938	2,124
Cut and fed unthreshed.....						1,138	492
Wheat.....	39,589	39,168	46,619	13,269	10,389	6,306	9,138
Barley.....	24	95	55	81	49	35	887
Rye.....	806	1,978	2,110	2,106	1,376	318	1,763
Sorghum for sirup.....	² 96,657	818	303	988	446	127	72
Hay, total.....	6,153	12,367	12,659	23,508	32,171	28,386	44,670
Annual legumes.....					7,112	6,777	1,675
Alfalfa.....					215	456	1,297
Lespedeza.....							35,486
Clover or timothy, alone or mixed.....				10,004	6,632	9,848	1,869
Clover alone, all kinds.....			2,596		6,197	4,152	³ 131
Small grain hay.....			3,347	1,074	4,570	1,464	1,995
Other tame hay.....			6,667	12,313	7,350	5,261	1,678
Wild hay.....			49	117	95	428	739
Sorghums for silage, hay, or fodder.....					1,393	1,055	770
Potatoes.....	⁴ 29,182	366	170	337	279	283	306
Sweetpotatoes.....	958	406	252	298	256	224	134
Market vegetables.....				1,311	47	87	14
Cotton.....	2,239	1,004	233	810	1,779	4,478	2,113
Tobacco.....	51	3	8	7	37	35	140
Apple..... trees.....	Number	Number	Number	Number	Number	Number	Number
Peach..... do.....		93,589	86,521	47,267	33,575	14,152	11,663
		29,735	34,936	38,144	29,423	16,869	18,759

¹ Fruit trees as of years of census, 1890-1940.² In gallons; acreage not available.³ Sweetclover only.⁴ In bushels; acreage for 1879 not available.

During the 60-year period from 1879 to 1939, there was a large increase in the acreages of barley, hay, tobacco, and rye; the acreage in barley was about 37 times as much in 1939 as in 1879, rye increased about 119 percent, hay crops about 627 percent, and tobacco about 175 percent. In the same period, however, the acreage of corn decreased about 40 percent; wheat about 77 percent; oats threshed about 66 percent; and sweetpotatoes about 86 percent. There was only a slight decrease in the cotton acreage. In the period from 1889 to 1939 the acreage used for potatoes decreased about 16 percent and that used for sorghum for sirup about 91 percent.

Fruit crops are of little importance in the county. During the period from 1889 to 1939, there was a decrease of about 87 percent in the number of bearing apple trees and about 37 percent in the number of bearing peach trees. Most of these fruit trees are in home gardens and home orchards, and the fruit is consumed in the homes. In 1939, hay and corn occupied far greater acreages than any other field crop.

In the period from 1900 to 1940 the number of horses and mules decreased about 30 percent. More of the decrease was in horses used as pleasure animals than in work animals. Hogs also decreased about 37 percent. The largest increases in livestock were in cattle, about 82 percent, and sheep, about 63 percent.

The beef cattle are dominantly of the Hereford breed, although a few Aberdeen Angus and Shorthorn breeds are raised by farmers who have ample pasturage. Most of the farms have 6 to 15 milk cows,

chiefly grade Jerseys. Whole milk from these cows is collected by motortrucks at the farms and delivered to nearby processing plants.

Sheep are more numerous in the eastern and southern parts of the county. The wool and the lambs are sold in spring. Southdown and Hampshire are the most common breeds, but in recent years many western ewes, which appear to be heartier than the native-bred animals, have been introduced for breeding.

Hogs have decreased considerably in number since 1920, probably because of an increase in sheep raising and a decrease in the corn acreage. The principal breeds are Poland China, Hampshire, and Duroc-Jersey.

Most of the mules and horses are raised on the farms and used as work animals, but each year many mules are sold to livestock traders and buyers who come from Georgia, Alabama, and Mississippi.

Considerable interest is manifest throughout the county in the breeding and training of the Tennessee Walking Horse, a three-gaited animal that makes a very good horse for comfortable riding (pl. 2, B). Many of these horses are trained and sold to people throughout the country.

The number of livestock in the county for the years stated is given in table 3, compiled from Federal census reports.

TABLE 3.—Number and value of livestock and beehives on farms in Bedford County, Tenn., in stated years

Livestock	1910 (April 15)		1920 (January 1)		1930 (April 1)		1940 (April 1)	
	Number	Value	Number	Value	Number	Value	Number	Value
Horses.....	8,487	\$909,159	7,218	\$671,596	4,539	\$273,720	1 5,030	\$438,100
Mules.....	5,814	698,781	7,245	946,024	4,239	351,872	1 3,462	395,188
Asses and burros.....	439	73,609	224	23,052	127	6,350		
Cattle.....	18,687	434,729	21,488	997,303	25,998	989,628	1 25,545	887,117
Milk cows 2.....	5,985	(³)	6,166	(³)	9,549	(³)	13,485	(³)
Sheep.....	56,598	241,679	19,525	267,727	40,900	229,158	4 25,076	162,727
Swine.....	32,624	177,926	46,161	424,128	24,613	236,455	1 20,076	115,040
Goats.....	1,402	2,589	2,827	7,070	3,184	6,336	1 3,100	4,583
Chickens.....	171,168	84,874	226,667	206,311	104,211	124,800	1 144,177	69,205
Other poultry.....			9,511	(³)	(³)	(³)	1 4,839	6,413
Beehives.....	2,078	5,605	2,624	8,795	2,128	7,129	1,677	3,857
Total value.....		2,718,931		3,552,006		2,225,448		2,082,228

1 Over 3 months old.
 2 Cows and heifers 2 years old and over on Jan. 1 of census year (kept for milk production).
 3 Not reported.
 4 Over 6 months old.
 5 Over 4 months old.
 6 Poultry of all kinds, over 3 months old.

In 1909 (1910 census) 28.9 percent of the farms spent \$59,587 for feed, or \$61.49 a farm reporting. The percentage of farms that purchased feed increased to 35.9 in 1919 and to 52.3 in 1929, the average purchase increasing to \$136.86 in 1919 and decreasing to \$114.29 in 1929. The expenditures for feed include purchases of hay and corn and of concentrates for dairy cattle. Expenditures in 1939 for feed for domestic animals and poultry were \$90,514 for the 1,408 farms (47.2 percent) that reported, or an average of \$64.29 for each farm.

The value of agricultural products by classes, as reported by the Federal census for the years 1909, 1919, 1929, and 1939, is shown in table 4.

TABLE 4.—Value of certain agricultural products, by classes, in Bedford County, Tenn., in stated years

Crop	1909	1919	1929	1939	Livestock products	1909	1919	1929	1939
	All cereals.....	\$1, 118, 381	\$2, 917, 981	\$977, 064		\$778, 774	Dairy products sold.....	\$29, 536	\$164, 313
Corn harvested for grain.....	(1)	(1)	901, 773	674, 076	Whole milk.....	(1)	(1)	428, 216	446, 612
Wheat threshed.....	(1)	(1)	63, 216	71, 540	Cream ⁴	(1)	(1)	149, 501	39, 038
Other cereals.....	(1)	(1)	12, 075	33, 158	Butter.....	(1)	(1)	6, 078	2, 906
Other grains and seeds.....	1, 207	40, 211	26, 026	90, 676	Poultry and eggs produced.....	257, 886	⁵ 614, 587	479, 313	237, 528
Hay and forage.....	306, 543	1, 237, 961	553, 606	645, 637	Poultry.....	(1)	(1)	186, 627	120, 618
Cotton lint and cottonseed.....	(1)	(1)	165, 574	62, 531	Chicken eggs.....	(1)	(1)	292, 686	116, 910
Tobacco.....	(1)	(1)	9, 602	21, 346	Livestock sold alive or slaughtered.....	1, 679, 599	(1)	(1)	848, 729
All vegetables.....	129, 732	277, 960	153, 080	148, 440	Cattle and calves.....	(1)	-----	-----	308, 520
For sale ²	(1)	(1)	5, 957	853	Hogs and pigs.....	(1)	-----	-----	414, 587
For farm household use ²	(1)	(1)	103, 430	122, 901	Sheep and lambs.....	(1)	-----	-----	125, 622
Potatoes and sweetpotatoes.....	(1)	(1)	48, 693	24, 686	Wool and mohair produced.....	24, 518	⁶ 33, 597	30, 294	⁶ 23, 104
Fruits and nuts.....	29, 042	57, 711	24, 193	32, 520	Honey and wax produced.....	2, 474	4, 696	7 6, 087	7 3, 551
All other crops.....	156, 051	221, 312	³ 6, 981	³ 4, 529					
Forest products sold.....	(1)	(1)	44, 403	10, 936					
Total.....	1, 740, 956	4, 753, 136	1, 973, 529	1, 795, 389	Total.....	1, 994, 013	817, 193	1, 099, 489	1, 601, 468

¹ Not available.² Excluding potatoes and sweetpotatoes.³ Including horticultural specialties sold.⁴ Both sweet cream and sour cream (butterfat).⁵ Poultry other than chickens not included.⁶ Wool only.⁷ Honey only.

There was a decrease of \$338,112 in the total value of agricultural products during the 30-year period from 1909 to 1939. The greatest total value, \$5,570,329, was in 1919, and much of it may be explained by the high prices for agricultural products at that time. The total value of livestock and livestock products sold or traded in 1939 was \$1,266,322, whereas the total value of crops sold or traded was \$383,341.

FERTILIZERS

Expenditures for commercial fertilizers, according to Federal census reports, increased from \$1,032 in 1879 to \$16,110 in 1939, and the number of farms that used fertilizer increased from 240 in 1909 to 628 in 1939. The quantity of fertilizer bought in 1939 was 699 tons, practically all of it factory mixed. An increase in cotton and tobacco acreages and the gradual loss of soil fertility through improper land use and soil erosion are probably the main causes of the increased use of commercial fertilizers. The crops for which fertilizer is used are cotton, wheat, oats, and tobacco. Superphosphate is applied at 150 to 200 pounds an acre mainly to land for wheat, oats, alfalfa, and in places for corn. A 2-10-2^s mixture is used mainly on cotton land, at 150 to 200 pounds an acre. Barnyard manure in liberal quantities is the fertilizer applied mostly to tobacco land. Local reports, however, indicate that in recent years an increased number of farmers treated tobacco land with 200 to 300 pounds an acre of a 3-9-6 mixture. Superphosphate, or in some places an 0-10-4 mixture, is applied to land for alfalfa, crimson clover, and other leguminous crops. In recent years increased interest in the use of lime has been shown, and as a result several lime crushers have been purchased. Limestone present on the farms is crushed, and the crushed stone is applied to those soils that are used for clovers and alfalfa. In 1939, a total of 1,865 tons of liming materials was purchased by 54 farms at a total cost of \$2,261.

The county agricultural agent estimates that 7,500 tons of limestone has been crushed and applied to soils since 1934. In that year, 762 acres were seeded to alfalfa, but the acreages had been nearly doubled in 1939, when 1,297 acres were seeded. Applications of crushed limestone account largely for the increase in alfalfa. The cost of crushing limestone is reasonable, inasmuch as practically every farm has more than sufficient limestone on or very near the surface to meet its needs. The limestone is quarried and crushed when there is usually little farm work to be done. Several farms report that the cost of quarrying and crushing the limestone and of distributing the crushed stone ranges from \$1.25 to \$1.50 a ton.

LAND USE CHANGES AND TYPES OF FARMS

The number and size of farms in 1940 changed little from those in 1880, when 2,965 reported by the Federal census averaged 99 acres as compared with the 2,981 in 1940 that averaged 96 acres. The improved land in farms was 69.0 percent in 1880 and 66.9 percent in 1940.

In 1929, 126,310 acres were used for cropland, of which 97,764 were harvested; in 1939, 106,492 of the 116,736 acres of cropland were har-

^s Percentages, respectively, of nitrogen, phosphoric acid, and potash.

vested. Plowable pasture occupied 47,852 acres and woodland 64,625 in 1929, compared with 74,812 in plowable pasture and 44,965 in woodland in 1939.

Of the 2,801 farms reported by the 1930 census, 963 were classed as general farms, 489 as animal-specialty, 248 as dairy, 158 as cash-grain, 151 as cotton, and 72 as poultry. Of the remainder, 358 were classed as self-sustaining, 150 as abnormal, 1 as fruit, 1 as truck, and 20 as crop-specialty farms; and 190 were unclassified.

About half the farms are of the subsistence type, or those on which the products are used in the farm homes. Next in order, about one-fifth of the total, are farms on which livestock furnish the main income. The third type, about one-sixth of the total, includes farms from which field crops provide the chief income. About one-seventh consist of farms from which dairy products are sold or traded. Other types are in relatively small numbers.

The major sources of income on the 2,920 farms reporting in 1940 were as follows:

<i>Major source of income</i>	<i>Number of farms</i>	<i>Major source of income</i>	<i>Number of farms</i>
Farm products used by farm households.....	1,389	Dairy products.....	392
Livestock.....	599	Poultry and poultry products..	29
Field crops.....	490	Forest products.....	16
		Other livestock products.....	5

In 1940, a total of 92.8 percent of the county was in farms, and the farms averaged 96.0 acres in size. Of the total number of farms, 839 contained from less than 3 to 29 acres; 990, from 30 to 99 acres; 716, from 100 to 179 acres; 270, from 180 to 259 acres; 147, from 260 to 499 acres; and 19, from 500 to 999 acres.

FARM TENURE AND POPULATION

In 1940, 60.0 percent of the farms were operated by owners (full owner, 1,503, part owners, 247), 39.9 percent (1,229 farms) by tenants, and 0.1 percent (2 farms) by managers. There were 161 cash tenants, 49 share-cash tenants, 863 share tenants and croppers, and 156 other tenants. Under the usual share system the landlord furnishes the work animals and farm machinery, and the tenant receives half of the cotton or tobacco and a third of the small grains and hay. When the tenant furnishes the work animals and equipment, he receives half the crops, provided the cropland is considered to be good. The cost of fertilizer and seeds is divided in the same proportion as the crops.

All land in farms occupied by full owners in 1940 totaled 154,523 acres, of which 51,835 was cropland harvested in 1939. Part owners occupied 33,959 acres in 1940, of which 13,692 was cropland harvested; managers operated less than three farms, the acreage of which is not given by the census; and all tenants occupied 97,277 acres, of which 40,830 was cropland harvested. The type of tenants and the number of acres occupied by each type were as follows: Cash tenants, 3,768 acres; share-cash tenants, 2,153; share tenants and croppers, 30,516; and other tenants, 4,393 acres.

Federal census data indicate that the total amount spent for farm labor in the county increased 49.7 percent during the period 1899 to 1929. Wages paid in 1939 for hired labor, exclusive of housework and contract construction work, was \$134,272 for 1,015 farms reporting; in 1899, \$97,100 was spent for labor. Labor hired by the month was

paid \$13,890 in 1939 on the 50 farms reporting, and that hired by the day or week was paid \$110,667 on the 873 farms reporting. Farm labor by the year appears to be ample, but help for threshing, haymaking, and other seasonal work is scarce. The farm help includes both whites and Negroes, but white people are employed mostly. The quality of the work is fair to good. Under the usual terms for hired help the landlord supplies the laborers with a house, fuel, water, a garden, and pasture for a cow, and pays the laborer a daily wage for the days he works. In a few instances, the laborer works a small crop part of the time, for which he receives half of the crop.

During the 50 years prior to 1930, the population of the county decreased 19 percent. This decrease was uniform and probably may be explained by the increased use of farm machinery and by industrial developments that drew people away from the farms. The population was all classed as rural until 1910, when 87.3 percent was so classed. In 1940, 71.8 percent was classed as rural and 28.2 percent as urban.

Native white persons constitute 84.5 percent (19,561), Negroes 15.4 percent (3,568), and foreign-born white 0.1 percent of the population.

FARM INVESTMENTS AND EXPENDITURES

Federal census reports indicate that the average investment in all farm property increased from \$2,482 in 1879 to \$4,372 in 1939. Of the average investment of \$4,372 in 1939, 78.7 percent was in land and buildings, 5.3 percent in implements and machinery, and 16.0 percent in domestic animals, poultry, and bees. During the period from 1880 to 1930, the proportion of the farm investment in land and buildings decreased from 82.6 to 80.1 percent; whereas the proportion in implements showed a slight increase. The proportion of the farm investment in buildings increased from 17.5 percent in 1900 to 24.3 percent in 1930.

In 1940 the value of farms, including land and buildings, was \$10,250,351, and the value of buildings on the 2,891 farms reporting was \$3,497,618. The average value of land and buildings per farm was \$3,439, and the average value of land and buildings per acre was \$35.82. The total value of implements and machinery on 2,128 farms was \$699,685.

Land values vary considerably in different parts and are higher in the outer Central Basin than elsewhere. A large proportion of the tillable land can be cultivated with labor-saving machinery. In 1940, there were 164 tractors on farms. These were used for custom work as well as for general farm work. The average farm has a disk harrow, sectional harrow, turning plows, mowing machine, hay rake, seed drill, one-row walking cultivator, and other one-horse cultivating and plowing equipment. Many of the farmers who have tractors also have threshers, binders, and combines, and a few own lime crushers.

Specified expenditures relating to farm operation in 1939 were as follows: Implements and machinery, \$145,631 for 745 farms reporting; building materials, \$110,979 for 1,020 farms; and gasoline, distillate, kerosene, and oil, \$58,052 for 1,526 farms.

SOIL SURVEY METHODS AND DEFINITIONS

Soil surveying consists of the examination, classification, and mapping of soils in the field and the recording of their characteristics,

particularly in regard to the growth of various crops, grasses, and trees.

The soils and the underlying formations are examined systematically in many locations. Test pits are dug, borings are made, and exposures, as in road and railroad cuts, are studied. Each excavation exposes a series of distinct soil layers or horizons, termed collectively the soil profile. Each horizon, as well as the underlying parent material, is studied in detail, and the color, structure, porosity, consistence, texture, and content of organic matter, roots, gravel, and stone are noted. The reaction of the soil and its content of lime and salts are determined by simple tests.⁶ The drainage, both internal and external, and other external features, as the relief, or lay of the land, are taken into consideration, and the interrelation of the soil and vegetation is studied.

The soils are classified according to their characteristics, both internal and external, with special emphasis upon the features that influence the adaptation of the land for the production of crop plants, grasses, and trees. On the basis of these characteristics the soils are grouped into classification units, the three principal of which are (1) series, (2) type, and (3) phase; some areas that have no true soil—as limestone outcrop, rough gullied land, and smooth stony land—are termed (4) miscellaneous land types.

The series is a group of soils having the same genetic horizons, similar in their important characteristics and arrangement in the profile and having similar parent material. Thus, the series comprises soils having essentially the same color, structure, natural drainage, and other important internal characteristics and the same range in relief. The texture of the upper part of the soil, including that commonly plowed, may vary within a series. The series are given geographic names taken from localities near which they were first identified. Cumberland, Etowah, Hagerstown, and Talbott are names of important soil series in Bedford County.

Within a soil series are one or more types, defined according to the texture of the upper part of the soil. Thus, the class name of this texture, as sand, loamy sand, sandy loam, silt loam, clay loam, silty clay loam, or clay, is added to the series name to give the complete name of the soil type. For example, Hagerstown silt loam and Hagerstown stony silt loam are soil types within the Hagerstown series. Except for the texture of the surface soil, these 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 usually the unit to which agronomic data are definitely related.

A phase of a soil type is a variation within the type, differing from the type in some minor feature, generally external, that may be of special practical significance. Differences in relief, stoniness, and degree of accelerated erosion may be shown as phases. For example, within the normal range of relief of a soil type some areas may be adapted to the use of machinery and the growth of cultivated crops and others may not. Even though no important differences may be apparent in the soil itself or in its suitability for the growth of native

⁶ 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. Indicator solutions are used to determine the chemical reaction. The presence of lime is detected by the use of a dilute solution of hydrochloric acid.

vegetation throughout the range in relief, there may be important differences in respect to the growth of cultivated crops. In such instances the more sloping parts of the soil type may be segregated on the map as a sloping or a hilly phase. Similarly, some soils having differences in stoniness may be mapped as phases, even though these differences are not reflected in the character of the soil or in the growth of native plants.

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

The term "workability," as used in this report, refers to the ease with which tillage, harvesting, and other farming operations can be accomplished. Six relative descriptive terms used are, in decreasing order of ease of performance of farming operations; excellent, very good, good, fair, poor, and very poor. A soil with excellent workability is one on which all the common kinds of farm machinery can be used with a minimum of effort. One with very good workability is suited to the use of all common types of farm machinery, but some feature, as heavy texture, small quantities of stone or gravel, or somewhat uneven but mild slopes, makes their use more difficult than on soil of excellent workability. A soil with good workability is suited to the use of all common kinds of farm machinery, but their use requires more effort than on soils of very good workability. Soils of fair workability are poorly suited to the use of heavy farm machinery, and most farm implements are used with more difficulty than on soils of good workability. Soils of poor workability are not suited to the use of heavy farm machinery, and all types are used with great difficulty. Soils of very poor workability generally can be tilled only with hand implements.

The term "conservability" refers to the ease with which productivity and workability can be maintained or improved. Major factors considered are ease of conservation of soil material, ease of conservation of plant nutrients, and ease of maintenance of good tilth. Relative descriptive terms, in decreasing order of ease of conservability, are excellent, very good, good, fair, poor, and very poor. In general, excellent, very good, good, and fair are relative terms within the range of conservability that considered alone would permit feasible use of the soil for crops that require tillage on the majority of farms; the terms poor and very poor are considered too limiting for the majority of farms to make use feasible for crops that require tillage.

SOILS

The soils of Bedford County are here described and classified on the basis of characteristics that are observable in the field, to provide a common frame of reference for persons who work with the soil. On the accompanying soil map of the county the areas of each unit of classification are outlined to scale to provide an inventory of the areal extent and geographic distribution of each soil. The purpose of this section is to describe each soil, its present uses and management, its suitability for use, and its management requirements for uses in the agriculture of the county. The first part describes the general char-

acteristics of the soil series of the county and the relationship among them. The second part describes the characteristics and agriculture of each soil type in detail.

The inventory of the soil resources of Bedford County shows that about 52 percent of the county is at least fairly well suited physically to the production of crops requiring tillage and that of this, about 8 percent is good to excellent cropland, 16 percent is fair to good cropland, and 28 percent is poor to fair cropland. About 48 percent of the county is poorly suited physically to the production of crops requiring tillage, but less than 1 percent is poorly suited to both crops and pasture.

Differences in the characteristics of soils determine differences in their physical suitability for use. About 62 percent of the soils are undulating or nearly level; 25 percent, rolling or sloping; 7 percent, hilly; and 6 percent, steep. About 13 percent have slopes in excess of 15 percent. The soils of 24 percent are too shallow and rocky for feasible cultivation. An additional 17 percent are generally less than 3 feet thick over bedrock or have outcrops of bedrock within areas of deep soil. About 81 percent of the soils are not very badly eroded, 18 percent are eroded sufficiently for subsoil material to constitute a noticeable part of the plow layer, and less than 1 percent are eroded to an extent that makes them unsuitable for cultivation. About 15 percent of the soils are imperfectly or poorly drained.

The soils range from nearly neutral to very strongly acid. In general, the bottom land soils are medium acid; on the uplands of the Central Basin, the terraces, and the colluvial lands they are medium to strongly acid; and on the Highland Rim escarpment they are strongly to very strongly acid throughout. The content of organic matter ranges from very low to moderately high and is concentrated largely in the upper part of the soil. Colors of the subsoils range from very light gray, through yellow, to brownish red. Consistence of the subsoils ranges from loose to sticky and plastic. The texture of surface soils is silt loam on about 55 percent of the county and silty clay loam on most of the rest.

SOIL SERIES AND THEIR RELATIONS

The methods of classifying and mapping the soils of Bedford County are described in the section on Soil Survey Methods and Definitions. A total of 57 units of mapping are shown on the soil map. These represent 32 normal types, 19 phases of 14 of these types, and 6 miscellaneous land types. The 38 soil types are members of 28 series. In this section the relationship among the soil series and the manner of distribution of the major series are described so that the characteristics of the soils and their relation to the agriculture of the county may be understood more easily.

A convenient method of presentation is to associate each soil series with the position it normally occupies and with the character of the parent material. Accordingly, the soil series have been grouped in four classes: (1) Uplands, (2) colluvial lands, (3) terraces, and (4) bottom lands. The uplands, as used here, are undulating to steep lands that lie at elevations higher than those of adjacent lowlands along streams and are covered by materials that are residual from the weath-

ering of rocks in place. Colluvial lands are foot slopes or depressions where soil material has accumulated from adjacent higher lands through the action of water and gravity. Terraces are benchlike areas along streams that are at elevations higher than those of the first bottoms and are covered by soil material deposited by streams when they occupied higher positions. Bottom lands are nearly level areas covered by soil material deposited when the streams overflowed their present channels.

The outstanding characteristics and conditions of each soil series, including topographic position and source of parent material, are shown in table 5. These series are described in the following pages in reference to the table.

SOILS OF THE UPLANDS

Each soil series of the uplands is discussed with respect to its manner of occurrence with other upland soils and the geographic distribution of such soil associations within the county. Three distinct broad associations of soils are represented. Soils of the uplands dominate each, but relatively small parts of soils of colluvial lands, terrace lands, and bottom lands are generally present. There is some overlapping of upland soils from one broad association to another, but each series is described with respect to the association in which most of it exists.

Each association is distinguished by its soil constituents, the relative acreage of these constituents and the pattern in which they exist. The areas of each association are related to and correspond closely to the three most important physiographic areas, as mapped in figure 2, and are named accordingly: (1) The Highland Rim escarpment soil association is characterized by high narrow cherty ridges, steep slopes, narrow valleys, and yellowish-brown to reddish-brown soils of medium to low productivity; (2) the outer Central Basin soil association is hilly to undulating and has a mixture of reddish-brown to brownish-yellow soils characterized by a relatively high content of phosphorus; and (3) the inner Central Basin soil association has almost level to gently undulating topography and reddish-brown to brownish-yellow soils.

Of soils of the uplands of the Highland Rim escarpment, all except the Dickson, have a cherty silt loam texture in the upper part, rapid external drainage, and moderate internal drainage. Baxter, Frankstown, Bodine, and Dellrose are the dominant series. The soils on the ridge tops appear to be less fertile than those on the hillsides, but crops respond well to applications of lime and phosphorus.

Soils of the hillsides have average gradients of 20 percent and are derived chiefly from the residuum of weathered limestone mixed with soil materials that have sloughed, rolled, or washed downward from soils in higher positions. These soils are generally cultivated one year out of three and are in unimproved pasture or idle land the rest of the time. When well managed, they produce good bluegrass, hop clover, and lespedeza, but the slopes are so steep that crops other than corn and pasture grasses and legumes are generally not grown on them.

Agriculture of the Highland Rim escarpment centers about production of pasture, corn, and livestock. Practically every farmer has a few milk cows and sheep and raises one or two colts each year. The

hillsides are commonly used for pasture between corn crops. The soils of terraces and bottom lands, which together occupy but a small part of this association, are used for corn and winter pasture, the latter consisting of crimson clover and rye or rye alone. Lespedeza seed is produced on some soils of the terraces, colluvial lands, and bottom lands and provides some income to supplement that from livestock. Some wheat also is produced on soils of the terraces and colluvial lands, and small fields of the more fertile upland soils are used for tobacco.

A small part, less than 1 square mile in total extent, that is actually representative of a Highland Rim plateau soil association has been included here in the Highland Rim escarpment soil association. It is characterized by smoother broader ridges than those typical of the Highland Rim escarpment, and the yellow siltpan Dickson soils predominate.

The tops of the typical ridges of the Highland Rim escarpment are generally occupied by soils of either the Baxter or Frankstown series. Soils of both series are characteristically cherty. The Baxter series has darker surface soils and redder subsoils than the Frankstown. The Bodine and Dellrose series occupy the slopes of the Highland Rim escarpment. The Dellrose series has a browner surface soil and subsoil and is much more fertile than the Bodine series, which appear to be more highly leached. Both are characteristically cherty, and have gradients of 15 percent or more.

The outer Central Basin uplands are composed of reddish-brown, yellowish-brown, and grayish-yellow soils relatively well supplied with phosphorus. The topography is undulating to hilly, and drainage is generally good. These soils are less cherty and more erosive than those of the Highland Rim escarpment. Mimosa, Maury, and Mercer, are the principal series. The outer Central Basin agriculture is dominated by livestock production and the growing of pasture and feed crops for livestock. In addition to feed crops, some tobacco and wheat are grown for market. The principal livestock enterprises consist of the raising of sheep, mule and horse colts, dairy and beef cattle, a few hogs, and small flocks of chickens and turkeys. Dairying is the principal enterprise in this area. Income from dairy products is supplemented on some farms by the sale of poultry and poultry products. Crops most commonly grown in the outer Central Basin are corn, wheat, rye, lespedeza, crimson clover, alfalfa, and red clover. Pastures are composed chiefly of bluegrass, white clover, hop clover, and lespedeza. During winter and early spring the livestock are pastured on wheat, rye, and crimson clover.

The upland soils of the inner Central Basin are chiefly brownish-red and yellowish-red and have nearly level to gently undulating topography. They are practically free of chert fragments and quite variable in consistence of their subsoil, and most of them are well drained. The principal series are Hagerstown, Talbott, Colbert, Dowellton, and Pickaway. Cotton, corn, wheat, oats, rye, and lespedeza are the chief crops, and alfalfa, barley, and tobacco the minor. The lay of the land is more favorable for the growth of row crops than that of the rest of the county, although a considerable acreage is not suited to this use for other reasons. The soil thickness, as com-

pared with that of other parts of the county, is shallow, and there are large areas of stony land suited only to and used chiefly for pasture. Bluegrass does not thrive voluntarily as it does in the outer Central Basin, although satisfactory growth is obtained by applying lime and phosphorus. Practically the same crops are produced as in the outer Central Basin, but cotton growing is the main enterprise on many farms instead of livestock or tobacco. The lack of year-around water supply and the low carrying capacity of pasture lands are outstanding factors that limit livestock production in this section.

DICKSON SERIES

Dickson silt loam, the only soil of the series mapped, is characterized by smooth relief, a light-colored surface soil, a yellow subsoil, and a siltpan just below the subsoil. The grayish-brown mellow friable silt loam upper layer is about 7 inches thick. The subsoil is light brownish-yellow friable silt loam or silty clay loam, 12 to 18 inches thick. The underlying firm compact siltpan is the most conspicuous characteristic of the Dickson series. It is mottled yellowish-brown, yellow, gray, and brown silty clay loam, relatively impervious to water and air, and is penetrated by plant roots with difficulty. The underlying material is a firm light silty clay loam, brownish-red mottled with gray, yellow, and brown. The moderately cherty limestone bedrock is at a depth of 5 feet or more. As the relief is mild, heavy farm machinery can be used without difficulty. The more sloping areas are noticeably susceptible to erosion and have medium or low fertility.

BAXTER SERIES

Although the Baxter series is most commonly associated with soils of the Highland Rim escarpment, it is also associated with the Dickson series of the Highland Rim plateau. Baxter cherty silt loam, the only member mapped, is characterized by a 9-inch brown or light-brown friable cherty silt loam surface soil and a light brownish-red firm but friable silty clay loam subsoil about 24 inches thick. The parent material is brownish-red moderately plastic silty clay loam to a depth of about 6 feet. In most places chert fragments are on the surface and throughout the soil. The cherty silt loam type is moderate in fertility, and its productivity for various crops varies somewhat with the degree of slope and the quantity of chert fragments. It is moderately susceptible to accelerated erosion.

FRANKSTOWN SERIES

The Frankstown series, developed from the residuum of weathered highly siliceous limestone, is very cherty. The cherty silt loam is the only representative in the county. The subsoil is yellow, as compared with the red of the Baxter soils, which occupy similar positions. The dark-gray friable surface soil is about 12 inches thick, and the brownish-yellow firm friable silty clay loam subsoil about 24 inches thick. The parent material is light brownish-yellow friable silty clay loam, and the depth to bedrock varies from 3 to 9 feet. These soils characteristically occupy the crests of ridges and knobs and are medium to low in productivity for most crops.

BODINE SERIES

The Bodine series is developed from very cherty limestone. The light grayish-yellow friable surface soil is about 7 inches thick, and the light brownish-yellow firm but friable silty clay loam subsoil about 20 inches thick. The parent material is yellow or brownish-yellow cherty silty clay loam. These soils are low in fertility and are difficult to cultivate because of the steep slopes and large masses of chert fragments on the surface and throughout the soil. The cherty silt loam and its slope phase are mapped.

DELLROSE SERIES

The Dellrose series is distinguished from Bodine by the brownish-yellow subsoil and the grayish-brown surface soil. These soils are developed from the residuum of weathered fairly high-grade limestone mixed with cherty soil material that has rolled down from Frankstown, Baxter, and Dickson soils of higher positions. The cherty surface layer is about 15 inches thick, and the moderately plastic cherty silty clay loam subsoil about 20 inches thick. The lower part of the subsoil generally is mottled with yellow and brown. The underlying material is mottled yellow splotched with gray and brown silty clay or silty clay loam, and the depth to the underlying level-bedded rock ranges from 4 to more than 30 feet. These soils receive considerable seepage water containing plant nutrients. Drainage is excessive, but because of the seepage waters, injury to crops by drought is less than on most soils of similar slopes. These soils are relatively resistant to erosion and moderately fertile, but they are difficult to work because of steep slopes and a high content of chert fragments (pl. 3, A). The normal type and the steep phase of the cherty silt loam are mapped.

MIMOSA SERIES

The Mimosa series is underlain by light-gray slightly phosphatic moderately clayey limestone. The dark grayish-brown to light-brown friable surface soil is about 7 inches thick, and the brownish-yellow slightly plastic moderately tough silty clay subsoil about 24 inches thick. The parent material is mottled gray, yellow, and brown plastic silty clay. The horizontally bedded limestone bedrock generally is more than 4 feet below the surface. These soils are medium in fertility and are productive under good management. Three normal types and two phases are mapped. The relief is mild enough to permit the use of modern farm equipment.

MAURY SERIES

The Maury series is distinguished from the Mimosa by the dark-brown surface soil and reddish-brown subsoil. The Maury soils are noted for their high content of phosphorus and are developed from weathered products of light-gray phosphatic limestone containing a small quantity of sand. The mellow surface soil is about 8 inches thick, and the firm friable silty clay or silty clay loam subsoil, about 40 inches thick. The parent material is moderately compact silty clay of a yellowish-brown or light reddish-brown color, mottled with yellow

and gray. Depth to bedrock ranges from 3 to 10 feet. The Maury soils—the silt loam and its eroded rolling phase—are very productive. The slopes are generally mild, permitting the use of heavy farm equipment, but the steeper slopes are susceptible to accelerated erosion.

MERCER SERIES

The Mercer series resembles the Mimosa, but is lighter in color, lower in phosphorus, and less productive. Locally the Mercer soils are called “gray land or white oak land.” The gray or grayish-brown friable surface soil is about 10 inches thick, and the light brownish-yellow to yellowish-brown firm silty clay loam subsoil about 24 inches thick. The parent material is grayish-yellow sticky plastic silty clay, mottled with gray, brown, and yellow. The slightly cherty moderately clayey limestone bedrock is generally at a depth of 3 to 8 feet. These soils are susceptible to erosion, particularly on the stronger slopes. They have been eroded in many places and appear to sheet erode more easily than associated soils. They are medium in fertility, but the relief is sufficiently mild to permit the use of all types of farm machinery. The silt loam and the eroded rolling phase of the silty clay loam are mapped.

HAGERSTOWN SERIES

The Hagerstown series is very similar to the Maury but these soils are lower in phosphorus and have been differentiated chiefly on that basis. They were mapped in the inner Central Basin over geologic formations that are lower in phosphorus than those that underlie the Maury series in the outer Central Basin. The dark-brown mellow surface soil is about 8 inches thick, and the reddish-brown firm friable silty clay loam subsoil about 40 inches thick. The parent material is yellowish-brown or light reddish-brown mottled with yellow and gray moderately compact silty clay. Nearly level bedrock is at depths of 3 to 10 feet. These soils are very productive. The series is represented by three typical soils and three phases. The relief generally is mild, permitting the use of modern farm equipment, but the more sloping parts are susceptible to accelerated erosion.

TALBOTT SERIES

The Talbott series is less brown and more yellow than the Hagerstown, and its subsoil heavier in texture and more plastic. The grayish-brown friable surface soil is about 6 inches thick, and the yellowish-red to reddish-yellow tough moderately plastic clay to silty clay subsoil 18 to 30 inches thick. The parent material is mottled yellow, brown, and gray tough clay or silty clay. The clayey limestone bedrock generally is more than 3 feet below the surface. These soils are moderately productive of most crops, but are susceptible to erosion and require careful management. The silt loam, the silty clay loam, and three phases are mapped.

COLBERT SERIES

The Colbert series, represented by the silt loam and the eroded rolling phase of the silty clay loam, is distinguished from other soils of the inner Central Basin by their drab-yellow color and a plastic massive subsoil. The soils are mapped in association with those of

both the outer and the inner Central Basins. They have a light grayish-brown moderately friable surface soil about 5 inches thick and a grayish-yellow tough sticky and plastic clay subsoil about 20 inches thick. The highly clayey limestone bedrock is generally between 12 and 36 inches below the surface, but outcrops are common, and fragments of limestone are generally throughout the soil mass. These soils are difficult to work and conserve and are not well suited to crop production but are fairly well suited to pasture.

DOWELLTON SERIES

The Dowellton series, developed from highly clayey limestone, is represented by the silt loam type. To a depth of 8 to 10 inches the surface soil is light yellowish-gray friable heavy silt loam. The subsoil is sticky and plastic silty clay mottled with orange, yellow, and brown. Bedrock is at a depth of 2 to 4 feet. External drainage is fair to good, but internal drainage is very poor. Part of the soil is used for crops common to the area, part for pasture, and some is in forest.

PICKAWAY SERIES

The Pickaway series is similar in color to the Mercer of the outer Central Basin. The profile of the Pickaway soils is characterized by a siltpan below the subsoil. The light grayish-brown friable surface soil is about 6 inches thick, and the light brownish-yellow firm friable silty clay loam subsoil about 15 inches thick. The lower part of the subsoil is commonly mottled with yellow and brown. It is underlain by a 4- to 6-inch compact semicemented silty clay loam hardpan layer that is not easily penetrated by plant roots. The underlying parent material is brownish-yellow plastic silty clay loam, mottled with gray and yellow. Pickaway soils—the silt loam and its rolling phase—are low to moderate in fertility and are not so productive as the Mercer soils under similar management.

SOILS OF THE COLLUVIAL LANDS

Soils of the colluvial lands occupy sinks or depressions and foot slopes; those of the Abernathy, Ooltewah, and Guthrie series, depressions, and those of the Greendale and Burgin series, foot slopes.

Soils of the Abernathy, Ooltewah, and Guthrie series are derived from materials washed largely from adjacent soils developed from high-grade limestone. The parent materials in the Guthrie and Ooltewah series were washed largely from soils less fertile than those of the Abernathy series, but the principal differences between the three series are the results of differences in internal drainage. The Abernathy soils are well drained; the Ooltewah, imperfectly; and the Guthrie, poorly drained. All have poor or very poor surface drainage but variable internal drainage.

On the colluvial foot slopes the Greendale soils are in association mainly with Dellrose and Mimosa soils, the Burgin series mainly with heavier textured soils of the uplands. The Burgin soils are easily differentiated from the Greendale by their heavier texture, tougher consistence, and darker surface soil. Internal drainage of the Greendale soils is moderate; that of the Burgin from slow to very slow.

ABERNATHY SERIES

The Abernathy series is represented by the young and fertile silt loam type. It is brown or reddish-brown and very friable to a depth of 30 inches or more. Internal drainage is good. The soil is productive and is easily worked and conserved.

OOLTEWAH SERIES

Soils of the Ooltewah series differ from those of the Abernathy chiefly in characteristics arising from slower internal drainage. Only the silt loam type is mapped. The surface layer is thinner and lighter colored and is underlain by heavier textured mottled material. The soil is grayish brown and friable to a depth of 12 to 16 inches, below which it is highly mottled yellow and gray silty clay loam or silty clay. The material is moderately compact at a depth of 24 to 30 inches. The Ooltewah silt loam is less productive than the Abernathy and more limited in the kinds of crops that grow well on it.

GUTHRIE SERIES

The Guthrie series, represented by the silt loam type, is poorly drained. The upper 15 to 24 inches is grayish and floury underlain by mottled gray, yellow, and brown compact clay. The soil is poorly suited to cultivated crops.

GREENDALE SERIES

The Greendale series occupies positions intermediate between the uplands and bottom lands. The grayish-brown to dark grayish-brown friable surface soil of the silt loam, the only representative of the series, is about 15 inches thick, and the yellowish-brown firm friable silty clay loam subsoil, about 15 inches thick. The parent material is mottled yellow and brown compact silty clay loam extending to a depth of 4 to 15 feet. This soil is of medium to high productivity for most crops, easily worked, and moderately easy to conserve.

BURGIN SERIES

The Burgin series, represented by the silty clay loam and its shallow phase, occurs on foot slopes where constant seepage of water from the adjacent uplands maintains a poorly drained condition. These soils occupy positions comparable to those of the Greendale, but are generally associated with the heavy-textured soils developed from clayey limestone. The 8- to 12-inch surface layer is dark gray or almost black and friable. The sublayer is predominantly gray or bluish-gray compact silty clay. The soils are commonly saturated with water 20 to 24 inches below the surface, and are poorly suited to cultivation without artificial drainage.

SOILS OF THE TERRACES

The Cumberland series is on old terraces at an elevation high above that of the present stream channels. These mature soils are developed from old alluvium consisting largely of weathered limestone materials. In contrast with the high terrace positions occupied by the

Cumberland soils, the Etowah, Wolftever, Taft, and Robertsville series are on lower terraces or second bottoms.

CUMBERLAND SERIES

The Cumberland series is similar in appearance to those of the Maury and Hagerstown, but has a slightly more friable and less compact subsoil and generally contains pieces of round gravel. In the silt loam and its slope phase, the brown to dark-brown mellow surface soil is about 8 inches thick, and the dark reddish-brown to yellowish-brown firm friable silty clay loam subsoil about 30 inches thick. The soils are highly productive of most crops under good management. They are easy to till, but the more sloping parts are more susceptible to erosion.

ETOWAH SERIES

The well-drained Etowah series is developed from alluvium consisting chiefly of weathered limestone materials. This series is less well developed than the Cumberland, but has distinct surface soil and subsoil layers. The only representative is the silt loam. In this, the grayish-brown or brown friable surface layer is about 10 inches thick, and the yellowish-brown to reddish-brown firm friable silty clay loam subsoil about 24 inches thick. The parent material ranges from silty clay to fine sandy clay and is generally mottled reddish-brown, gray, and yellow. The relief is mild, and the soils are easily worked and conserved. They are productive of most crops.

WOLFTEVER SERIES

The Wolftever series is associated with the Etowah, and is developed from similar parent materials, but differs in having lighter colored surface soils and more yellow, more compact, less pervious subsoils. In the silt loam, the only type in the county, the light grayish-brown friable upper layer is about 10 inches thick, and the yellowish-brown compact slowly pervious silty clay subsoil about 15 inches thick, below which is mottled gray, yellow, and brown material. The soil is moderately productive of most crops, easy to work, and moderately easy to conserve.

TAFT SERIES

The Taft series is on low terraces and is developed from alluvium, consisting largely of weathered limestone. This soil differs from that of the Wolftever in having grayer surface soils, more mottled subsoils, and in most places a very compact almost impervious hardpan below the subsoil. In the silt loam type, the only representative, the brownish-gray friable surface soil is about 8 inches thick. The moderately friable silty clay loam subsoil is brownish yellow in the upper part and mottled yellow and gray in the lower. This layer is underlain by about 12 inches of gray mottled with yellow very compact almost impervious silty clay. The parent material is highly mottled brown, gray, and yellow moderately compact silty clay loam. The Taft soil is only fairly suited to cultivation.

ROBERTSVILLE SERIES

The Robertsville series is represented by only one type, the silt loam. This soil is lighter colored and less well drained than the Taft soil and is very poorly suited to cultivated crops. The gray or light brownish-gray friable surface soil is about 8 inches thick. The subsoil is gray mottled with yellow compact silty clay. This series is comparable in drainage to the Guthrie of the colluvial lands.

SOILS OF THE BOTTOM LANDS

The soils of the bottom lands are derived from recently deposited alluvial materials largely washed from soils underlain by limestone—all are subject to flooding (pl. 3, *B*). They are young soils, and their characteristics are closely related to the character of the parent material and the condition of drainage. The Huntington and Egam soils are well drained, but the Egam appear to be the older. Lindsides soils are imperfectly drained, and Melvin and Dunning poorly drained. Dunning soils are heavier textured than the Melvin and have darker surface layers.

HUNTINGTON SERIES

The Huntington series is brown or dark brown and mellow to a depth of more than 30 inches. The only type mapped is the silt loam, and its texture both in surface soil and subsoil is variable from place to place, but is most commonly typical. The soil is fertile and well drained and especially well suited to the production of corn.

EGAM SERIES

The Egam series is represented by the silt loam type. The surface layer is grayish brown and friable to a depth of 15 to 20 inches, below which is a brown or dark-brown moderately compact silty clay loam layer that inhibits internal drainage. The soil is not so well drained or fertile as the Huntington and is less productive of the crops commonly grown.

LINDSIDE SERIES

The soils of the Lindsides series, consisting of silt loam and its shallow phase, are grayish brown and friable or mellow to depths of 12 to 18 inches, below which they are highly mottled with gray, yellow, and brown. They are intermediate in drainage between the Huntington and Melvin soils, they are fertile, and lie well for cultivation, but crops are injured by wet conditions more frequently than on Huntington soils.

MELVIN SERIES

The Melvin series are mottled gray, yellow, brown, and blue from the surface downward, although the surface layer is dominantly brownish gray, and the soil material generally is heavier textured and more compact in the lower layers than near the surface. The silt loam, the only type in the county, is poorly drained and better suited physically to pasture than to cultivated crops.

DUNNING SERIES

The Dunning series differs from the Melvin in having dark-gray or almost black surface soils and generally heavier textures throughout the profile. It resembles the Burgin in color, texture, consistency, and drainage. Unless artificially drained, the soils are generally well suited to pasture. The series is represented by the silty clay loam and its drained and shallow phases.

DESCRIPTIONS OF SOIL UNITS

In the following pages the soils of the county are described in detail, and their agricultural relationships discussed. Their location and distribution are shown on the accompanying soil map, and their acreage and proportionate extent are given in table 6. The soils are arranged in alphabetical order to facilitate reference, and by that arrangement all types and phases of each series are in sequence.

TABLE 6.—*Acreage and proportionate extent of the soils mapped in Bedford County, Tenn.*

Soil type	Acres	Per cent	Soil type	Acres	Per cent
Abernathy silt loam	2,496	0.8	Maury silt loam	6,016	2.0
Alluvial soils, undifferentiated	4,800	1.6	Eroded rolling phase	4,416	1.4
Baxter cherty silt loam	2,176	.7	Melvin silt loam	512	.2
Bodine cherty silt loam	2,688	.9	Mercer silt loam	6,464	2.1
Slope phase	1,344	.4	Mercer silty clay loam, eroded rolling phase	7,104	2.3
Burgin silty clay loam	3,712	1.2	Mimosa cherty silt loam	3,776	1.2
Shallow phase	320	.1	Mimosa silt loam	4,352	1.4
Colbert silt loam	10,112	3.3	Undulating phase	960	.3
Colbert silty clay loam, eroded rolling phase	8,704	2.9	Mimosa silty clay loam, eroded hilly phase	1,536	.5
Cumberland silt loam	5,568	1.8	Mimosa stony silty clay loam	1,216	.4
Slope phase	3,968	1.3	Ooltawah silt loam	1,984	.7
Dellrose cherty silt loam	17,664	5.8	Pickaway silt loam	6,080	2.0
Steep phase	14,208	4.7	Rolling phase	192	.1
Dickson silt loam	448	.1	Robertsville silt loam	1,088	.4
Dowellton silt loam	5,952	2.0	Rolling stony land, Colbert soil material	27,584	9.0
Dunning silty clay loam	640	.2	Rough, gullied land, Mimosa soil material	768	.3
Drained phase	8,320	2.7	Smooth stony land:		
Shallow phase	3,584	1.2	Colbert soil material	11,200	3.7
Egam silt loam	2,112	.7	Hagerstown soil material	32,768	10.8
Etowah silt loam	3,776	1.2	Taft silt loam	512	.2
Frankstown cherty silt loam	6,784	2.2	Talbott silt loam	3,520	1.2
Greendale silt loam	3,072	1.0	Shallow phase	13,440	4.4
Guthrie silt loam	320	.1	Talbott silty clay loam:		
Hagerstown pebbly silty clay loam	960	.3	Eroded phase	12,800	4.2
Eroded phase	128	(¹)	Eroded rolling phase	4,224	1.4
Hagerstown silt loam	3,520	1.2	Wolftever silt loam	1,728	.6
Eroded phase	10,176	3.3			
Hagerstown silty clay loam, eroded rolling phase	2,496	.8			
Hagerstown stony silt loam	3,008	1.0			
Huntington silt loam	2,368	.8			
Limestone outcrop	1,792	.6			
Lindside silt loam	11,520	3.8			
Shallow phase	1,664	.5			
			Total	304,640	100.0

¹ Less than 0.1 percent.

Abernathy silt loam.—Although formed from material washed from surrounding soils on uplands underlain by limestone, this soil occupies well-drained depressions. The external drainage is slow or very slow, but the internal drainage, which finds outlets in crevices

in the underlying limestone bedrock, is rapid enough for satisfactory use for crops.

The soil varies somewhat in physical characteristics, but the upper 20 to 30 inches is dark grayish-brown to reddish-brown friable silt loam in most places. This layer is underlain by reddish-brown to yellowish-brown friable clay loam or silty clay loam to a depth of 48 to 60 inches. Becoming more compact with depth, the material is faintly splotched with gray, yellow, and brown below about 27 inches. A few small rounded dark-brown or black particles occur throughout the soil mass. The reaction, according to field determinations, is slightly acid.

As the soil occupies positions in depressions, it is receiving organic matter and other soil material washed from surrounding Maury and Hagerstown soils and, in places, from Cumberland soils, and constituents from seepage issuing near the base of the slopes. Although not subject to erosion, its productivity is impaired in places by an excess of raw subsoil material thus washed in from severely eroded slopes. The physical properties of this silt loam are favorable to tillage and to normal movement and retention of soil moisture. Cultivation changes the character of the plow layer very slowly. As the soil is fertile, well drained, and possesses physical properties favorable to plant growth, it is productive of most of the crops commonly grown.

Although the soil has an area of only 2,496 acres, it is important to agriculture because of its splendid suitability for crops. The larger areas are in the inner Central Basin in the vicinity of Longview, Rover, and Unionville, and smaller areas occur throughout the county. Some areas that are very small or occur in small sinks having sharply sloping or stony slopes are especially unfavorable for use where the surrounding soils have vastly different use suitability.

Areas of sufficient size for crops are used largely for corn, with some tobacco, hay, and wheat. Corn yields 45 to 60 bushels an acre; hay, 1½ to 2½ tons; and wheat, 20 to 23 bushels. As this soil is naturally very fertile and plant nutrients are at least partly replenished by wash and seepage from surrounding soils, its productivity is easily maintained.

Alluvial soils, undifferentiated.—This miscellaneous land type occurs in long narrow strips in first bottoms along small streams and intermittent drainageways in the outer Central Basin (Nashville Basin) and in the Highland Rim escarpment physiographic areas. These soils consist of a mixture of chert and rock fragments and soil materials that were washed or sloughed from the slopes and accumulated on the bottoms. They vary considerably in texture, in content of chert and rock fragments, and in condition of drainage. The individual soil materials are too small or too intricately associated to be shown separately on the soil map.

The aggregate area is 4,800 acres, and all of it has been cleared for agricultural use. The relief is level or nearly level, with a gradient of less than 3 percent. This soil complex is used mostly for pasture, but corn is grown occasionally. External drainage is slow or very slow but adequate, except in some small spots where water remains on the surface for a short time. Internal drainage is imperfect in some places and poor in others.

As this land type occurs in narrow strips, it is used for crops mostly in conjunction with soils on the surrounding uplands. Poorly drained areas, however, are used for the production of meadow and pasture plants, chiefly redtop, lespedeza, and some timothy, among which are scattered stands of hop clover and white clover.

Baxter cherty silt loam.—Developed from materials weathered from St. Louis and Warsaw limestones, this soil is associated with Dickson, Frankstown, Bodine, and Dellrose soils and occupies positions on ridge tops in the Highland Rim escarpment. As these ridge tops are relatively narrow, ranging from 100 to 500 feet or more in width, the soil occurs in narrow irregular-shaped strips. Small areas of Dickson and Frankstown soils, which differ from the Baxter type in subsoil color, are included; hence, the mapped areas show some variation in the color of the subsoil. A total of 2,176 acres is mapped, the larger areas south of New Herman, Mount Herman, Raus, Hilltop, Union Ridge, and Shiloh.

In cultivated fields the brown or light-brown friable surface soil is 5 to 8 inches thick. In uncleared areas the first 2 inches of the surface layer is stained dark brown by organic matter, but the rest of it is light brown. The surface soil is slightly acid. The subsoil is a brownish-red or red moderately friable firm silty clay loam or heavy silt loam that becomes heavier with depth. It is slightly plastic when wet but brittle when dry. Throughout the subsoil layer are varying quantities of small rounded dark-brown or black mineral particles and chert fragments $\frac{1}{2}$ to 3 inches in diameter. The substratum, or parent material, beginning at a depth of 26 to 36 inches, consists of reddish-yellow or light brownish-yellow friable silty clay loam faintly mottled with yellow, gray, and red and moderately plastic when wet. Chert fragments are throughout the substratum, although the small dark-brown or black rounded mineral particles of the subsoil seem to be absent. Both the subsoil and substratum are medium to slightly acid.

External drainage is rapid, but internal drainage is moderate. The chert fragments mixed with the soil mass make it porous, permitting the absorption of much rain water, whereas the fragments on the surface somewhat impede runoff, thereby increasing infiltration.

The crops commonly grown are corn and lespedeza. Some small patches are planted to crimson clover, rye, and timothy. Chert fragments are so numerous on the surface in places that cultivation and the use of large labor-saving machinery are greatly hampered. Moreover, the ridge tops occupied above steep slopes are difficult to reach with machinery, a condition that determines to some extent the use and manner of cultivation. Because of the steep slopes, long winding routes must often be followed to reach the ridge tops from most of the valley farmsteads.

About 90 to 95 percent of the soil has been cleared, and it is estimated that 30 percent is used for corn and the rest for lespedeza and other pasture and hay crops. Depending on management, corn yields 10 to 35 bushels an acre and lespedeza $\frac{1}{2}$ to $1\frac{1}{2}$ tons of hay. As the chert fragments on the surface interfere greatly with mowing, little of the lespedeza is cut for hay, most of it being used for pasture.

Much of this soil is used with areas of Dellrose cherty silt loam, steep phase, as the two soils are commonly parts of the same fields. In the crop rotation usually practiced the land is planted to corn for

1 or 2 years, then to lespedeza or fallowed for 3 to 5 years or more, after which it is again planted to corn. If planted to corn or other row crops more than 2 years in succession, considerable soil is lost by accelerated erosion. As the soil is susceptible to erosion when row crops are grown, a good management practice is to grow corn in a rotation that includes sod-producing crops for long periods. Strip cropping and contour tillage may be useful water control practices, but it is thought that terracing is not a satisfactory practice on slopes as strong as many of those common to this soil.

Treatment of the soil with 200 pounds an acre of 4-12-4 mixture or with superphosphate gives satisfactory increases in corn yields. Some farmers, however, report satisfactory increases from the use of $\frac{1}{2}$ to 3 tons to the acre of ground limestone and 150 to 200 pounds of superphosphate.

Bodine cherty silt loam.—Formed from weathered material of Fort Payne chert and Warsaw limestone, this soil occupies the higher parts of the steep ridge slopes (20 percent or more) in the Highland Rim escarpment, associated with the Dellrose soils, the slope phase of the cherty silt loam, and alluvial soils, undifferentiated. The surface soil is thicker than that of the slope phase, which lies on the ridge tops. This thicker surface soil is caused by the lodging of soil material and chert that has washed, sloughed, or rolled from the ridge tops and upper slopes. Although it varies little in physical characteristics, small areas of Dellrose cherty silt loam are included. The 2,688 acres mapped are confined almost wholly to an area south and southwest of Normandy, chiefly on Rippey Ridge and south of Willow Grove School.

In cultivated fields, the light grayish-yellow to dark grayish-yellow friable silt loam surface soil is 8 to 12 inches thick, or even more in places. Many small chert fragments are on the surface and in the surface soil. In forested areas, the first 1 or 2 inches of the surface layer is dark brown from organic matter, but the rest of the layer is somewhat lighter in color. The subsoil is slightly brownish-yellow friable silt loam or silty clay loam, containing many small angular pieces of chert. The lower part of the subsoil is faintly mottled with gray, yellow, and brown, and chert fragments are more numerous. The substratum, beginning at a depth of 20 to 30 inches, is light brownish-yellow, mottled with gray and light-brown friable silty clay loam, containing many chert fragments. The soil ranges from medium to slightly acid.

The external drainage is rapid to very rapid and the internal drainage moderate. Some seepage from the slopes adds moisture to the lower lying parts during droughts. Approximately 60 percent of the soil is in forest, and the rest is used for corn and lespedeza, although some of it is idle. Corn is grown with lespedeza in rotations of 3 to 7 years, and weeds or pasture grasses are allowed to grow during the interval between corn crops. Corn yields are somewhat lower than on the slope phase, ranging from 5 to 15 bushels an acre, depending on the soil management.

The cherty nature of this soil retards the erosive action of rill runoff and contributes to the ease of absorption of water. Erosion is active, however, especially where row crops are grown successively. Frequent close-growing crops or even weedy growth during idle

seasons interspersed with row crops are beneficial in maintaining the stability of the soil. Contour tillage and strip cropping are well-suited practices, but the slopes are too steep for practical terracing. Most areas probably can be best used for pasture or for forest.

Bodine cherty silt loam, slope phase.—The slope phase, like Baxter cherty silt loam, occupies positions on the tops of long high narrow ridges of the Highland Rim escarpment, associated with Frankstown, Baxter, and Dellrose soils. It occurs in the same localities as the normal type. No important variations are apparent, but small areas of Frankstown cherty silt loam are included. A total of 1,344 acres is mapped.

The surface soil in cultivated fields is light grayish-yellow to dark grayish-yellow friable cherty silt loam 6 to 8 inches thick. The upper 1 or 2 inches of the surface layer in forested areas is dark brown from organic matter. The subsoil to a depth of 20 to 30 inches is grayish-yellow or faintly brownish-yellow friable cherty silt loam or silty clay loam. In the lower part of this layer the content of chert is greater and the color is faintly mottled or splotched gray, yellow, and brown. The substratum consists of a mixture of chert fragments and mottled brownish-yellow, brown, and gray friable silty clay loam. The soil is medium to slightly acid.

External drainage is moderate to rapid, and internal drainage is moderate. Approximately 70 percent of the soil is in forest or in abandoned cleared land. The virgin forest consists of various oaks and some hickory, dogwood, and elm. The cultivated areas are used mainly for corn, lespedeza, and sorghum, but a patch here and there is used for cotton. When first cleared, the virgin soil produces fair yields of crops, but after 5 to 10 years of cultivation, its organic-matter content and plant-nutrient supply are considerably reduced. The color also changes to whitish or ashy, and the crop yields are very low in comparison with those of the associated soils. Corn yields 8 to 25 bushels an acre; lespedeza, $\frac{1}{3}$ to 1 ton of hay; lespedeza seed, 135 to 225 pounds; and cotton, $\frac{1}{8}$ to $\frac{1}{2}$ bale, depending on management practices. The soil is very cherty, and like the normal type is somewhat difficult to reach for cultivation because of its position above the steep slopes. The use of heavy types of labor-saving machinery appears to be impracticable because of the abundance of chert fragments on and in the soil.

Low natural fertility and rapid losses of organic matter and plant nutrients present a serious problem of fertility maintenance. The use of sod-forming and green-manure crops in the rotations should preserve these valuable constituents; and long rotations, contour tillage, and perhaps strip cropping should preserve the soil against losses by runoff. Terraces may not be practicable on land of this character. The local information on the use of fertilizers was not available at the time of this report, but responses similar to those obtained on Dickson silt loam may be expected.

Burgin silty clay loam.—The materials from which this soil is derived are of both colluvial and alluvial origin, deposited near the base of slopes near the outer boundaries of bottom lands along some of the smaller streams. It is similar to Dunning silty clay loam in color and texture, but differs mainly in that its position is on colluvial slopes rather than on bottom lands and its drainage is somewhat better.

Some small areas of the Dunning soils are included in the 3,712 acres mapped, all of which are cleared and cultivated. The larger bodies are in the vicinity of Cortner, Shofner Bridge, Deason, North Fork Creek, Kingdom Church, Rover, Pleasant Grove, and East Rock Creek. The soil lies well for cultivation, the relief ranging from level to nearly level and the gradient not exceeding 3 percent.

This is the dark-colored imperfectly drained heavy clay soil of some of the gentle colluvial foot slopes of valleys. A few small rounded dark-brown or black particles are on the surface and throughout the soil mass. The 8- to 10-inch surface soil is dark-gray to almost black moderately friable silty clay loam, underlain to a depth of 24 to 30 inches by a very dark-gray to black compact heavy silty clay loam that is plastic when moist and brittle when dry and breaks easily into small cubes. The medium-gray or bluish-gray compact slightly plastic silty clay substratum, intensely mottled with rust-brown, yellow, and brown, extends 40 to 50 inches to bedrock. In some places the water table is at a depth of about 24 inches, and bedrock may be within 36 inches of the surface. The soil is almost neutral in reaction.

Seepage from the adjacent uplands empties on the soil, but the nearly level surface and heavy dense consistence of the subsoil make both external and internal drainage slow or very slow, and the soil remains in an imperfectly drained condition most of the time.

Although its productivity and suitability are limited somewhat by impaired drainage and heavy consistence, it is a fertile soil and is used for corn, soybeans, sorghum, and lespedeza and to a lesser extent for meadow. Corn yields 20 to 30 bushels an acre; soybeans, 10 to 15 bushels; lespedeza, 225 to about 340 pounds of seed; and hay, 1 to 2 tons, depending on the kind. The sorghum grown is mostly for silage or roughage, although at times some is used for making sirup.

The tilth of this soil is only fair, and as the slow or very slow external drainage and the heavy texture of the surface layer are detrimental to good tilth, care must be taken not to plow the soil when so wet that clods will form and impair its workability. Poor drainage, however, is the greatest problem in proper management, as seepage from the upland slopes keeps the soil, especially the lower part, damp or saturated throughout the year. Good drainage is obtained in some places by tile drains and in others by open ditches. Some farmers, however, have not drained the land but prefer to risk damage to crops by poor drainage or to use the soil for pasture or meadow. Tiling is probably more efficient than open ditching but it is more expensive, especially as the slowly pervious nature of the soil material makes it necessary to set the tile at close intervals.

Burgin silty clay loam, shallow phase.—The dark-gray or nearly black surface soil is similar to that of the normal soil, but the phase differs in subsoil color and mode of occurrence. The relief, drainage, consistence, and structure are similar to those of Colbert silt loam, the Burgin soil differing primarily in color. Most of the 320 acres mapped are southwest of Keyes Chapel School and Cedar Grove and north of Walnut Grove School.

This phase represents areas of the typical soil in which the dark color extends to only a relatively shallow depth. The very dark-gray or nearly black rather heavy silty clay loam surface soil is 6 to 8 inches thick. The subsoil is brownish-yellow compact silty clay,

plastic, sticky, and mottled and streaked with red, yellow, and gray, and throughout contains a few small rounded dark-brown or black particles. At a depth of 22 to 30 inches this gives way to the substratum, which consists of brownish-yellow plastic and sticky silty clay or clay mottled with red, yellow, and brown. Bedrock lies at a depth of 40 to 50 inches; and in some places the water table is at a depth of 30 to 40 inches.

All the soil is under cultivation, and about 30 percent is used for corn, 30 percent for lespedeza, and the rest for pasture and sorghum. Corn yields 10 to 20 bushels an acre, depending on management practices. Lespedeza yields are fair and are comparable with those obtained on Colbert silt loam, but pasture yields are slightly higher. The organic-matter content appears high, but the plant-nutrient content is either low or not readily available.

Most of this soil is level enough not to require terracing. Crops would probably respond well to treatment with ground limestone and superphosphate, though subject to fluctuating yields because of common drought periods.

Colbert silt loam.—Developed mainly from argillaceous or clayey limestone members of the Lowville, Hermitage, and Cannon limestone formations, this soil is almost wholly in the outer Central Basin and is associated with Mercer, Maury, and Mimosa soils and smooth stony land (Colbert soil material). The larger areas are near Bell Buckle, Ransom Hill, Deason, Horse Mountain, Haley, Whiteside Church, and Himesville. An outstanding smaller area is in the vicinity of Hickory Hill Church. A total of 10,112 acres is mapped.

The light grayish-brown to brownish-gray friable silt loam surface soil is 4 to 6 inches thick. The subsoil consists of light brownish-yellow to grayish-yellow or brownish-gray moderately plastic sticky cherty silty clay, hard when dry, and mottled with red, gray, yellow, and brown. This range in color includes the most noticeable variations recognized in the soil as mapped, although minor differences exist in the consistence in places near the associated soils. The material of the subsoil breaks into small angular and subangular particles when dry, but it is massive and plastic when moist. At a depth of 24 to 30 inches is heavy, plastic, sticky, and massive light brownish-yellow to grayish-yellow silty clay or clay, intensely mottled with yellow, gray, and brown. Bedrock is at a depth of 36 to 48 inches. The reaction is slightly acid to neutral.

The soil has mild surface relief, with gradients of 2 to 7 percent. External drainage is moderate, but internal drainage is slow. The heavy subsoil impedes the movement of air and moisture, and the soil material shrinks and cracks when dry and swells to a tight very slowly previous condition when wet. This condition causes excessive runoff and increases damage by erosion. Failure of the soil to absorb sufficient rain water and its ability to hold water in a form unavailable to crops render it incapable of sustaining crops during summer droughts. Consequently, pasture and other plant growth are cut short. The shallow surface soil and relatively heavy subsoil are unfavorable to the formation of a good tilth and hinder to some extent the cultivation of corn and other ordinary field crops. Very few chert fragments occur on the surface and in the soil, but in some places a few small flat

pieces of limestone are on the surface, and such areas are generally used for pasture.

It is estimated that 85 percent of this soil has been cleared and that 90 percent of the cleared land is used for pasture. Some areas are used for small grain, lespedeza, and corn. The pasture includes mainly bluegrass, hop clover, white clover, and lespedeza, together with some orchard grass, redbud, and timothy.

Under the more favorable weather conditions and in long rotations with pasture, corn yields about 25 bushels an acre. Erosion, however, has damaged the soil considerably in most of the areas suitable for corn. Lespedeza yields 270 to 400 pounds of seed an acre and $\frac{1}{2}$ to $1\frac{1}{2}$ tons of hay. Pasture-carrying capacity depends on the seasonal moisture conditions, but normally the soil sustains sufficient pasturage for 1 cow an acre for 60 to 90 days a year.

Little of the soil has been terraced, and to slow down loss of soil by rapid runoff the farmers depend wholly on pasture or sod-forming crops. This practice has given fairly satisfactory results in erosion control, except in the areas where corn and small grain are grown part of the time. In such places damage by erosion has been considerable and other measures for the control of water on the soil are necessary. It is thought that terraces would improve pastures by retarding the runoff and affording more time for the water to soak into the soil. Fertilization of pasture and other crops is not generally practiced, and farmers who reported the use of amendments state that no appreciable response was apparent.

Chiefly because of its relatively poor physical suitability for crops requiring tillage, the best use for this soil is pasture.

Colbert silty clay loam, eroded rolling phase⁷.—This phase has a more rolling surface than Colbert silt loam (pl. 3, C) and has lost about two-thirds of its original surface layer by erosion. The subsoil material has been mixed with the remaining material of the original surface soil, thus making the plow layer heavier and of finer texture. The relief is rolling, and the gradient ranges from 7 to 15 percent.

This eroded rolling phase has the same variation in color and parent material and is associated with the same soils and on the same locations as Colbert silt loam. External drainage is very rapid, but internal drainage is slow. The soil absorbs more seepage, however, than Colbert silt loam and is more moist in dry seasons.

The aggregate area of this is 8,704 acres. Approximately 90 percent of it has been cleared, and almost all the cleared land is used for pasture, containing the same kinds of plants as on Colbert silt loam. The trees on the forested areas include black locust and some hickory, elm, and red cedar. Much of this soil was once cropped, but on account of low yields and erodibility it is now used as pasture land.

Special attention apparently must be given to controlling water and increasing fertility if this soil is to be productive and properly conserved. Very little of it has been terraced or fertilized.

Cumberland silt loam.—This soil is developed on old well-drained terraces along the Duck River and Flat Creek from alluvial materials deposited before these streams had cut down to the level

⁷ Normal type not mapped.

of their present channels. The old terraces, which are 25 to 50 feet above the normal level of the streams, are now too high to be overflowed. The composition of the alluvial materials seems to indicate that most of them were derived from limestone and some from sandstone.

The 6- to 12-inch surface layer is dark-brown friable silt loam, and the 36- to 50-inch subsoil is dark reddish-brown to yellowish-brown friable silty clay loam, containing a few small rounded dark-brown and black particles. The slightly compact substratum is a somewhat plastic silty clay loam in the lower part and contains a great many small dark-brown or black particles. This layer has about the same color as the subsoil, except for some yellow and gray splotches and mottlings, which increase in intensity with depth. A layer of water-worn gravel underlies the substratum in most places at a depth of 4 to 10 feet. The soil is medium to slightly acid.

Under virgin conditions the organic-matter content is moderately high and is well mixed with the upper 2 to 4 inches of the surface layer. When the soil has been cleared, the organic matter gradually disappears through cultivation and the plow layer becomes lighter in color. Tilth is good to excellent, although a few particles of water-worn gravel $\frac{1}{2}$ to 1 inch in diameter are on the surface in places. The permeable surface soil and subsoil absorb and retain moisture well.

The most noticeable variation in the soil is in color. North of Powell Creek School a 15- to 20-acre area of a variation of this nature resembles Waynesboro silt loam because its surface layer is light grayish-brown silt loam and its subsoil yellowish-brown slightly compact and moderately plastic silty clay. The soil is only about 3 feet deep and is underlain by residual material from bedrock. The crops grown apparently give lower yields than on the more typical soil.

The aggregate area of 5,568 acres is nearly all along the Duck River and in places extends almost a mile north and south of it, and there is a small area north of Flat Creek along the State highway. The relief is very gently sloping, the gradient being 2 to 7 percent. Both external and internal drainage are moderate. Areas between Warner Bridge and the Coffee County line appear to be slightly more productive and to have better tilth than those elsewhere. Areas in that part of the county have not been so severely sheet eroded as between Warner Bridge and the Marshall County line. This soil is closely associated with Etowah and Wolftever soils on the lower terraces and with Maury, Hagerstown, and Talbott soils in the uplands.

Practically all the soil has been cleared and is well suited physically to the production of many different farm crops. Those commonly grown are corn, wheat, oats, alfalfa, crimson clover, rye, barley, lespedeza, and tobacco. Little commercial fertilizer has been used except on alfalfa; the soil is treated with 2 to $3\frac{1}{2}$ tons an acre of ground limestone and with 200 to 300 pounds of superphosphate. Under different levels of soil management, corn yields 25 to 50 bushels an acre of grain, or 12 to 20 tons of silage; wheat, 13 to 25 bushels; oats, 25 to 50 bushels; alfalfa, 3 to 4 tons of hay; and lespedeza, $1\frac{1}{3}$ to 2 tons of hay, or 270 to 450 pounds of seed. Approximately 30 percent of the soil is used for corn, 20 percent for wheat, and the rest for legume and other hay crops.

Management is less difficult than on soils of the uplands, where the subsoils are heavier and the slopes steeper. The friable and porous surface layer can be plowed without risk soon after rains, as it does not easily clod or puddle. The most urgent management problem has to do with the prevention and control of runoff and the maintenance of fertility. Runoff may be controlled to some extent by contour plowing, well-planned rotations, and in some places by terracing. Fertility may be maintained by well-planned rotations that include a legume crop for plowing under, supplemented by some fertilization.

Cumberland silt loam, slope phase.—This phase occurs on the stronger slopes of old high terraces and includes the same variations as the typical soil. A total of 3,968 acres is mapped.

Compared with the typical silt loam the slopes of this phase are stronger (with gradients of 7 to 15 percent) and the surface soil is thinner. Sheet erosion has removed 2 to 6 inches of the original surface soil; consequently, the content of organic matter and plant nutrients is lower than in uneroded areas. The tilth is not so good as in the normal soil, and brownish-red patches of heavy consistence are numerous. The materials of subsoil and substratum are about the same as the corresponding layers of the normal type.

External drainage is very rapid, and internal drainage moderate. Where there is a rapid runoff, serious losses of surface soil result. The control of the excessive runoff is a pressing problem in management.

The proportion of this phase under cultivation, the crops grown and their distribution, and the fertilizer requirements are about the same as on the normal type. This slope phase, however, is slightly less productive than the typical soil, the crop yields being lower by 5 to more than 20 percent.

Cultivation as practiced in the past has caused considerable loss of soil material by erosion. As a consequence, there has been a lowered natural fertility, a lowered ability to absorb moisture, and a lowered capacity for moisture available to plants. Proper management, which would include fertilization, especially with phosphorus and lime; and longer rotations, including leguminous cover crops for green manure, should retard soil losses, increase the fertility, and help to improve the tilth. Mechanical means of reducing losses by erosion, such as contour tillage, strip cropping, and possibly subsoiling and terracing, may well be practiced on areas that are to be tilled. It is probable that the most severely eroded parts should be used for permanent pasture or in very long rotations.

Dellrose cherty silt loam.—Occupying slopes of high ridges in the Highland Rim escarpment, this is probably the dominant soil south of a line extending from Richmond eastward through Flat Creek to Normandy and in the vicinity of Shiloh. An aggregate of 17,664 acres is mapped.

This soil is more nearly a land type than a normal soil type, because of an abnormally deep surface layer, the result of accumulations of soil materials that have washed, rolled, or sloughed off other soils on ridge tops and on upper slopes. The upper 6- to 30-inch layer consists

of grayish-brown or brown friable cherty silt loam. To a depth of 20 to 60 inches the subsoil is brownish-yellow moderately plastic cherty silty clay loam, slightly mottled yellow and gray at lower depths, and containing many rounded dark-brown and black concretions $\frac{1}{8}$ to $\frac{1}{4}$ inch in diameter. The substratum is yellow spotted with gray and brown heavy firm silty clay, which is mottled with dark brown, rust brown, yellow, and gray and breaks into blocklike fragments. Chert fragments of varying size are in the material but are less numerous than in the upper soil layers. The reaction is slightly acid.

The slopes are 15 to 30 percent in gradient. The organic-matter content is relatively high and is constantly replenished by slough from soils on the upper slopes. External drainage is rapid to very rapid, and internal drainage is moderate. Variations recognized in the soil as mapped are in depth of surface soil and color of subsoil. Variations in subsoil color include dark yellowish brown in some places and reddish yellow in others.

Like Bodine cherty silt loam, this soil is too steep for terracing (see pl. 6, *B*), and water control is one of the major soil management problems. The use of sod-producing crops, strip cropping, and contour plowing are apparently the most practical measures for the control of runoff, and contour plowing is a prevailing practice.

Little information is available on the response of plants when the soil is fertilized, but probably lime and phosphate will increase the carrying capacity of pastures. Locally, though the soil has strong slopes and is rather cherty, it is regarded highly for its ability to grow corn, which gives comparatively large yields.

From 90 to 95 percent of the soil has been cleared and is under cultivation. It is well suited physically to plant growth and absorbs moisture well. Its position on strong relief, however, almost precludes its use for common field crops, except corn. It is estimated that 20 percent of the soil is used for corn, 60 percent is idle or fallow, and the rest is in pasture. Corn yields 25 to 40 bushels an acre, according to the soil management practiced. Pasture land that is properly seeded and otherwise well managed will support 1 animal unit about 95 days a year.

The strong slopes admit the use of only the simplest implements for cultivation. The usual management procedure is to grow corn for 2 years and either rest the soil for 3 to 6 years without cultivation or seed it to lespedeza for pasture. Areas kept permanently under bluegrass, hop clover, white clover, and orchard grass afford good grazing. Seepage from the slopes appears to supply enough moisture for these pasture plants throughout most of the ordinary summer droughts.

Dellrose cherty silt loam, steep phase.—This soil is in the same parts of the county as the typical soil, but its aggregate area—14,208 acres—is slightly less. Large areas are northeast of Bell Buckle, Shiloh, and Normandy and south of Flat Creek and Richmond.

This soil, including subsoil and substratum, is very similar to the normal type in most of its physical characteristics but differs in slope gradient and in thickness of surface soil. Its surface soil is everywhere thinner, more eroded, and lower in organic-matter content, and its slopes average about 35 percent.

External drainage is very rapid, and internal drainage moderate. The runoff is so rapid that much less moisture is absorbed than on

the less steep slopes of the typical soil. On the steep phase corn suffers much during droughts.

Approximately 70 percent of this soil has been cleared. It is estimated that 15 percent of the cleared land is used for corn, which yields about 50 percent less than on the normal soil. The rest of the soil is idle or is used as pasture land. Considerably less pasturage is produced on this steep phase than on the typical soil, because of the less favorable moisture relations.

Under the same management, soil losses will be greater on the steep phase than on the less steep type (see pl. 6, A). Approximately the same water control practices are suited to both soils, but greater care and somewhat more restricted use will be required for proper conservation of the steep phase. Row crops should be grown less frequently and, where feasible, this phase can be best used either for pasture or for forest.

Dickson silt loam.—Developed on the Highland Rim plateau from weathered materials of St. Louis and Warsaw limestones, this soil is undulating to gently rolling, with a gradient of 2 to 7 percent. It covers a total of 448 acres and is found only in the extreme southeastern corner of the county adjacent to Moore County, where it is the dominant soil of the "Barrens."

This is the light-colored soil with a hardpan on the smoother, broader ridges of the Highland Rim plateau. The 6- to 8-inch surface layer consists of grayish-yellow to light grayish-brown loose friable silt loam. The subsoil is light brownish-yellow friable silt loam or silty clay loam and grades to slightly heavier and faintly mottled material. From a depth of about 27 inches to the substratum is brownish-yellow moderately compact and slowly permeable silty clay loam, slightly plastic but firm when wet, and hard when dry. This is the hardpan characteristic of Dickson soils. The substratum begins at a depth of 30 to 40 inches and is dominantly brownish-red or dark reddish-brown firm silty clay splotched and mottled with yellow, brown, and light gray. The material of this layer is sticky and plastic when wet, but hard and brittle when dry.

In virgin areas and in plowed fields the organic-matter content is low in comparison with that of Maury and Hagerstown soils. In virgin areas, however, the upper 1½ to 2 inches of the surface layer is colored dark from organic matter, but it soon disappears when cleared and cultivated. Small chert fragments are on the surface and in the surface soil in cultivated fields, but none of these cherty areas are large enough to be shown on the map. The soil is medium to slightly acid.

External drainage is medium to slow, and internal drainage is slow to very slow, chiefly because of the partly cemented hardpan. The natural fertility is low, as evidenced by the leached gray surface layer, and this feature, with the unfavorable physical nature of the hardpan, is responsible to a great extent for low productivity and somewhat limited suitability for agricultural use.

About 25 percent of the soil is cleared, the rest mainly in a forest growth of oaks, some hickory and dogwood, and a few elms. The crops commonly grown are corn, lespedeza, and rye. Under different levels of soil management, corn yields 10 to 30 bushels an acre and lespedeza ½ to 1½ tons of hay and 180 to 350 pounds of seed. Rye is

usually not grown for grain but for winter and early-spring pasture.

It is generally recognized that this soil needs amendments supplied by lime and fertilizers. The Tennessee Agricultural Experiment Station (7, p. 196) reported—"Generally speaking, the Highland Rim soils are in need of liming. . . The gray lands of the Barrens type [Dickson soils] are naturally very poor in lime, which has repeatedly been found, in the Station's experiments, to be helpful to practically all crops." The Experiment Station recommends 250 to 400 pounds an acre of 5-10-0 fertilizer for corn and small grain; 250 to 400 pounds of 0-10-7 for leguminous crops; and 400 to 800 pounds of 5-10-5 for such crops as cotton, tobacco, tomatoes, and potatoes (8).

As it is naturally low in organic-matter content, any program for the maintenance and conservation of this soil should include measures for supplying this needed constituent. Maintenance of the organic-matter supply, control of sheet erosion, and proper fertilization will greatly help in keeping the soil in fair productivity and workability. Alfalfa and certain other deep-rooted crops that require good internal drainage may be expected to have growth impeded by the hardpan.

Dowellton silt loam.—This soil occurs in the inner Central Basin, lying near heads and forks of streams and between well-drained soils on the upland and overflowed soils near streams. The relief is very mild, with gradients seldom exceeding 3 percent. Both surface and internal drainage are slow to very slow, and though the soil remains saturated for rather long periods, in dry spells it becomes very dry and hard. A total of 5,952 acres is mapped, most of it in the vicinity of Deason, Longview, Walnut Grove School, Cedar Grove, Wheel, and Whitaker.

The surface layer is medium-gray to light-gray friable silt loam 4 to 6 inches thick, underlain by an 8- to 10-inch moderately compact and friable mottled light-gray and rust-brown layer. The subsoil consists of grayish-yellow plastic sticky clay mottled with orange and red. At a depth of 30 to 34 inches it grades into a heavy compact plastic and sticky substratum of splotched brownish-yellow and bluish-gray silty clay. The substratum continues to a depth of 48 to 60 inches, its upper 30 to 36 inches containing varying quantities of small rounded dark-brown or black particles. The soil is slightly acid, and its organic-matter content is low, as indicated by the characteristic gray surface soil.

Approximately 90 percent has been cleared, chiefly for meadow and pasture, although small acreages are used for soybeans and sorghum. Farmers state that the sorghum produces a very satisfactory quality of sirup. The most common meadow plants are red-top, timothy, and lespedeza. Yields of meadow and pasture are somewhat lower than on Colbert silt loam.

The maintenance of adequate drainage rather than erosion control is the soil management problem. As the subsoil is heavy and plastic, it is doubtful whether underdrainage would be profitable or even effective. Open ditches, however, help to draw off surface water and are used to a greater extent than tile drains. The best uses for this soil are pasture and meadow, as these crops can be grown without artificial underdrainage.

Dunning silty clay loam.—The alluvial materials from which this soil has been formed on first bottoms of the inner Central Basin were

washed from slopes and glades underlain by limestone and deposited near streams during overflow. Most of its total area of 640 acres is along Hurricane, Little Hurricane, and Alexander Creeks, and northeast of Putman Well and East Rock Creek.

The 5- to 7-inch surface soil is dark-gray moderately friable silty clay loam, apparently very high in organic matter. The subsoil is very dark-gray to almost black heavy slightly plastic and moderately compact silty clay loam to a depth of 18 to 20 inches. Below this and to a depth of about 40 inches is mottled dark-gray and yellowish-brown heavy plastic and slightly sticky silty clay or clay. The substratum is dominantly yellowish brown, mottled with dark-gray compact silty clay or clay. Limestone bedrock is at a depth of about 50 inches. The soil is nearly neutral in reaction. The dark color indicates a high content of organic matter, which, unlike that of the thin dark layer of the lighter colored soils of the uplands, is not so easily dissipated by cultivation.

Approximately 90 percent of the soil is cleared and used almost wholly for meadow and pasture. The predominant pasture and meadow plants are redtop, timothy, orchard grass, and lespedeza. The hay yields range from $\frac{1}{2}$ to 1 ton an acre, and the carrying capacity as pasture from 70 to 90 animal-unit days a year.

The poor drainage of both the surface and sublayers make this soil poorly suited to crops that require tillage. It differs from Melvin silt loam mainly in its darker color, finer texture, and heavier, more compact consistence. Little drainage has been attempted, but in a few tiled areas satisfactory yields of corn have been obtained.

Dunning silty clay loam, drained phase.—This soil lies on first bottoms along small streams of the inner Central Basin, the largest areas along Taylor Branch and Weakly, Wilson, Bullock, Alexander, North Fork, Fall, and Hurricane Creeks, with smaller areas along their tributaries. Of the 8,320 acres mapped, approximately 95 percent is cleared and under cultivation. As with the normal type, the soil material was washed chiefly from uplands underlain by limestone. Although its internal drainage is noticeably impeded and slow, external drainage is medium to slow, approximating that of Lindside silt loam.

This phase differs from the typical soil chiefly in having better natural internal drainage. Compared with Lindside silt loam, the upper layers are darker and their consistence is heavier. The surface layer under virgin conditions is dark grayish-brown moderately friable silty clay loam 3 to 5 inches thick. The subsoil is very dark-gray or nearly black moderately plastic heavy silty clay loam. At a depth of 18 to 20 inches is dark-gray, mottled with rust-brown and dark brownish-yellow, plastic silty clay. Thoroughly distributed through the layer are a few dark rounded particles about the size of buckshot. The soil is slightly to medium acid.

This better drained phase is apparently high in content of organic matter and relatively high in plant nutrients. It is stone free and nearly level, but tilth is poor, chiefly because of its heavy plastic consistence. It is used for the production of corn, lespedeza, and soybeans. Small grains and winter legumes are seldom grown because of the likelihood of damage by floodwaters, although flooding is not so common or prolonged as on the normal soil. Corn yields 20 to

nearly 40 bushels an acre; soybeans, 8 to 20 bushels of seed; lespedeza, 300 to 500 pounds of seed; and hay, 1 to 2 tons.

Runoff control apparently is no problem, but adequate drainage is a limiting factor to the suitability and productivity of this soil. Tile drains have been installed on some areas, but many of these have become clogged and have ceased to function satisfactorily. Open ditches expedite the removal of surface water but commonly are seriously obstructive to field operations.

Dunning silty clay loam, shallow phase.—This phase differs from the normal type chiefly in having a shallower depth to bedrock—the depth not exceeding 30 inches. About 15 percent of it has been cut and scoured by swift-moving floodwaters.

Most of the 3,584 acres is cleared and used for permanent pasture, the use probably to which it is best suited. Impaired internal drainage and shallow depth to bedrock make it too wet during part of the growing season and too droughty during drier periods. Accordingly, crop yields are generally low. Redtop, timothy, and Bermuda grass are well-adapted pasture plants and under good management afford good grazing during favorable periods.

Egam silt loam.—This soil is associated with Huntington and Lindside soils, and in some places it is difficult to distinguish the three. The relief is nearly level, the gradient never exceeding 2 percent. External drainage is slow but adequate, and internal drainage is slow, chiefly because of the compact subsoil. This is not an extensive soil. Most of its 2,112 acres are on first bottoms of Duck River and its larger tributaries, including Garrison Fork, Thompson Creek, and Flat Creek.

Like Huntington silt loam, which also occurs on first bottoms, this soil is subject to periodic overflow. The most significant difference between the two is the compact very slowly permeable subsoil of the Egam type at a depth of about 15 inches. The surface 14 to 16 inches is light-brown to grayish-brown friable silt loam. The subsoil consists of light-brown to dark-brown compact silty clay loam, stiff when wet and brittle when dry. When crushed the material breaks to fine angular particles. Below a depth of 30 to 36 inches is brown or dark-brown compact silty clay loam splotched and streaked with gray, yellow, and rust brown, which is stiff and slightly plastic when wet and hard and brittle when dry. The mass breaks to small angular aggregates. The reaction indicates that this soil probably has a lower lime content than Huntington silt loam. The surface soil is slightly acid, and the subsoil medium acid.

It is a productive soil, although somewhat less so than Huntington silt loam, and is relatively high in organic-matter content and apparently is high in plant nutrients. Moisture relations, however, are much less favorable than for Huntington silt loam. The high clay content and compact nature of the subsoil interfere with root penetration and with an adequate supply of moisture for plants during the drier periods. On the other hand, crops are likely to scald or drown during especially wet periods, evidently because of the slow removal of excess moisture in the soil at such times.

Practically all the soil is cleared and used either for crops or pasture. Corn for grain and lespedeza and grasses for hay are the predominant crops. Corn yields 25 to 45 bushels an acre, hay 1½ to 2 tons, and

lespedeza for seed 300 to 500 pounds. This soil affords good pasture, but the growth is suppressed during the drier periods. Fertilizer is seldom used for any of the crops.

A variation included with this type is characterized by a very dark layer but otherwise is similar to the typical soil. At a depth of 18 to 24 inches this layer is very dark or almost black heavy moderately compact silty clay loam. Though associated with areas of the normal type, this variation is slightly less productive, its management requirements are about the same, and it is used chiefly for corn, hay, and pasture.

Etowah silt loam.—This soil lies on well-drained young to very young terraces along the Duck River, Garrison Fork, and Thompson, Flat, Sugar, Sinking, Wartrace, and North Fork Creeks, the larger areas being along the Duck River. The alluvial materials from which the soil is derived were washed from soils on the uplands underlain by limestone and in places by sandstone, and were deposited near the streams by running water before the rivers had cut down to their present channels. The soil is not flooded by the usual overflow of the streams, although the terraces on which it lies are lower than those on which Cumberland soils occur. An area of 3,776 acres is mapped.

The 10- to 18-inch surface soil consists of grayish-brown to brown friable silt loam. The subsoil is yellowish-brown to reddish-brown friable heavy silt loam or silty clay loam to a depth of 36 to 48 inches. The material beneath the subsoil is variable, but in most places it is yellowish-brown or brown silty clay, faintly splotched and mottled with gray and yellow. Its consistence ranges from firm and friable to plastic and, when disrupted, the material breaks into small to fairly large angular fragments some of which are blocklike.

In virgin areas the organic-matter content is moderately high and is well mixed with the upper 2- to 4-inch layer. It gradually disappears, however, when the soil is cleared and cultivated continuously and leaves the surface soil lighter in color. A few water-worn particles of gravel, as much as 4 inches in diameter, are on the surface, generally on areas in sharp bends of the larger streams. Except in such places the soil is generally free of gravel, although a gravel bed commonly lies at the base of the substratum. The physical character of both the surface soil and subsoil permit normal circulation and retention of moisture. The soil has good tilth and is slightly acid to neutral.

Practically all of this soil is cleared and cultivated for the production of the common field crops. It is well suited physically to corn, cotton, and tobacco, as it is relatively fertile, has favorable internal physical characteristics, and has nearly level to gentle slopes, with gradients of 2 to 7 percent. Crop yields are practically the same as on Cumberland silt loam, and the fertilizer and other management requirements are the same as for that soil.

The most important variation included on the map consists of about 65 acres of a light-brown very fine sandy loam to a depth of 15 to 20 inches, underlain by a very fine sandy clay loam or very fine sandy clay subsoil to a depth of 36 to 48 inches. The largest area of this variation is south of Shelbyville Mills, on the Duck River. A smaller area is along the same river northeast of Shofner Bridge. Other minor variations include very small areas that resemble Huntington and Lindsides soils, with which the Etowah soil is closely associated.

Frankstown cherty silt loam.—Developed from weathered material of the Fort Payne chert, this soil is associated with Baxter, Bodine, and Dellrose soils; and like the Baxter and Bodine it occupies positions on the tops of narrow high ridges in the Highland Rim escarpment. It is differentiated from the associated soils by its dark-gray surface soil and brownish-yellow subsoil, as the Bodine soils have a light-gray or ashy-colored surface soil and a pale-yellow subsoil and the Baxter soils a brown surface soil and a red or reddish-brown subsoil. The aggregate area of 6,784 acres is in the eastern and southern parts of the county, mainly in the vicinity of Richmond, Mount Herman, New Herman, Raus, Normandy, and Shiloh, and north and east of Bell Buckle.

The 8- to 12-inch surface layer consists of dark-gray friable cherty silt loam. The 24- to 48-inch subsoil is a dark grayish-yellow or brownish-yellow friable cherty silty clay loam. The substratum is yellow or light grayish-yellow friable cherty silty clay loam, light reddish yellow in the lower part. The soil is acid. The surface soil appears to be comparatively high in organic matter and retains its dark color for a long time after being cultivated.

The external drainage is rapid to very rapid and the internal drainage moderate. Suitability for use and fertilizer and management requirements approximate those of Baxter cherty silt loam. The present use and yields are almost the same as in the Baxter type.

Small areas of variations were included with the soil, as mapped, in which the subsoil of some is pale yellow and of others red or yellowish red.

Greendale silt loam.—This soil occupies positions chiefly within the Highland Rim escarpment and in the outer Central Basin on colluvial slopes between those of the first bottoms and the uplands. It has developed from materials of residual, colluvial, and alluvial origin, but in most places the upper 24- to 30-inch layer has formed from colluvial and alluvial materials. The colluvium rolled, washed, or sloughed off the slopes and accumulated on the underlying residual material. The alluvium was deposited during unusually high floods. The underlying residual material is the same as that under the Mimosa soils in most places, and the same as that under Maury, Mercer, Hagerstown, or Talbott soils in others. A total of 3,072 acres is mapped.

The 12- to 18-inch surface layer is dark grayish-brown porous friable silt loam underlain to a depth of 26 to 30 inches by a dark-brown or yellowish-brown friable silt loam or silty clay loam layer containing a few small dark-brown particles. To a depth of about 40 inches the material is brownish-yellow and moderately compact silty clay loam or silty clay faintly mottled with gray. This is slightly plastic and sticky and breaks easily into small angular fragments. The substratum has a slightly heavier consistence and finer texture. The soil is medium to slightly acid.

Throughout the upper 24- to 30-inch layer a few small areas have variable quantities of small chert fragments, but not enough of sufficient size or quantity to hinder normal tillage operations. The organic-matter content is higher than in Mimosa or Maury silt loam, and the plant-nutrient content is probably higher than in the Mimosa type but lower than in the Maury.

The soil lies well for the cultivation of field crops, as the slopes are very gently to gently sloping, never exceeding 7 percent and probably averaging 3 percent. The soil areas are irregular in size and consist of strips of varying width and length. They are well drained both externally and internally, although some small parts are imperfectly drained.

Most areas of this soil are in fields with soils of the adjoining uplands. A great part is associated with the Mimosa soils, and is used and managed in the same manner. Crop yields average higher than those obtained on Mimosa silt loam, but pasture yields are about the same. A small quantity of tobacco is grown on land usually treated with manure and commercial fertilizer. The yields range from 800 to 1,600 pounds an acre, depending largely on the level of management.

Continual wash and seepage from the upper slopes help to maintain the fertility of much of this soil. The control of runoff is somewhat of a problem, but in most cases it can be handled by the proper use of close-growing crops or contour tillage, and in some places by establishing broad base terraces. The small imperfectly drained areas may be improved by open ditches or tile; either measure would afford adequate drainage, but in the long run tiling would probably be more satisfactory.

The soil is associated with alluvial soils, undifferentiated; Lindside silt loam; Mimosa soil; and Maury soil; and small tracts of these are included with the Greendale type as mapped.

Guthrie silt loam.—This is the gray poorly drained soil in depressions and sinks of the uplands of the inner and outer Central Basin areas. The materials from which it is derived are washed from soils on the surrounding uplands. The soil is acid and has a very low organic-matter content. Occurring in depressions, swales, poorly drained places at the heads of streams, and in saucerlike limestone sinks, the areas are widely scattered and in most places are less than ½ acres in extent. The aggregate area is 320 acres.

The 6- or 8-inch surface layer is light-gray or pale-gray friable silt loam, and the subsoil is whitish or very light grayish-yellow, somewhat mottled with yellow and light-brown moderately friable silt loam or silty clay loam. Below a depth of 15 to 24 inches is yellow and gray compact clay. The subsoil continues to a depth of 30 to 40 inches, where it is underlain by bluish-gray heavy slightly sticky and plastic silty clay or clay, mottled with dark brown, rust brown, and yellow. This substratum, which reaches a depth of 40 to somewhat more than 60 inches, is very compact and almost impermeable but breaks readily into fine angular aggregates.

With both external and internal drainage slow, water remains on the surface for days. The soil is grayer and much less productive than the Ooltewah and Abernathy soils, although the three occupy similar positions.

Little attempt has been made to crop the soil. In fields used for corn, wheat, or other common crops the areas are not generally cultivated but are passed over or around and allowed to grow up with weeds and other volunteer plants.

Erosion is not a problem in the management of this soil, and in most places artificial drainage, either surface or underdrainage, is

not practicable, because of the absence of outlets for the water. The greatest returns from this soil would be obtained by its use for meadow and pasture wherever feasible. As it is particularly low in organic matter and nitrogen, its productivity either for crops or for pasture undoubtedly would be benefited by the application and incorporation of these elements.

Hagerstown pebbly silty clay loam.—A total of 960 acres of this pebbly soil is mapped, the larger bodies north of Longview. It is associated mainly with other Hagerstown and with Pickaway soils, but is easily distinguished from Hagerstown silt loam chiefly by the abundance of dark-brown or nearly black pellets or pebbles $\frac{1}{4}$ to $\frac{1}{2}$ inch in diameter on the surface and throughout the soil mass. In many places at a depth of 25 to 36 inches a concentrated 2- to 4-inch layer of these pebbles, is more slowly permeable than is the subsoil of the silt loam.

The relief is smooth to gently rolling, the gradient seldom exceeding 5 percent. External drainage accordingly is moderate, but internal drainage is greatly impeded. Drainage is adequate to accommodate most of the crops commonly grown except during the more moist periods. Chiefly because of the less permeable nature of the subsoil, runoff is more active, and in general the soil is more eroded than are comparable areas of the silt loam.

Most of this soil is tilled and used for corn, tobacco, wheat, cotton, hay, and other general farm crops, but the yields are 30 to 50 percent lower than on the silt loam.

Hagerstown pebbly silty clay loam, eroded phase.—This phase represents areas of the normal type that have a rolling relief and are materially eroded. Like the silt loam, it has an abundance of dark-brown or nearly black pellets or pebbles $\frac{1}{4}$ to $\frac{1}{2}$ inch in diameter on the surface and throughout the soil mass but has a more rolling relief, ranging from 5 to 12 percent, and has lost an appreciable quantity of the surface soil as a result of erosion. Subsoil material has been mixed with the rest of the surface layer by tillage, and in occasional patches, represented in the soil map by appropriate symbols, the original surface layer has been completely removed, leaving the subsoil material exposed.

The runoff is sufficiently active on tilled areas to cause material damage. Internal drainage, though greatly impeded, is sufficient for most of the crops commonly grown.

Much of this soil is used for crops, but the yields are much lower than on the silt loam and somewhat lower than on the normal type and chiefly because of greater slope and eroded condition the management requirements are more exacting.

Hagerstown silt loam.—Occupying irregular-shaped areas of moderate to small size throughout the inner Central Basin, this soil lies on well-drained uplands underlain by the Carters member of Lowville limestone and by Lebanon limestone, but at lower elevations than either Maury or Mercer soils. Its surface is undulating, the gradient ranging from 2 to 7 percent, most of it from 3 to 5 percent. It is well drained both externally and internally. Runoff is slow, and because of good internal physical qualities, the soil absorbs and retains much of the rain water. Of the 3,520 acres mapped the larger areas are in the vicinity of Deason, Longview, and Unionville.

In cultivated fields the 8- to 10-inch surface layer consists of dark-brown friable silt loam. The subsoil to a depth of 40 to 56 inches is brownish-red or reddish-brown firm but moderately friable silty clay loam. Small rounded dark-brown or black particles are well dispersed throughout the subsoil. The substratum consists of light reddish-brown or yellowish-brown firm moderately compact silty clay loam or silty clay, mottled and splotched with yellow, gray, and red, and this material breaks into small angular fragments when disrupted. The substratum is underlain by limestone bedrock at a depth of 5 to 8 feet.

The virgin soil is practically the same as the cultivated soil, except that a thin layer of partly decomposed leaf litter is on the surface and the presence of much organic matter makes the upper 2 or 3 inches darker. Many roots of grass, shrubs, and trees penetrate the soil to varying depths. The surface soil and subsoil are acid to neutral; the substratum, medium acid.

Although it is difficult to distinguish this soil from Maury silt loam by readily recognized characteristics, the two can be separated in the field on the basis of the phosphorus content of the parent limestone rock, which is high in the Maury soils and relatively low in the Hagerstown. The distinction between the two was established after considerable investigation with respect to their respective positions and on their reaction to quick tests for phosphorus. The Hagerstown soil occurs at lower elevations than the Maury, and that between them are Mercer soils, Colbert soils, or smooth stony land (Colbert soil material), in combination or alone.

Agronomically, the silt loam is 10 to 15 percent less productive in the Hagerstown than in the Maury series, probably because it is shallower and contains less phosphorus. It is well suited for agricultural use, and practically the same crops, plus cotton, are grown as on the Maury type. Under different levels of soil management, cotton yields 200 to 440 pounds an acre, corn 25 to 50 bushels, tobacco 1,500 to 1,600 pounds, wheat 13 to 23 bushels, alfalfa 3 to 4 tons of hay, and other hay crops 1 to about 2 tons.

Commercial fertilizers, including superphosphate, are generally used, the usual application for cotton, wheat, and corn being 200 pounds an acre of 2-10-2 mixture, or 150 to 200 pounds of 16-percent superphosphate. Farmers report favorable crop returns from the use of 1 to 3 tons of ground limestone and 150 to 200 pounds of 16-percent superphosphate. At least 98 percent of this soil is cleared and under cultivation; and the management requirements, including measures for soil conservation, are very similar to those for Maury silt loam, especially those concerned with erosion control and crop planning.

About 500 acres of slightly superior productivity in the vicinity of Longview and Unionville and south of Three-Cornered Garden are included on the map. In these areas the soil is characterized by a brown friable silt loam surface soil 10 to 14 inches thick and a 28- to 50-inch dark reddish-brown or dark brownish-red firm but friable silty clay loam subsoil. This soil is very similar in color, structure, and consistency to soils of the Decatur series mapped elsewhere in the State.

Hagerstown silt loam, eroded phase.—This phase (see pl. 1, *C*) differs from the normal type chiefly in having lost an appreciable quantity of the surface soil as a result of erosion. Some subsoil material has been incorporated with the remaining surface soil by till-

age, and there are occasional small patches from which practically all of the surface layer has been lost. The heavier more reddish subsoil thus exposed is represented on the map by appropriate symbols. A total of 10,176 acres is mapped.

The acreage cleared, soil amendments used, and soil management practices are similar to those on the typical soil. The plow layer is of lower organic matter content and its tilth and capacity to hold moisture available for plants are less favorable, consequently its general productivity is lower. Crop yields are 5 to 40 percent lower than on the uneroded type.

Important variations included with this phase as mapped comprise about 1,358 acres. One variation has a lighter brown surface layer and a faintly mottled dark yellowish-red layer in the lower part of the subsoil. Another variation occurring in about 150 acres 2 miles west of Deason has a very dark-brown friable silt loam surface soil 4 to 6 inches thick, underlain by dark brownish-red firm but moderately friable silty clay loam.

The eroded phase is more extensive than the uneroded type, and is associated with the typical soil and with Pickaway and Talbott soils, mostly within the inner Central Basin. Areas of Pickaway and Mercer soils too small to be indicated separately on the map are included.

Hagerstown silty clay loam, eroded rolling phase.^s—This phase has lost an appreciable quantity of the original surface soil as a result of erosion and has a more rolling surface than Hagerstown silt loam. As a consequence of the erosion, some material of the heavier subsoil has been intermixed by tillage with the residue of surface soil, and there are occasional patches from which practically all the surface layer has been lost. The heavier more reddish subsoil exposed is represented on the map by appropriate symbols. The relief is 5 to 12 percent.

The aggregate area of this phase is 2,496 acres, with prevailingly rolling relief. The runoff is rapid to very rapid and less water soaks in than on the silt loam, which has gentler slopes and a more permeable surface layer. This phase also is relatively low in content of organic matter and has a lower content of plant nutrients. About the same proportion is used for crops and the same kinds of crops are grown, but the yields in general are about 10 to 60 percent lower.

Need for erosion control is more pressing on this soil than on Hagerstown silt loam, and such management practices as long crop rotation, strip cropping, contour plowing, and possibly terracing should be followed to rebuild and maintain the soil. Crops appear to give satisfactory response to mixed fertilizers or to superphosphate and lime.

This phase contains the same inclusions as the silt loam, and the areas are associated with the other Hagerstown soils and those of the Pickaway and Talbott series.

Hagerstown stony silt loam.—This soil differs from Hagerstown silt loam mainly in that outcrops of limestone bedrock, or "chunk" rocks, are in the soil and a few flat pieces of limestone are on the surface. The two soils are similar in color, texture, and structure of surface soil, subsoil, and substratum; in average depth to bedrock, even in

^s Normal type not mapped.

close proximity to outcrops; and in mode of occurrence, slope, associated soils, drainage, and character of parent material. A considerable part of the 3,008 acres is in the vicinity of Unionville and Poplins Crossroads.

The rock outcrops are marked hindrances to field operations, especially tillage operations and others involving the use of power-drawn machinery. Crops grown and management practices followed approximate those for the silt loam, and the yields range from about the same to about 60 percent less.

Huntington silt loam.—In an aggregate area of 2,368 acres, this soil occupies bottom lands that are subject to periodic overflow and consists chiefly of material washed from soils developed over limestone. The relief is nearly level, and although surface drainage is slow, internal drainage is moderate and adequate to maintain good moisture relations except during periods of high water.

This is the brown, well-drained fertile soil on the bottom lands of the larger streams (pl. 4, A). It is associated with Linside and Egam silt loams, and most areas lie as narrow strips along the Duck River, with narrower strips along Garrison Fork and some of the other tributaries.

The 18- to 24-inch surface layer is brown or grayish-brown friable silt loam, resting on moderately firm but friable heavy silt loam or silty clay loam. Below a depth of 40 to 48 inches is dark grayish-brown friable heavy silt loam or silty clay loam, in places moderately compact or firm, and grading to darker more friable material. Much humus is in the upper 12 to 24 inches, and this is sufficiently durable to persist through many years of continuous cultivation. The soil is slightly acid to neutral.

A high content of organic matter and plant nutrients and periodic overflows tend to maintain the fertility of this soil, but its suitability for crops is limited by its susceptibility to flooding and the hazards of lodging and diseases. Corn, soybeans, certain hay crops, as redtop and lespedeza, and many pasture plants are well suited to it and commonly give high yields. Row crops, especially corn, are generally grown several years in succession with very little fertilization. Corn yields 50 to 70 bushels an acre and lespedeza 2 to 3 tons without fertilization. Tobacco, fruits, alfalfa, and small grains, especially wheat, are not suited to this soil. The high production of the well-suited crops and the ease with which the soil is worked and with which both plant nutrients and soil material are conserved make it one of the most fertile soils in the county.

The chief variation of this soil is in texture. About 60 acres is very fine sandy loam and another 60 acres is silty clay loam. The more sandy variation is near Shofner Bridge, Shelbyville Mills, and Halls Mill, and the silty clay loam variation near Dement Bridge and along Wartrace Creek south of Bell Buckle.

Limestone outcrop.—Most of the limestone outcrop consists of undulating to rolling land in the inner Central Basin and strongly sloping to steep areas in the Highland Rim escarpment. This type, commonly known as rock, or glady land, represents areas in which 75 percent or more of the surface is occupied by limestone outcrops. The soil among the outcrops produces very little if any grazing vegetation, and only stunted trees commonly persist. It is very droughty, has

undulating to steep relief, and when the vegetation is destroyed the small quantity of soil material is easily carried away by runoff. It is used for range land and feeding places for livestock, for what forest it will sustain, and for building sites. The many limestone outcrops preclude any other agricultural use. The natural vegetation is stunted redcedar and cactus, or pricklypear, the former stand on much of the land, especially on undulating and rolling areas, having been killed by summer droughts in recent years.

Lindside silt loam.—On first bottoms along small streams in the Highland Rim escarpment and in the outer Central Basin this is probably the predominant soil. It is the imperfectly drained type commonly associated with Huntington silt loam. Though similar to that soil in mode of occurrence, parent material, and organic-matter and plant-nutrient content, it differs primarily in its less perfect drainage, poorer productivity, and in the physical characteristics of the sublayers. With an aggregate area of 11,520 acres, it is more extensive than the silt loam in either the Huntington or the Egam series.

The light-brown or grayish-brown friable silt loam surface soil, is 12 to 18 inches thick, with a few gray mottlings in the lower 2 or 3 inches. The subsoil is grayish-brown mottled with gray, yellow, and brown friable heavy silt loam. The color and size of mottlings increase to a depth of 36 to 40 inches, below which is fine and coarse gravel. Although gravel and small chert fragments are on the surface in places, they are too few to interfere with normal cultivation. The reaction is about neutral.

Drainage is slow externally, and slow to very slow internally. Agricultural suitability is more restricted than on Huntington silt loam. The areas more poorly drained are used for pasture and meadow (pl. 4, *B*) and most of those better drained are planted to corn, which probably is grown more extensively on this soil than on any other in the county. Fertilizers are not commonly used. A few small areas have been drained with tile, and where this was properly laid the crop yields nearly equal those obtained on Huntington silt loam.

Lindside silt loam, shallow phase.—This shallow phase occurs on first bottoms along small streams in several parts of the county in an aggregate area of 1,664 acres, including areas of Huntington silt loam too small to be separated on the map. Differing from the normal type, its depth to bedrock does not exceed 30 inches, but the soil material is quite similar. Shallowness to bedrock and consequent poorer drainage are chiefly responsible for yields that are probably 20 to 75 percent lower. Most of the soil is used for pasture and meadow, although attempts have been made to grow corn in a few places. Redtop, orchard, timothy, and other grasses grow well with lespedeza for the production of hay and pasture.

Maury silt loam.—This soil is developed from weathered material of the Hermitage formation, which is relatively high in phosphate content (*I*). It is associated with soils of the Mimosa series of higher elevations and with soils of the Mercer series of lower elevations. Differing from these, it has a higher phosphate content, a darker surface soil, and a dark reddish-brown rather than brownish-yellow and more permeable subsoil.

A total of 6,016 acres is mapped, the largest bodies near Bell Buckle, Fairview, and Wartrace, and along United States Highway No 241, south of Shelbyville and Pleasant Grove, with smaller areas near Haley, Cortner, Roseville, Three Forks Church, north of Flat Creek, and northwest of Shelbyville.

Locally known as beech land or chocolate land, probably its most outstanding features are the deep-brown and rich-looking surface soil and dark brownish-red or dark yellowish-red subsoil. The surface soil is dark-brown to light-brown friable silt loam 8 to 10 inches thick. The content of organic matter is relatively high and is well incorporated in the soil mass. The surface layer is generally free of chert and other rock fragments, although in some small areas there are a few on the surface and in the surface layer. The subsoil is reddish-brown to dark yellowish-brown firm but moderately friable heavy silt loam or silty clay loam. Rounded dark-brown to black particles $\frac{1}{16}$ to $\frac{1}{8}$ inch in diameter are throughout the subsoil and are numerous in the lower part. The surface soil and subsoil are slightly acid.

Below a depth of 48 to 72 inches is light brownish-yellow to dark brownish-yellow silty clay loam or silty clay, mottled and streaked with yellow, red, and brown and slightly sticky and plastic when wet. There are small partly decomposed fragments of rock in this material, and in some places a few small rounded dark-brown particles. The material is slightly acid to neutral. It is underlain by bedrock at a depth of 6 to 10 feet.

The relief is gently undulating to undulating, with gradients of 2 to 7 percent. External drainage is slow but ample, and internal drainage is good. As the open porous subsoil quickly absorbs water, plowing is possible soon after rains.

This is one of the most desirable soils of the county for crops. It is productive, the content of phosphorus being especially high, it is easily worked, and its fertility, good tilth, and soil material are not difficult to conserve. The physical character of the subsoil favors the absorption of moisture and the maintenance of good moisture relations and aeration for plants.

The soil has an unusually wide range in use suitability, the principal crops being corn, wheat, and hay, including alfalfa, lespedeza, and crimson clover. Corn commonly yields 30 to 50 bushels an acre, depending on soil management. It is probably the best soil in the county for wheat, the yields of which range from 15 to 25 bushels an acre, according to its management, and some farmers report yields of 30 to 35 bushels. Alfalfa does well, but to obtain good yields of hay it is necessary to treat the soil with $\frac{1}{2}$ to $3\frac{1}{2}$ tons an acre of ground limestone before seeding. The hay yields of alfalfa range from 4 to about $4\frac{1}{2}$ tons, and other leguminous crops yield proportionately well. It is estimated that about 35 percent of the soil is used for corn, 20 percent for wheat, 30 percent for leguminous hay, and the rest for less important crops.

Under proper management, which includes legumes in the rotation, incorporation of organic matter in the soil, and control of runoff, high crop yields may be easily attained. Continuous use for corn, cotton, and other intensively cultivated crops greatly reduces the capacity of the soil to produce high yields. Terraces have helped retard accelerated erosion, especially on the stronger slopes.

Information regarding fertilizer requirements is scarce. Very few farmers use fertilizer on this soil, but those who do report that the crop response is not sufficient to justify its regular use.

Some small areas of brownish-yellow soil resembling Mimosa in color but otherwise resembling this type are included on the map, chiefly along United States Highway No. 241 south of Shelbyville and north of Bell Buckle in the vicinity of Beechwood School.

Maury silt loam, eroded rolling phase.—Most of this phase is associated with the normal type and with Mimosa and Mercer soils. Small areas that resemble these associated soils are included, and severely sheet-eroded areas are indicated on the map by symbols. A total of 4,416 acres is mapped.

In this phase the slopes are stronger than on the typical soil, ranging from 5 to 12 percent, and the surface soil is thinner and contains less organic matter. Of the original surface soil 50 to 75 percent has been lost by erosion, so that subsoil material is exposed in places and some of it is mixed with the plow layer over most of the area. External drainage is moderate to very rapid, and internal drainage moderate.

Nearly all of this phase is under cultivation, and the crops and their proportionate acreages are about the same as on the normal type, though the soil is slightly less fertile and yields of many crops are much lower. Except on a few farms, fertilizers are not used. Satisfactory increases in corn yields were obtained on a field of the severely eroded soil treated with 200 pounds an acre of 4-12-4 fertilizer.

The management requirements of this phase are similar to those of the typical soil, except that more care is required to conserve it against losses by runoff. Longer rotations than are necessary for proper management of the normal soil are advisable, and where feasible contour tillage and strip cropping are probably preferred. Terracing may be justified in some circumstances.

Melvin silt loam.—This soil, consisting chiefly of material washed from upland soils formed over limestone, is on first bottoms, mostly along small streams in the outer Central Basin and the Highland Rim escarpment. Of the small areas, aggregating 512 acres, the largest are near Fairfield, Normandy, Bell Buckle, Wartrace, Shelbyville, and Unionville. The surface is nearly level, and internal drainage is very slow. Most areas are in the lowest parts of the first bottoms and these are the first to be covered by floodwaters. Compared with Lindside silt loam, with which it is commonly associated, it has poorer drainage, lighter color, and subsoil of heavier consistence.

This is the most poorly drained soil on the first bottoms. The 8- to 10-inch surface layer is medium-gray friable heavy silt loam faintly mottled with brown. When dry it is light gray. Varying quantities of small rounded dark-brown or black particles are on the surface and in the surface soil, and crawfish chimneys are numerous. Beneath the surface soil the material is dominantly bluish-gray intensely mottled with rust-brown silty clay loam or silty clay. This is underlain at a depth of 34 to 40 inches by fine gravel.

The very slow drainage makes productivity low and variable for practically all crops and tillage impracticable, as a rule, except during

the most favorable periods. Though very little of the soil is tilled, practically all of it is cleared and used for pasture and meadow, to which it is well suited. Redtop, timothy, orchard grass, lespedeza, bluegrass, and white clover are the most common meadow and pasture plants. Hay yields are $\frac{1}{2}$ to 1 ton an acre, and the carrying capacity as pasture ranges from 70 to 100 days a year for 1 animal unit. Chiefly because of its more moist condition, pasture vegetation persists longer during dry periods than on most of the better drained soils. Fertilization is not commonly practiced.

Little of the soil has been artificially drained, although drainage would be beneficial by improving tilth, soil moisture, air, and temperature conditions.

Mercer silt loam.—In association with Mercer silty clay loam, eroded rolling phase, Maury silt loam, and smooth stony land (Colbert soil material), this upland soil occurs in the outer Central Basin, the larger bodies near Bell Buckle, Wartrace, Fairfield, Haley, and Pleasant Grove, and north of Richmond. The relief is gently undulating to undulating with gradients of 2 to 7 percent. A total of 6,464 acres is mapped.

This soil is developed from weathered materials of the basal member of the Hermitage formation and the Tyrone member of Lowville limestone. External drainage is moderate, but internal drainage is slow to very slow. The surface soil is usually of good tilth but lower in plant-nutrient materials than Maury silt loam. The subsoil, because of its heavy character, impedes the movement of moisture, air, and heat and results in poor water-absorption capacity, low resistance to summer drought, and in erosion. Sheet erosion especially is very active, and its control is an important management requirement.

The grayish-brown friable silt loam surface layer 8 to 12 inches thick is underlain abruptly by a characteristic subsoil of light brownish-yellow or yellowish-brown heavy silt loam or silty clay loam, which continues to a depth of 20 to 30 inches. The subsoil is firm but moderately friable, its material is slightly plastic and sticky when wet and becomes slightly heavier with depth, and throughout it contains varying quantities of small rounded dark-brown particles. The substratum is mottled yellow, gray, and brown stiff plastic clay, and in some places are a few rounded dark-brown or black particles. Its material breaks into small angular particles of glossy appearance. The soil is slightly acid. Under virgin conditions the upper 2 inches of the surface soil is dark brown with organic matter. When the soil is cultivated, this organic matter is soon dispersed and the plow layer has a noticeably gray cast.

About 30 percent of this soil is used for corn, 10 percent for wheat, and 60 percent for lespedeza and other crops. Corn yields 15 to 38 bushels an acre, wheat 8 to 19 bushels, and lespedeza 270 to 450 pounds of seed and $\frac{3}{4}$ to $1\frac{1}{2}$ tons of hay. The differences in the yields of these crops depend on soil variation and on levels of soil management.

Crops respond well to green manure and barnyard manure. Little information is available as to the response to mixed fertilizers, but a few farmers report satisfactory crop increases from the use of superphosphate when the rainfall is ample, but small yields when the growing season is dry. Bluegrass, well suited to this soil, is grown in some

places, responding to treatment with ground limestone and superphosphate.

The maintenance of organic matter and plant nutrients, a pressing problem in management, is affected in most places by some fertilization and by a rotation of corn, wheat, and crimson clover, followed by lespedeza for 2 to 4 years. This rotation also lessens soil losses by runoff. Contour tillage, strip cropping, and possibly terracing are mechanical means that may well be considered as a means of reducing soil losses.

Variations included with this soil type are mainly in the color and consistence of the subsoil, which ranges from brownish yellow to grayish yellow and from firm and moderately friable to compact, sticky, and moderately plastic. These differences are reflected in crop yields, but they occur in such intricate patterns that it is impossible to map them with reasonable accuracy. Included with this type also are small spots or patches 5 to 50 feet in diameter imperfectly or poorly drained and easily identified by the growth of a species of water grass. The soil of these patches is underlain at a shallow depth either by a semicemented mass of small rounded particles or by heavy impermeable clay or silty clay that causes slow or very slow internal drainage.

Mercer silty clay loam, eroded rolling phase⁹.—This soil has a more sloping surface than Mercer silt loam and has lost an appreciable quantity of its surface soil by erosion. Most of the plow layer includes some subsoil material, and on severely eroded patches the subsoil is exposed. These patches are represented on the soil map by appropriate symbols. The slope ranges from 7 to 15 percent.

This phase is more extensive than Mercer silt loam, with which most of it is associated. A total of 7,104 acres is mapped. All of it has been tilled at some time, and most of it is used for crops and pasture. Chiefly because of the eroded condition and stronger slope, productivity is lower, workability less favorable, and conservability more difficult than on Mercer silt loam, but crops respond about equally well to proper fertilization, though the yields in general are lower. A small quantity of alfalfa grown in fields treated with lime, phosphate, and manure yielded 2 to 2½ tons an acre.

Proper management requires relatively long rotations, effective cover crops, and such field practices as contour tillage, strip cropping, and possibly, in some places, terracing to prevent serious losses of soil material by runoff.

Mimosa cherty silt loam.—This soil differs from Mimosa silt loam chiefly in having chert fragments 1 to 4 inches in diameter throughout its entire depth in sufficient abundance to interfere slightly with ordinary tillage but in places to facilitate the percolation of water. The relief is rolling, and internal drainage is moderate. The aggregate area is 3,776 acres, chiefly in the outer Central Basin. It is associated with other Mimosa soils, and many areas are adjacent to and below areas of Dellrose soils. Most of this soil is cleared and used for general farm crops, the yields averaging a little less than on Mimosa silt loam, owing chiefly to lower fertility. Management requirements approximate those of that soil.

Mimosa silt loam.—This fairly extensive upland soil, entirely within the outer Central Basin, has developed in place from materials

⁹ Normal type not mapped.

weathered from Cannon limestone, which is of high calcium carbonate content. Associated with Maury, Greendale, and Dellrose soils, it occupies benchlike positions below and adjacent to long steep slopes of the Dellrose, and most areas are at a slightly higher elevation than the Maury. The largest areas of the 4,352 acres mapped are north and east of Bell Buckle, west of Fairfield, and east of Wartrace, Haley, Roseville, Singleton, and Flat Creek. The relief is rolling, the gradient ranging from 7 to 15 percent. Internal drainage is moderate to slow.

The surface soil is characterized by a 6- to 8-inch dark grayish-brown to light-brown friable silt loam containing a few small chert fragments. In places, an appreciable part of it has been lost as a result of erosion. The brownish-yellow to light brownish-yellow heavy silty clay loam or silty clay subsoil is moderately compact, slightly plastic, and sticky. The lower part is faintly mottled and streaked with gray and yellow. Below a depth of 24 to 36 inches is very light brownish-yellow, mottled with yellow and gray silty clay or clay of stiff, compact, plastic, and sticky consistence. Under virgin conditions the upper 1 or 2 inches of the surface layer is stained dark brown with organic matter. The upper part of the soil in places contains an appreciable quantity of chert fragments, but these are not large or numerous enough to hinder normal tillage operations. The soil is medium to slightly acid.

More than 95 percent of this soil is under cultivation, chiefly for corn, tobacco, wheat, oats, rye, lespedeza, redtop, bluegrass, hop clover, white clover, and alfalfa. Under average conditions, corn yields 25 to 35 bushels an acre; wheat, 9 to 18 bushels; oats, 18 to 33 bushels; crimson clover, 4 to 7½ bushels of seed; alfalfa, 2½ to 3 tons of hay; and lespedeza, 225 to 400 pounds of seed and ¾ to 1½ tons of hay. Bluegrass, hop clover, and white clover are generally grown for permanent pasture, the carrying capacity ranging from 80 to 115 days a year for 1 animal unit, the capacity varying according to season and management. Rye and crimson clover are commonly grown for winter and early spring pasture.

The soil is fairly desirable for agricultural use. It is productive and well suited to most of the crops commonly grown. Its rolling nature and rather slowly permeable subsoil make management requirements more exacting than on the Maury and Etowah silt loams. Moderately long rotations should be used, and mechanical means of control of runoff may be justified in some circumstances. Contour tillage and strip cropping can be practiced to advantage. Barnyard manure is commonly used, and crops respond to it, but farmers report that, except for alfalfa, mixed fertilizer and phosphorus fertilizers do not give marked results. Where alfalfa is to be grown, lime is applied at the rate of 1½ to 3½ tons an acre.

Mimosa silt loam, undulating phase.—This phase has a smoother surface than the typical soil, the gradient seldom exceeding 7 percent. The surface layer is a little thicker, the organic-matter content averages a little higher, and fewer patches are eroded materially. The subsoil and substratum are similar to those of the normal soil.

Most of the areas are small, and the aggregate of 960 acres is less extensive than in the normal type. Practically all of it is cultivated, chiefly for corn, tobacco, wheat, oats, rye, redtop, alfalfa, and lespedeza. Crop yields are somewhat higher than on the normal soil.

Productivity and ease of workability and of conservability make this a very desirable soil for agriculture. Its natural fertility is not so high as in Maury silt loam, but under good management good yields of all the crops commonly grown are obtained. Crops respond to barnyard manure, but noticeable results have not been generally obtained with phosphorus and other mixed fertilizers. Lime is usually applied where alfalfa is to be grown.

Mimosa silty clay loam, eroded hilly phase¹⁰.—This soil differs from Mimosa silt loam chiefly in having a thinner and heavier surface soil and a stronger slope, the gradient ranging from 15 to more than 25 percent. Much of the original silt loam surface layer has been lost through accelerated erosion, and the present surface soil is a yellowish-brown moderately friable silty clay loam, in most places less than 5 inches thick. The subsoil and substratum are similar to Mimosa silt loam. Surface drainage is very rapid, and internal drainage moderate.

This is not an extensive soil, 1,536 acres being mapped. It is associated with the other Mimosa soils and much of it is adjacent to areas of Dellrose soils. Practically all of it has been cultivated at some time, but much is now used only for pasture. Many areas are badly cut by numerous shallow gullies. Chiefly because of its unproductive state, susceptibility to erosion, and difficult workability, this soil is not well suited to crops that require tillage. In most cases it can be used to good advantage for permanent pasture. Observations indicate that bluegrass, lespedeza, and hop clover become established on areas that have not been tilled for several years, and it is probable that with proper fertilization the carrying capacity could be substantially increased.

Mimosa stony silty clay loam.—This type is distinguished from the other Mimosa soils chiefly by the numerous small flat limestone fragments throughout the mass and by the heavy nature of the plow layer. Much of the original surface layer has been lost by erosion, consequently the plow layer is composed of subsoil material. The 5- or 6-inch surface layer of brownish-yellow silty clay loam contains small flat limestone fragments and is underlain by brownish-yellow moderately compact, slightly plastic and sticky silty clay. The mottled brownish-yellow, yellow, and gray stiff compact plastic and sticky silty clay substratum is about 24 inches thick. Limestone bedrock may lie at a somewhat shallower depth than under Mimosa silt loam. The relief is rolling, and internal drainage is moderate to slow. The reaction is acid.

Most of this soil has been cleared, and much is now used for crops. A greater proportion than in the other Mimosa soils is used for sorghum and lespedeza, sorghum being especially well suited because of its having a lower moisture requirement than corn. Yields of the common fields crop are 25 to 50 percent less than on Mimosa silt loam.

Chiefly because of stoniness and the less favorable nature of the eroded surface layer, this soil is not well suited to crops that require tillage. Productivity is low, workability poor, and conservability only fair, though the productivity of a few of the less eroded areas approaches that of Mimosa silt loam. It is well suited to pasture, and a good stand of bluegrass and white clover can generally be expected to be established on areas used as permanent pasture.

¹⁰ Normal type not mapped.

Management requirements for crop areas are a fairly long rotation and a system of tillage and cover crops that will keep runoff at a minimum and the soil stabilized. Many areas can be used to good advantage as permanent pasture.

Ooltawah silt loam.—Like Abernathy silt loam, this fertile, imperfectly drained soil of the uplands occupies sinks and depressions at the heads of drainageways. It has been formed from material washed from soils chiefly of the Talbott and Hagerstown series of surrounding uplands underlain by limestone. Unlike the Abernathy type, it has slower internal drainage, a lighter colored surface soil, and a heavier and more compact subsoil. Its total area is not great (1,984 acres), and most of it is in small areas widely distributed over the inner Central Basin.

The 8- to 12-inch surface layer of grayish-brown friable silt loam is underlain by a layer about 3 inches thick of grayish-brown faintly mottled with dark-brown or black friable silt loam. The subsoil is very light reddish-brown or yellowish-brown mottled with brown moderately friable to compact silty clay loam. The mottled condition is more pronounced at greater depths. Below 40 to 46 inches is dark yellowish-brown intensely mottled with gray and dark-brown silty clay loam or silty clay. It is acid throughout.

Practically all of this soil is tilled, and about the same crops are grown as on the Abernathy type. Yields of corn and hay are high, although they may be low in wetter seasons. Normally it is very productive of crops requiring tillage as well as of pasture plants. It is fertile, generally has an abundance of moisture throughout the growing season, and is permeable to roots except during wet periods. Workability is good, although wet conditions more commonly interfere with field operations than on the silt loams of the Abernathy and Hagerstown series. The conservability is excellent, chiefly because of the nearly level relief and high fertility. This soil is suited to short rotations, and fertilizer requirements are not high. The good type of natural vegetation it is capable of supporting and the favorable moisture relations make it a very desirable soil for pasture.

Pickaway silt loam.—This soil resembles Mercer silt loam in general physical character, but its browner more friable subsoil is underlain by a brittle hardpan and it is somewhat less productive. Whereas the Mercer soils are developed over the basal member of the Hermitage formation and the Tyrone member of the Lowville formation and are associated with the Maury, Mimosa, and Colbert soils of the outer Central Basin, the Pickaway soils are developed over Ridley and Lebanon limestones and are associated with the Hagerstown and Talbott soils of the inner Central Basin. The larger bodies are north of Rover and Longview and smaller ones are near Deason, Keyes Chapel School, Harts Chapel, Cedar Grove, Bedford, and Wheel. An aggregate area of 6,080 acres is mapped.

This grayish-brown silt loam is the imperfectly drained soil with a hardpan commonly associated with Hagerstown and Talbott soils. In uneroded areas the surface layer is 6 to 8 inches thick; over most of this soil, however, at least half the surface layer has been lost by erosion. The plow layer of much of the eroded areas has some subsoil material mixed with it, and in places the subsoil is exposed. To a depth of 20 to 30 inches, the subsoil is light brownish-yellow moderately com-

compact but fairly friable silty clay loam, which breaks down to fine angular soil particles, light yellow or grayish yellow when dry. Many small rounded dark-brown or black particles are throughout this layer. Directly beneath the subsoil is a semicemented, hard, compact, almost impermeable or very slowly permeable layer 4 to 6 inches thick. The substratum is brownish-yellow mottled and splotched with gray and yellow plastic silty clay loam or silty clay, which breaks into irregular-shaped aggregates $\frac{1}{2}$ to 2 inches in diameter, hard and brittle when dry, but plastic and sticky when moist. The soil is medium to slightly acid. As indicated by the grayish color of the surface layer, the content of organic matter is comparatively low, even under virgin conditions, and this material is readily dispersed by cultivation. It is also probably low in plant nutrients, as indicated by the comparatively low crop yields.

The relief is undulating to gently rolling, the average gradient being 4 percent. A few nearly level areas have in general a somewhat thicker and darker surface soil. Internal drainage is slow, and the subsoil above the hardpan is almost saturated with water during periods of heavy precipitation.

The virgin forest growth consists of northern red oak, white oak, red cedar, and some shrubs. About 85 to 90 percent of this soil has been cleared and cultivated at some time, but a large part is now idle and covered with volunteer vegetation of lespedeza and broom-sedge. Yields on the crop areas are comparatively low, that of corn being 10 to 30 bushels an acre; wheat, 5 to 16 bushels; cotton, 80 to 280 pounds; and lespedeza, $\frac{1}{2}$ to 1 ton of hay. The higher yields in general are obtained by farmers practicing a systematic rotation in which leguminous cover crops are turned under as green manure.

Though suited to most of the crops commonly grown, this silt loam is less well adapted to agricultural use than the Hagerstown, Mimosa, and Maury. Its natural fertility, especially in eroded areas, is lower; moisture relations are less favorable because of impaired internal drainage; and the tilth of the more eroded parts is only fair. Most areas have been managed under a system that allows for frequent row crops, and their productivity has been lowered materially during the period of agricultural use. Fertilization has been chiefly by applications of 150 to 200 pounds an acre of superphosphate, or 200 to 250 pounds of a 2-10-2 or 4-12-4 mixed fertilizer for wheat or cotton. This soil responds to a system of management that includes some fertilization and a rotation with infrequent row crops, but including a legume cover crop turned under for green manure.

A most noticeable variation occurs in a small area near Kater Crossing. Here the surface soil is darker colored than in the normal type, and the subsoil is light reddish-yellow silty clay loam. It appears to be more productive than most of the typical soil.

Pickaway silt loam, rolling phase.—In this phase the surface is more rolling than in the normal type, the gradient ranging from 5 to 12 percent. More than two-thirds of the original surface soil has been lost by erosion, and the plow layer is composed largely of subsoil material. Most of the areas are small and intermingled with areas of the typical soil. The greater part of the 192 acres mapped is between Rover and Kingdom Church. All this soil has been

cleared and cropped, but some of it now is not regularly tilled. Its productivity is poor, and its workability and conservability are fair. The less favorable suitability for agriculture is due chiefly to the more sloping surface and the thinner, less friable, and less fertile surface layer. Management requirements are more exacting than on the typical soil, but in general more effort must be put forth to protect this phase against losses by runoff and to maintain a good state of fertility and tilth. Longer rotations and more care in maintaining a vegetative cover are thought to be well justified.

Robertsville silt loam.—As in the Etowah, Wolftever, and Taft series, the material from which this soil is derived was washed from uplands underlain by limestone and was deposited along the streams by moving water. The type occurs on poorly drained low terraces or second bottoms adjacent to the larger tributaries of the Duck River. Bodies of it are northeast of Fairfield on Garrison Fork, north and southwest of Wartrace, north of Normandy, Bell Buckle, and Pleasant Grove, and south and northwest of Shofner Bridge. Smaller bodies are scattered over the rest of the county. The aggregate area is 1,088 acres.

This is the gray poorly drained soil on stream terraces. The 6- to 8-inch surface layer consists of yellowish-gray moderately friable and compact silt loam, which breaks down to fine particles under slight pressure. When dry, the color is light yellowish gray, light gray, or medium gray. Between 7 and 15 inches in depth is yellowish-gray to ashy-gray compact silt loam, slightly more friable than that of the surface layer, which breaks easily into small soft aggregates. From a depth of 15 to 50 inches the soil is light grayish-yellow to light-gray moderately compact heavy silt loam or silty clay loam, mottled with gray, rust brown, brown, and light yellow, the mottlings being more intense at a depth of 22 inches or more. The soil material, although moderately compact, breaks easily into coarse angular particles. The surface soil is slightly acid, the subsoil medium acid, and the substratum strongly acid. The content of organic matter and plant nutrients of the surface soil are low. Crawfish chimneys are common.

The relief is level or nearly level, as the gradient is less than 3 percent. External drainage is slow, and internal drainage slow to very slow. This poor natural drainage limits its use suitability for crops. Unless the seasons are favorable, it is hardly worth while to attempt to grow corn or wheat. Most of the soil is used for lespedeza or for meadow and pasture plants, chiefly redtop, orchard grass, and Dallis grass. Hay crops yield $\frac{1}{2}$ to 1 ton or a little more an acre, and lespedeza yields 180 to 360 pounds of seed. The pastures will graze 1 animal unit for 45 to 70 days a year, depending largely on the management of the soil.

Drainage either by open ditches or by tile would perhaps slightly increase the range of soil use, but because of the relatively low content of organic matter and plant nutrients and the compactness of the soil, drainage by either method would not be profitable.

Rolling stony land (Colbert soil material).—This is one of the more extensive separations of the county and it is widely distributed throughout the Highland Rim escarpment and the outer Central

Basin. An area of 27,584 acres is mapped. Locally known as glady land, rock land, or grass lots (pl. 4, *C*), it is characterized by numerous limestone outcrops that preclude feasible use for crops requiring tillage. Approximately half the area is occupied by rock outcrops and the rest by Colbert soil material. The thickness of this material ranges from a very few inches to 40 inches or more; where it is approximately 20 inches or more thick, it has a profile comparable with that of Colbert silt loam, although in a few areas it is redder and more nearly approaches Hagerstown soil material. The relief is rolling, with a gradient of 10 to 25 percent. External drainage is rapid, and internal drainage slow.

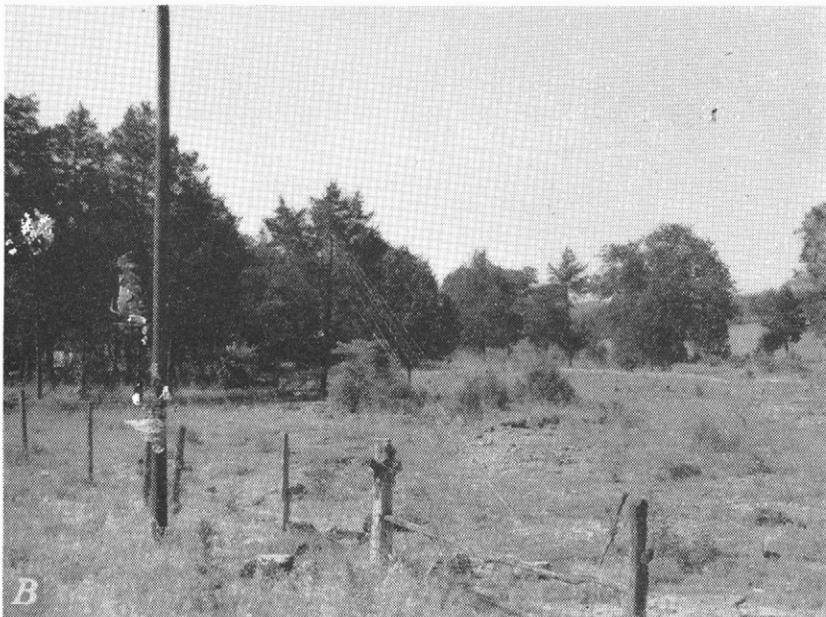
Although not physically suited to crops requiring tillage under present conditions, a few areas do have patches where hand implements can be used. A considerable part is used for pasture and an appreciable acreage is in redcedar forest. Bluegrass, hop clover, and white clover are the dominant native pasture plants, but timothy, orchard grass, redbud, and lespedeza are common in places. Bluegrass usually furnishes early-spring or late-winter grazing. Hop clover and white clover furnish spring grazing and lespedeza summer grazing. The carrying capacity varies widely, depending at least in part on slope, abundance of rock outcrops, and depth to bedrock. The slopes of this land type afford more grazing than do areas of smooth stony land (Colbert soil material); it is thought that smooth areas overlying the level-bedded rock are particularly droughty, whereas vegetation on the slopes benefits from seepage water from these rocks.

Applications of lime and phosphorus would probably increase the carrying capacity of this land type, both by improving the quality of the vegetation and by increasing the yield.

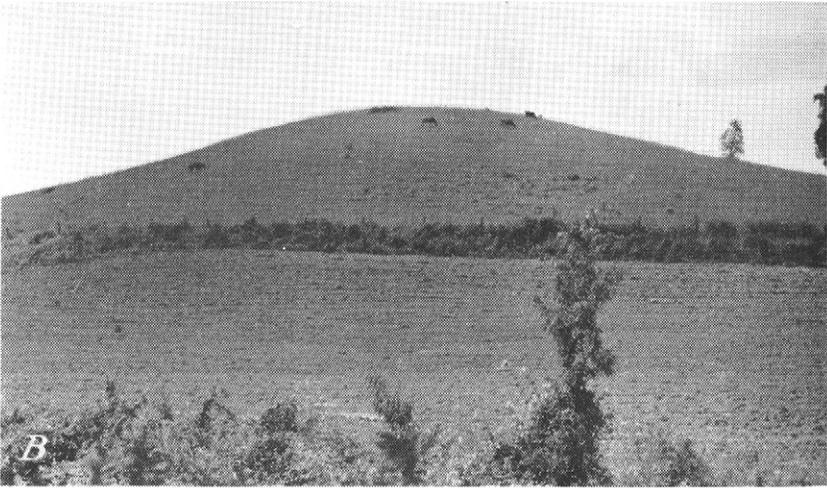
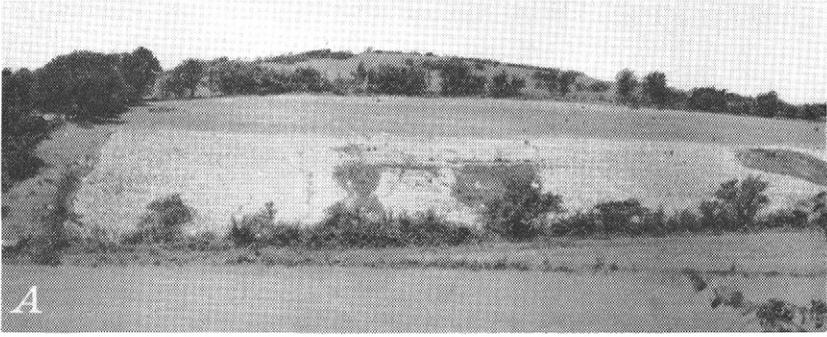
Rough gullied land (Mimosa soil material).—This land type represents areas of soils overlying limestone that have been eroded to such extent that reclamation would require expensive and very slow processes. The areas have been reduced to an intricate pattern of gullies that practically prohibit field operations. The soil profile is largely so mutilated as to reduce the separation to a miscellaneous land type. The relief ranges from gently to strongly sloping, most of it with a gradient of 10 to 15 percent. The total area is small (784 acres), and few of the tracts are larger than 8 or 10 acres. They are widely distributed over the county, those in the outer Central Basin and Highland Rim escarpment predominantly representing mutilated areas of Mimosa soils, and those in the inner Central Basin mutilated areas of Hagerstown soils.

Forest is the only use to which this land type is physically suited. Black locust does well on much of it, and in some areas a stand of redcedar has become established. These trees offer some return as fence-post material, and together with such plants as sericea lespedeza, kudzu, and sweetclover provide vegetation suitable for stabilizing the soil against further erosion.

Smooth stony land (Colbert soil material).—This stony land type is locally known as glady land, rock land, or grass lots. Like rolling stony land (Colbert soil material) it is extensive, a total of 11,200 acres being mapped. The areas, however, are mostly within the outer



A, Area of mixed Colbert silt loam and smooth stony land (Colbert soil material).
B, Area of smooth stony land (Hagerstown soil material).



Dellrose cherty silt loam: *A*, Steep phase, severely eroded as a result of too intensive cultivation of row crops. *B*, A fertile and productive hill soil when managed under a 4- to 6-year corn-legume-grass rotation. *C*, Strip cropping, contour tillage, and rather long rotations including sod-forming crops are good management practices for this soil.

Central Basin and are associated with Mimosa, Maury, Mercer, and Colbert soils and rolling stony land (Colbert soil material) (pl. 5, *A*). The numerous limestone outcrops, which are characteristic, preclude it from feasible use for crops requiring tillage. It has a smoother surface than rolling stony land (Colbert soil material), the gradient seldom exceeding 10 percent. Most of it is used for pasture, but part is occupied by redcedar forest mixed with some oak and hickory. The pasture vegetation is similar to that on the rolling type, but apparently because of its somewhat more droughty nature its carrying capacity as pasture is considered by farmers to be lower. Applications of lime and phosphorus would probably increase somewhat the carrying capacity as pasture.

Smooth stony land (Hagerstown soil material).—This land type is similar in most respects to smooth stony land (Colbert soil material), but differs mainly in that the soil material among the limestone rock outcrops is principally Hagerstown soil material. An aggregate of 32,768 acres is mapped in the inner Central Basin, the larger bodies along the Duck River, west of Shelbyville, in the immediate vicinity of Sims Spring, Warner Bridge, and Halls Mill, and west of Poplins Crossroads and Unionville, with smaller bodies throughout the northwestern part of the county. The relief is gently undulating to undulating, the gradient averaging about 4 percent. The surface soil is very thin and is underlain by flat or level-bedded limestone in most places. A few small areas contain "chunk rock" outcrops, and there the soil material is deeper. Most of this land type is occupied by oak-hickory forest, the oak predominating. The forest grows slowly and is of limited value (pl. 5, *B*). Pastures are less productive than on smooth stony land (Colbert soil material), owing to the thinner surface soil and the consequent low moisture-holding capacity. Bluegrass, hop clover, and white clover are scarce. Little attempt has been made to improve this land for pasture, but a great part is used as range.

Taft silt loam.—The material from which this soil is formed was washed from soils on the upland underlain by limestone and was deposited near the streams by running water. Most of the small aggregate area (512 acres) is contiguous to the bottom lands along the Duck River, particularly north of Normandy, west of Shofner Bridge, west and northwest of Three Forks Bridge, south of Wartrace, and near Shelbyville. It differs from Etowah silt loam in its grayer color and slow internal drainage. The relief is nearly level to gently sloping, and external drainage is mostly fair to good.

This is the light-colored imperfectly drained soil of low stream terraces or second bottoms adjacent to the first bottoms of the larger streams. The surface soil is light grayish-brown friable silt loam 7 to 10 inches thick. The subsoil consists of light grayish-yellow or yellowish-gray moderately friable heavy silt loam or silty clay loam to a depth of 20 to 24 inches, where it grades into light grayish-yellow spotted and mottled with brown, rust-brown, gray, and yellow moderately compact silty clay loam. This is underlain to a depth of 36 to 40 inches by yellowish-gray intensely mottled with rust-brown and yellow moderately compact silty clay loam. The upper 20- to 24-inch layer is slightly acid, the lower subsoil medium acid, and the sub-

stratum strongly to medium acid. The surface soil, apparently low in content of organic matter, is ashy colored or almost white when dry.

All the soil is cleared and used mainly for corn, crimson clover, and wheat. The crimson clover is used chiefly as winter grazing for sheep. Considerably less productive than the Etowah and Hagerstown types, its suitability for crops is limited chiefly by imperfect drainage. The workability is fair to good, although impaired drainage limits the tillage periods. Except for the limited sloping area, the nearly level relief makes the problem of runoff control negligible, but a high productivity is rather difficult to establish and maintain. Apparently both organic matter and plant nutrients are low. Local reports indicate that this soil responds well to treatments with either phosphorus or mixed fertilizers.

An area of about 20 acres of Taft silt loam, slope phase, lying west of Shofner Bridge, is included on the map. It is similar to the normal type, except that the slopes are stronger and the surface soil slightly thinner. The subsoil and substratum of the two soils are similar, as are the origin of the parent materials, the use of the soil, and the crops grown. The external drainage is rapid to very rapid, and losses from erosion are rather heavy. This condition increases the necessity for the conservation of the soil by such measures as terracing, contour plowing, and a rather long crop rotation. The crop yields obtained on this slope phase are slightly lower than on the normal type.

Talbott silt loam.—This soil is associated with other Talbott soils, Hagerstown and Pickaway soils, and smooth stony land (Hagerstown soil material). Variations resembling these soils are included with this type, the aggregate area of which is 3,520 acres. The size of the separate areas ranges widely. The larger areas, 50 to 100 acres, are to the north and south of Shelbyville. Some small areas contain flat pieces of limestone and outcrops of limestone bedrock and are indicated on the map by appropriate symbols.

This smooth yellowish-red soil of the upland is widely distributed over the inner Central Basin. The subsoil is of heavier consistence than the Hagerstown type. The 6- to 8-inch surface layer is grayish-brown friable silt loam. The 2-inch surface soil of virgin areas contains sufficient organic matter to give it a darker brown color. The yellowish-red clay subsoil is sticky and plastic when wet but hard when dry, and the material breaks into blocky lumps of almost massive structure. The lower part of the subsoil is mottled. Below a depth of 30 to 40 inches is intensely mottled yellow, red, rust-brown, and gray tough sticky clay. Bedrock limestone is at a depth of about 5 feet. The soil is acid.

The relief is undulating to gently rolling, the gradient ranging from 2 to 7 percent. Internal drainage is slow but adequate for all crops commonly grown.

Approximately 85 percent of this soil is used for crops, the more commonly grown being corn, wheat, and lespedeza. Yields under average conditions are fairly good but are lower than on Hagerstown silt loam. Corn yields 20 to 40 bushels an acre, wheat 8 to 19 bushels, lespedeza 1 to 1½ tons, and cotton 160 to 360 pounds. Commercial fertilizers, including superphosphate, are commonly used. The usual application of 16-percent superphosphate or its equivalent is about 200 pounds an acre for cotton and 150 to 200 pounds for corn and wheat.

Productivity is limited chiefly by the less favorable moisture relations. The heavy dense subsoil is slowly pervious to moisture, and the moisture available to plants is more limited than in the more friable open soils. As a consequence, plants commonly suffer from droughtiness during summer. The workability and conservability of this soil are good to very good, although the more sloping parts require particular attention for water control. The slow percolation of water through the subsoil favors the increase of runoff. Fewer row crops and more frequent close-growing crops would be good rotation practices. The organic matter present in the virgin soil is soon lost largely through sheet erosion when the soil is cultivated, and the surface soil assumes a reddish color. Tilth also becomes poorer with prolonged cultivation.

Talbott silt loam, shallow phase.—This extensive phase is associated with Hagerstown, Pickaway, and other Talbott soils, and much of it is adjacent to areas of smooth stony land (Hagerstown soil material), the larger bodies northwest of Unionville and south of Longview. A total of 13,440 acres is mapped.

Compared with the normal type, the surface layer is similar, the subsoil is thinner, depth to bedrock is less than 30 inches, and limestone fragments, though not abundant, are more numerous. The relief is undulating to gently rolling, the gradient not exceeding 7 percent. Surface drainage is adequate, but internal drainage is slow.

After 15 to 20 years of cultivation, a considerable acreage has become so unproductive that it has been abandoned as cropland; much of it is used for pasture, and the rest has become forested. The more common crops now grown on tilled areas are corn, wheat, cotton, and lespedeza. Yields are 40 to 70 percent of those obtained on the typical soil.

Shallow depth to bedrock and heavy consistence of the subsoil make this phase droughty, easily damaged by erosion, and not well suited to crops requiring tillage. Chiefly because of their resistance to drought, sorghum and millet can be grown on this soil, but most areas probably can be used best as pasture land.

Talbott silty clay loam, eroded phase.¹¹—Compared with the much less extensive silt loam, the surface soil is thinner, approximately two-thirds of the original layer having been lost by erosion, thus exposing the subsoil in places and bringing some subsoil material into the plow layer; the plow layer in general, is browner and more nearly silty clay loam; the relief is undulating to gently rolling; percolation of moisture is somewhat slower; and crop yields are lower, though the fertilizer practices and the soil management in general are similar. The area mapped is 12,800 acres.

All this soil has been cleared and cropped at some time, and about 90 percent of it is now tilled. Corn, wheat, lespedeza, and cotton are among the more common crops grown.

Lowered productivity and slower permeability make the proper control of water more difficult on this soil than on the uneroded silt loam type. Measures for improving the tilth, increasing the fertility, and slowing down runoff need to be considered in the management. Winter cover crops to be turned under as green manure, supplemented

¹¹ Normal phase not mapped.

by fertilizers, contour tillage, and at least moderately long rotations should contribute to the stabilization and improvement of this soil.

Included with this soil are areas of other associated soils too small to be represented on the map.

Talbott silty clay loam, eroded rolling phase.—This type phase differs from Talbott silt loam chiefly in having lost more than two-thirds of its original surface soil as a result of erosion and in having a stronger slope, the gradient ranging from 7 to 15 percent. The plow layer consists chiefly of subsoil material, and a great part of it is brownish-red silty clay loam or silty clay of fair to poor tilth.

This is not an extensive soil and in the 4,224 acres mapped most of the areas are of small to moderate size, in general occupying the stronger slopes of the smoother Talbott soils.

All of this phase has been cropped, and most of it at present is tilled. Corn, wheat, lespedeza, and cotton are among the more common crops grown. Yields are considerably lower than on Talbott silt loam, the soil is noticeably more difficult to maintain in productive condition, the natural fertility is lower, the moisture relations are less favorable and the control of water, especially runoff, is more difficult. Relatively long rotations, including winter cover crops, and other mechanical means of controlling runoff as are considered feasible should be used.

Wolftever silt loam.—This soil is developed from material on low stream terraces washed chiefly from soils overlying limestone and is characterized by a compact subsoil. The 7- to 12-inch surface layer is grayish-brown and friable. The subsoil is variable in color and consistence, but most of it is reddish-brown or yellowish-brown compact silty clay loam that breaks easily to coarse angular pieces. There are some mottlings below a depth of 18 inches. Below about 36 inches the material is variable—in some places it is gravel, and in others it is gray mottled with yellow and brown plastic clay. The entire soil is acid. The relief is nearly level to undulating. External drainage is good, but internal drainage is slow. Drainage conditions in general are fairly satisfactory for most of the crops commonly grown. The lower lying areas, however, are subject to flooding by exceptionally high waters, and the compact subsoil interferes with the movement of soil moisture.

The aggregate area of this soil is not great (1,728 acres), and most of it is along the Duck River and its larger tributaries, chief of which are Garrison Fork, Flat Creek, and North Fork Creek.

Practically all the soil is planted to crops, chiefly lespedeza, crimson clover, soybeans, timothy, and redtop. Corn is not so common as on silt loams of the Hagerstown, Etowah, and Huntington series. Hay yields are fairly good and consistent, but corn yields are more variable, depending on seasonal moisture conditions. Fertilizers are less commonly used than on the Hagerstown and Etowah types.

Physically suited to the production of crops requiring tillage, the smooth surface and friable plow layer are favorable from the standpoint of workability and conservability, except on the more sloping parts, where the control of runoff may be somewhat of a problem. The productivity and range of suitability for various crops are limited chiefly by the compact subsoil, which interferes with root penetration, movement of moisture, and aeration. Such late-season crops as corn commonly suffer from lack of moisture during the late summer months.

Included with this soil as mapped are variations that resemble Huntington silt loam.

PHYSICAL LAND CLASSIFICATION AND SOIL MANAGEMENT

The solution of many problems of agriculture involves a knowledge of the physical suitability of soils for agricultural uses. Soils that are widely separated in the natural classification may be relatively similar for a particular practical objective. The soil-mapping units of Bedford County are here classified on the basis of characteristics that can be observed in the field. It is necessary to interpret the characteristics of the mapping units in terms of physical suitability for agriculture if the data of the soil survey are to be useful in the solution of agricultural problems. Such interpretation can be made by persons who use the soil survey data for practical objectives, but it is frequently convenient to have interpretive data available in one place in the report.

PHYSICAL LAND CLASSIFICATION

On the basis of relative physical suitability for agricultural use under present conditions the soils of the county are grouped in five classes. Although those of no one class are ideal for the existing agriculture, the First-class soils more nearly approach that ideal than the Second-class. Likewise, the soils of each succeeding class are further from the ideal than those of the preceding class.

The physical suitability of a soil for agricultural use is determined by its characteristics, many of which contribute to its productivity, workability, and conservability. Because of poor workability, poor conservability, or both, a soil may be productive of a crop but not well suited to it.

Productivity, as used here, refers to the ability of the soil to produce crops. Workability refers to ease of tillage, harvesting, and other field operations. Texture, structure, consistence, stoniness, and degree of slope are important among the characteristics that affect workability. Conservability refers to ease of maintenance or improvement of productivity and workability. The degree to which the soil responds to management practices indicates the extent of the conservation measures that must be practiced.

An ideal soil for agriculture is one that is very productive of a large number of important crops, one that is easily worked, and one that can be conserved with a minimum of effort. All soils of the county fall short of the ideal, but they differ widely in the degree of such departure. For example, a soil may be highly productive and easy to conserve but very difficult to till. The relations among productivity, workability, and conservability are very complex in their influences on the physical suitability of a soil for agriculture. No simple method of evaluating these three qualities and applying the values toward a determination of the physical suitability of the soil for agriculture can be used.

The physical land class of a soil is an estimate of the combined effects of these three factors on the physical suitability of the soil for agriculture. In table 10, on productivity ratings, the soils are grouped

according to the five classes, and for each soil is shown its productivity in terms of indexes and workability and its conservability in terms of six relative descriptive expressions.

The six relative terms used to describe workability and conservability are excellent, very good, good, fair, poor, and very poor. Soils of excellent workability are generally light- or medium-textured, stone-free, and nearly level and require minimum effort in tillage and harvesting. It is successively more difficult to perform normal farming operations on soils of very good, good, and fair workability, but such operations are generally feasible for crops that require tillage, even on soils of fair workability. Silty clay or clay soils, hilly soils, or soils so stony as to interfere seriously with cultivation are considered to have fair workability. Soils on which normal tillage operations can be performed only with great difficulty are considered to have poor workability. Such soils in this county generally have gradients in excess of 25 percent or are so stony as almost to preclude tillage with ordinary implements. The soils of very poor workability are so steep or so stony, or both, that tillage is generally limited to the use of hand implements.

The six terms applied to conservability are also relative. The ease with which the content of available plant nutrients can be maintained at a high level, the ease with which runoff and consequent loss of soil material and water can be controlled, and the ease with which good tilth and good conditions for tillage can be maintained are the principal factors considered. Excellent conservability means that productivity and workability can be maintained with minimum intensity of management. Very good, good, and fair conservability represent soil conditions that require successively more intensive management for maintenance of productivity, workability, or both, but both can generally be maintained under the good management practices that are generally feasible. Poor conservability represents soil conditions that to conserve productivity and workability, or both, require tillage by intensive management practices that are generally not feasible on most farms. Very poor conservability represents the extreme of difficulty in conservation of productivity or workability, or both.

In separating the soils into five physical land classes, the productivity, workability, and conservability of each was considered. It is assumed that soils only moderately well suited both to tilled crops and to pasture are better suited to agriculture than soils that are poorly suited to crops but well suited to pasture. This assumption is made because soils well suited to crops are limited on more farms than are the soils well suited to pasture. If livestock should become more important in the agriculture this assumption would become less valid.

The five classes of the soils fall into two groups: In one, the productivity, workability, and conservability are sufficiently good for them to be considered at least fairly well suited physically to crops as well as to pasture; in the other, one or more of these three factors is sufficiently poor to make the soils poorly suited physically to crops that require tillage.

The first group consists of the first three classes, the limits between them being chosen to approximate the concepts of excellent, good, and fair cropland, respectively. These three, in decreasing order of

physical suitability for agriculture are the First-, Second-, and Third-class soils.

The second group consists of the two remaining classes. In one, the soils are at least fairly well suited physically to the production of permanent pasture; in the other, they are poorly suited to permanent pasture and are probably best suited to forest. The first of these two subgroups comprises the Fourth-class soils; the second, the Fifth-class soils.

Information obtained from the experience of farmers, soil surveyors, extension and experiment-station workers, and others who work with the soil is used in assigning the soils to these five physical land classes. Comparisons are made among the soils in considering productivity, workability, and conservability. For example, a farmer knows that some soils on his farm are physically better suited than others to agriculture. By comparisons of this nature within farms and among farms the soils are placed in the approximate order of physical suitability and appear in that order in the table of productivity ratings. The limits selected within this ranking for separation of the soils into the five physical land classes are approximations, and the soils that appear adjacent to each of these limits in the table are marginal between the two classes on either side of the limit.

The five physical land classes are defined in terms of the relative physical suitability of the soils for agriculture under present conditions. Within that definition, however, the range of relative physical suitability for crops that require tillage and for permanent pasture are given. The soils are listed under these five classes in table 10.

FIRST-CLASS SOILS

The First-class soils are physically very good soils for agriculture. They are good to excellent for crops that require tillage and also for permanent pasture. Compared with other soils all are relatively well supplied with plant nutrients, but on the most fertile some crops are responsive to fertilizer amendments. All are well drained, yet their physical properties are such that they retain moisture well. Good tilth is easily obtained and maintained, and the range of moisture conditions suitable for tillage is comparatively wide. The soils are relatively well supplied with organic matter. The physical properties favor normal movement of air and moisture and facilitate root penetration.

None of these soils is characterized by any prominent adverse soil condition. They are almost free of stones, their surface relief is favorable to tillage and other field operations, and none is severely eroded or highly susceptible to erosion. Productivity is high for many crops; and the conservation of soil fertility and of soil material itself is relatively simple under common farming practices. All the soils are well suited physically to most of the exacting and intensively grown crops common to the locality.

The aggregate area of the First-class soils is 37.1 square miles, or 7.8 percent of the county.

SECOND-CLASS SOILS

The Second-class soils are physically good soils for agriculture. They are fair to good for crops that require tillage and fair to excellent for permanent pasture.

They are at least moderately productive of most of the crops commonly grown. Their physical properties are at least moderately favorable for tillage, maintenance of good tilth, and normal circulation and retention of moisture. None has slopes greater than 15 percent, none is sufficiently stony to interfere seriously with field operations, and none is severely eroded. Although each is moderately deficient in one or more characteristics that contribute to productivity, workability, or conservability, none is so seriously deficient as to make it poorly suited physically to use for crops that require tillage.

The deficiencies vary widely among the soils. Some are fertile but sloping and moderately eroded; others are almost level and uneroded but poorly drained. The management requirements differ widely because of the many kinds of soils included. All are relatively similar in their suitability for agriculture, although the management practices by means of which the benefits of their suitability are realized may be greatly different.

The aggregate area of the Second-class soils is 77.2 square miles, or 16.2 percent of the county.

THIRD-CLASS SOILS

The Third-class soils are physically fair soils for the agriculture of the county; they are poor to fair for crops that require tillage and fair to very good for permanent pasture.

Each is characterized by a workability, conservability, or productivity that singly or in combination is sufficiently poor for the physical suitability for tilled crops to be definitely limited, but not to such an extent that the soil is poorly suited to such crops. These soils physically are better suited than Fourth-class soils to crops that require tillage but less well than Second-class soils. Factors that limit physical suitability for crops that require tillage include low content of plant nutrients, low content of organic matter, low water-holding capacity, undesirable texture, structure, or consistence, strong slope gradient, stoniness, erodibility, chertiness, or inadequate natural drainage. Because of the diversity of characteristics among the soils the management requirements range widely.

The aggregate area of the Third-class soils is 135.3 square miles, or 28.4 percent of the county.

FOURTH-CLASS SOILS

The Fourth-class soils are physically poorly suited to crops that require tillage and are poor to very good for permanent pasture. They are poor soils for the agriculture of the county, mainly because of the limited uses to which they are well suited. On some farms, however, where permanent pasture is desired, some of these soils may be the most important.

Each soil of this group is so difficult to work or to conserve, or both, that under present conditions on many farms the management practices necessary for their successful use for crops that require tillage are not feasible. On some farms, however, soils that are well suited to such crops may be so limiting that it is well to practice the intensity of soil management necessary for the successful use of Fourth-class soils for these crops. They are generally used for pasture on farms where an adequate crop acreage is available. A con-

siderable acreage is used for crops, however, on farms where the areas of soils better suited to the purpose are too small to satisfy the needs of the farm unit. The intensity of management practiced on areas used for crops is generally inadequate for good soil conservation. As on Third-class soils, the management requirements vary widely both for crops that require tillage and for pasture.

The aggregate area of the Fourth-class soils is 222.4 square miles, or 46.7 percent of the county.

FIFTH-CLASS SOILS

The Fifth-class soils consist of two land types that are very poor for crops that require tillage and poor to very poor for permanent pasture. Each is so difficult to work and conserve or so low in productivity that use for tilled crops is impractical. Each is so low in content of plant nutrients or has such poor moisture relations, or both, that common pasture plants produce very little feed. Under present conditions these land types apparently are better suited to forest or similar uses. Their aggregate area is 4.0 square miles, or 0.8 percent of the county.

MANAGEMENT REQUIREMENTS

Most of the common management practices and requirements for the soils of the county are discussed for each soil type in the section on Soils, but to assemble a record of the practices commonly followed a brief explanation of some of the principles of good management is here outlined.

Good soil management, as pointed out in the section on Water Control on the Land, involves the maintenance of an even and adequate supply of water in the soil and the adjustment of other soil conditions so that the moisture can be used efficiently by plants. Practices that aid in establishing and maintaining such conditions for groups of soils that have relatively similar requirements are suggested here. The discussion supplements the definition of good management for column C of the tables of estimated yields and of productivity ratings.

Land use, as used here, refers to three broad use-groups—for crops that require tillage, for permanent pasture, and for forests. Soil management refers to such practices as choice and rotation of crops; application of lime, commercial fertilizer, manure, crop residues, and other soil amendments; tillage practices; and engineering operations for the control of water on the land.

It should be recognized that the farmer who attempts to readjust the use and management of his soils is confronted with a number of problems, over some of which he has no control. Among the factors to be dealt with are (1) the size and type of farm; (2) the physical character of the land, including the pattern of soils on the farm; (3) the surrounding social and economic conditions, as transportation, markets, church, and school facilities; (4) the immediate demand for a cash income to meet taxes, to pay indebtedness, to support the family, and to provide for expenses; (5) the relation between prices of farm products and other commodities; (6) the farmer's facilities and resources for operating purposes, including buildings, equipment, seed, kind and number of livestock, credit, and other items; (7) his ability, preferences, and other characteristics; (8) community cooperation

with respect to drainage, water disposal, marketing, buying, and other operations; and (9) farm tenure, labor conditions, health, and other miscellaneous factors.

The farmer as an individual has full or partial control over some of these but little or no control over others. A full solution requires individual-community-State-National action, embracing all the problems and influences that affect agriculture. The individual farmer can make only those adjustments toward better management that are possible within his limited financial and personal ability. Certain of the suggestions for management practices for the various soils may not be feasible under present conditions for the majority of farmers. Many farmers may attain the same objective by combining management practices different from those indicated, but better suited to their particular conditions.

LAND USE AND SOIL REQUIREMENTS

Practices that aid in maintaining an even and adequate supply of moisture for plant growth and that adjust other soil conditions for the efficient use of water by plants are here discussed. The practices are for groups of soils with relatively similar management requirements. This part of the report is to be used for the definition of good management for column C of the tables of estimated yields and productivity ratings as well as for information on soil management requirements.

A particular use must be assumed in order to discuss this subject. Management requirements vary among different uses of the same soil as well as among different soils in the same use. The requirements of soils of each group are discussed with respect to two broad uses: Crops that require tillage, and permanent pasture.

As management requirements vary among crops that require tillage on the same soil, they are discussed for these crops in terms of rotations that are considered well suited to the soils. The management of the soil for one crop of the rotation generally has an effect on successful production of the others. The requirements of the soil for each crop are dependent, therefore, not only on the characteristics of the soil and of the crop but also on the management that has been practiced on other crops of the rotation.

Experimental data on which to base recommendations for the use or management of many of the soils of Bedford County are very meagre. Recommendations for best soil use and management in a particular place involve consideration of so many conditions that exist on a particular farm that they cannot be made in a general discussion of soils on a county-wide basis. Consequently, the material in this section is limited to a discussion of the deficiencies of soils in order that persons who have the other necessary information may interpret them into recommendations for particular areas.

Management practices that are thought to be good on many farms are suggested to serve as a guide for action under similar conditions on others. Many different combinations of management practices, however, can be used in various intensities of application. The proper choice depends upon conditions of the farm as a unit. For example, nitrogen may be maintained by the use of legumes, manure, commercial fertilizers, or combinations of the three.

Although each soil probably needs special management practices, some have certain requirements in common. Soils that have many requirements in common are placed in 11 groups for convenience of discussion and reference, as listed in table 7.

TABLE 7.—Groups of soils of similar management requirements and the conservability of plant nutrients, soil material, and good tilth of soils of Bedford County, Tenn.

Soil, type, and management group	Conservability ¹ of—			Physical land classification
	Plant nutrients ²	Soil material	Good tilth	
GROUP 1				
Abernathy silt loam.....	Excellent.....	Excellent.....	Excellent.....	1
Egam silt loam.....	Very good.....	do.....	do.....	2
Huntington silt loam.....	Excellent.....	do.....	do.....	1
Lindside silt loam.....	do.....	do.....	Very good.....	2
Shallow phase.....	do.....	do.....	do.....	4
Ooltewah silt loam.....	do.....	do.....	do.....	2
GROUP 2				
Burgin silty clay loam.....	Very good.....	Excellent.....	Poor.....	3
Shallow phase.....	do.....	do.....	do.....	4
Dunning silty clay loam.....	Excellent.....	do.....	do.....	4
Drained phase.....	do.....	do.....	do.....	3
Shallow phase.....	do.....	do.....	do.....	4
Melvin silt loam.....	do.....	do.....	Fair.....	4
GROUP 3				
Alluvial soils, undifferentiated.....	Excellent.....	Excellent.....	Fair.....	4
Guthrie silt loam.....	Good.....	do.....	do.....	4
Robertsville silt loam.....	Fair.....	do.....	do.....	4
GROUP 4				
Cumberland silt loam.....	Very good.....	Very good.....	Very good.....	1
Etowah silt loam.....	do.....	do.....	do.....	1
Greendale silt loam.....	Good.....	do.....	do.....	2
Hagerstown pebbly silty clay loam.....	do.....	Good.....	Good.....	3
Hagerstown silt loam.....	Very good.....	Very good.....	Very good.....	1
Eroded phase.....	Good.....	Good.....	Good.....	2
Hagerstown stony silt loam.....	Very good.....	Very good.....	do.....	2
Maury silt loam.....	do.....	do.....	Very good.....	1
Mercer silt loam.....	Good.....	do.....	do.....	3
Mimosa silt loam, undulating phase.....	Very good.....	Good.....	Good.....	2
Talbott silt loam.....	do.....	do.....	do.....	2
Wolftever silt loam.....	Good.....	Very good.....	do.....	2
GROUP 5				
Cumberland silt loam, slope phase.....	Good.....	Fair.....	Good.....	2
Hagerstown pebbly silty clay loam, eroded phase.....	do.....	do.....	Fair.....	3
Hagerstown silty clay loam, eroded rolling phase.....	do.....	do.....	do.....	2
Maury silt loam, eroded rolling phase.....	do.....	do.....	Good.....	2
Mercer silty clay loam, eroded rolling phase.....	Fair.....	do.....	Fair.....	3
Mimosa cherty silt loam.....	do.....	do.....	Good.....	3
Mimosa silt loam.....	Good.....	do.....	do.....	3
Mimosa stony silty clay loam.....	do.....	do.....	Fair.....	4
Talbott silty clay loam, eroded rolling phase.....	do.....	do.....	do.....	3
GROUP 6				
Colbert silt loam.....	Good.....	Fair.....	Fair.....	4
Dowellton silt loam.....	do.....	do.....	do.....	4
Talbott silt loam, shallow phase.....	do.....	do.....	do.....	4
Talbott silty clay loam, eroded phase.....	do.....	do.....	do.....	3

See footnotes at end of table.

TABLE 7.—Groups of soils of similar management requirements and the conservability of plant nutrients, soil material, and good tilth of soils of Bedford County, Tenn.—Continued

Soil, type, and management group	Conservability ¹ of—			Physical land classification
	Plant nutrients ²	Soil material	Good tilth	
GROUP 7				
Baxter cherty silt loam.....	Fair.....	Good.....	Good.....	3
Bodine cherty silt loam, slope phase.....	Poor.....	do.....	do.....	3
Frankstown cherty silt loam.....	do.....	do.....	do.....	3
GROUP 8				
Dickson silt loam.....	Fair.....	Very good...	Good.....	2
Pickaway silt loam.....	do.....	do.....	do.....	3
Rolling phase.....	do.....	Good.....	do.....	3
Taft silt loam.....	do.....	Very good...	do.....	3
GROUP 9				
Dellrose cherty silt loam.....	Good.....	Fair.....	Good.....	3
GROUP 10				
Colbert silty clay loam, eroded rolling phase.....	Fair.....	Poor.....	Poor.....	4
Dellrose cherty silt loam, steep phase.....	Good.....	do.....	Good.....	4
Mimosa silty clay loam, eroded hilly phase.....	Fair.....	Very poor...	Fair.....	4
Rolling stony land, Colbert soil material.....	Good.....	Poor.....	Poor.....	4
Smooth stony land:				
Colbert soil material.....	do.....	Fair.....	do.....	4
Hagerstown soil material.....	do.....	Good.....	Fair.....	4
GROUP 11				
Bodine cherty silt loam.....	Poor.....	Very poor...	Fair.....	4
Limestone outcrop.....	Good.....	do.....	Very poor...	5
Rough gullied land, Mimosa soil material.....	Poor.....	do.....	do.....	5

¹ Expressed in relative descriptive terms, assuming use for crops that require tillage. Terms used are excellent, very good, good, fair, poor, and very poor. For further information see text.

² Conservability of plant nutrients, assuming soil material to be conserved to an extent indicated by the name of the soil type.

The conservability of plant nutrients, soil material, and good tilth of each soil are given in table 7 to indicate some of the conditions that contribute to the management requirements that the soils of each group have in common. Six relative descriptive terms are used for each condition: Excellent, very good, good, fair, poor, and very poor. All refer to conservability under use for crops that require tillage. The terms are purely relative and refer to the intensity of management necessary to conserve the constituent or condition indicated. For example, excellent conservability of plant nutrients means that plant nutrients can be maintained at a high level for the production of crops that require tillage by means of management practices that are the least intensive of any necessary for maintaining a high nutrient level. Poor conservability of plant nutrients indicates the necessity of intensive management practices for maintaining a high level of plant nutrients for crops that require tillage. Inasmuch as plant nutrients are a part of soil material, the terms are used to describe conservability of plant nutrients, assuming accelerated erosion to be controlled.

GROUP 1

The soils of group 1 are fertile and easily worked and are generally not subject to severe erosion. With the exception of Lindsidesilt loam, shallow phase, they are well suited physically to intensive and continuous use for crops that require tillage.

Existing on first bottoms or in depressions of the upland, these soils have nearly level relief and receive deposits of alluvial material periodically. They are relatively high in content of organic matter and plant nutrients, which are added to the surface by flooding. Their physical condition is good for the maintenance of good tilth and for normal retention and movement of water in the upper part of the soil. External drainage is slow; internal drainage is relatively rapid in the Abernathy and Huntington soils and moderately slow in the Lindsidesilt loam, Egam, and Ooltewah. On Lindsidesilt loam, shallow phase, which consists of a thin covering of soil material over bedrock, the crops or pasture are commonly injured by lack of moisture. Huntington soils are generally the first to dry in spring; Lindsidesilt loam and Ooltewah are the last.

The soils of this group, with the exception of Lindsidesilt loam, shallow phase, are exceptionally well suited to the production of corn and certain hay crops. They are subject to temporary wet conditions, principally seasonal floods, in spring and during other periods of heavy rainfall and are not well suited to many winter annuals and perennial crops. Winter grains tend to lodge and are more susceptible to disease than on most of the well-drained soils of the uplands. Tobacco makes a rank growth and is generally of poor quality, although the yields may be high. Cotton makes a rank growth and matures late. Alfalfa may be injured by the temporary wet conditions that exist in spring, but it may produce well for several years, especially on Huntington silt loam.

These soils are commonly cropped intensively without applications of fertilizer materials, but their productivity may decline slowly under continuous cropping to intertilled crops without fertilization. Marked responses of truck crops have been obtained in other areas from heavy applications of complete mineral fertilizers, and it is probable that light applications of potash are necessary to maintain their productivity for corn and hay at high levels. Nitrogen probably can be maintained at a relatively high level by the growth of grass-legume mixtures in a rotation with corn or by the growth of winter-legume cover crops between corn crops. Phosphorus may be present in adequate quantities in areas on which the soil materials have been derived from uplands underlain by phosphatic rocks. Egam silt loam requires somewhat more potash and lime for good yields than do the other soils of this group. Lime is not necessary for most crops on these soils.

These soils can be used safely for intertilled crops each year. A suggested rotation is corn followed by crimson clover or hairy vetch to be plowed under as green manure for corn the following year. The green-manure crop and the crop that follows generally are improved by application of the equivalent of 50 pounds of muriate of potash at seeding. Application of lime is usually not necessary, and in most areas little response has been obtained from fertilization with phosphorus. Another rotation that may be used successfully consists of

corn and 2 years of red clover and orchard grass or timothy or 2 years of sweetclover. A few farmers have applied 1 ton of ground limestone once in 6 years for this rotation on Egam silt loam and have obtained good response of both the hay and the corn crop. Application of potash is expected to be beneficial for this rotation also.

No special practices of tillage or cropping are necessary for the control of runoff. There is some danger of scouring during floods on the Huntington and Lindsides soils; therefore, it is generally advisable to plow in spring instead of in fall. Cover crops to be used for green manure provide added protection. Artificial drainage would improve the Lindsides and Ooltewah soils for crops, but it is commonly difficult to provide outlets for the drains.

Permanent pastures are good without special management practices. Application of phosphorus may prove beneficial on Abernathy and Ooltewah soils or on areas of Huntington or Lindsides soils that consist entirely of materials washed from soils of the inner Central Basin or from the Highland Rim. Periodically pastures may be grazed or clipped closely to favor the growth of legumes at the expense of grasses. Heavy grazing is generally less harmful than undergrazing to pastures on these soils.

GROUP 2

The soils of group 2 differ from those of group 1 principally in being finer textured, heavier, and less well drained. They are relatively high in content of plant nutrients and are not subject to severe erosion. Existing on first bottoms and colluvial lands and generally occupying slight depressions or almost level positions, these soils commonly receive deposition of alluvial materials periodically. The principal management problems are the maintenance of good tilth and the improvement of drainage. Burgin silty clay loam and Dunning silty clay loam, drained phase, are fairly well suited to the production of crops that require tillage. The rest of the soils of this group are poorly suited physically to crops that require tillage because of their restricted internal drainage.

The rotations suggested for the soils of group 1 are well suited to these soils when sufficiently drained. Applications of lime are generally not necessary, and applications of phosphorus have produced little response in corn or hay crops on most areas except the Burgin soils. Application of the equivalent of 50 pounds of potash an acre under the hay crop, in a rotation of corn followed by 2 years of red clover and orchard grass or timothy, is beneficial.

No special tillage practices are necessary for the control of rapid runoff. The Dunning and Melvin soils are sometimes scoured during high floods, and it is therefore generally advisable to plow in spring rather than in fall or to use a winter cover crop to provide protection. The soils are difficult to maintain in good tilth and should be plowed only at the proper moisture condition. Green manure is beneficial, not only for the maintenance of nitrogen and organic matter but also for the improvement of tilth.

These soils are well suited physically to permanent pasture, and practices of good pasture management are similar to those described for the soils of group 1. They may be grazed closely or clipped periodically to favor the growth of legumes at the expense of grasses.

Undergrazing is generally more harmful than overgrazing. Liming is generally not necessary, but applications of phosphorus may be beneficial on areas where the soil materials have been washed from areas underlain by nonphosphatic rock. Considerable variation is to be expected in the response of pastures to phosphorus in different parts of the county.

GROUP 3

The soils of group 3 are poorly drained in depressions and terraces. They are relatively low in content of plant nutrients and organic matter and are medium to very strongly acid. They have nearly level relief. Both external and internal drainage are very slow.

These soils are poorly suited to crops that require tillage. If such crops are grown, corn and hay are probably best suited to them. Sorghum and soybeans also are grown on the artificially drained soils, but all these crops are subject to injury during periods of high rainfall, and crop failures are fairly common. Crops probably need to be fertilized heavily with lime and phosphorus, and nitrogen can be maintained by leguminous hay crops, as alsike clover, or by commercial fertilizers. As with the soils of group 2, good tilth is difficult to maintain and tilling should be done only under the most favorable moisture conditions. Where feasible, it is advisable to use these soils for permanent pasture rather than crops.

Pastures are generally only fair on these soils, but reasonably good ones can be obtained by liming, fertilizing with phosphorus, and regulated grazing. If the soils are not drained, these practices improve the pasture but to a lesser extent than on the drained soils. Undesirable water-tolerant plants make up a large part of the herbage on undrained areas.

GROUP 4

The soils of group 4 are undulating or gently sloping moderately fertile well-drained areas of uplands, colluvial lands, and terraces. Conditions are good for the absorption of moisture, and good tilth is at least fairly easily maintained. The content of plant nutrients and organic matter is relatively high, but lower than in soils of group 1. Maury silt loam and Mimosa silt loam, undulating phase, are generally higher in content of phosphorus than are other soils of this group. The eroded phase of Hagerstown silt loam is generally lower in content of organic matter and nitrogen than are other soils of this group. Mercer silt loam is probably the least fertile. Wolftever silt loam has slightly impeded internal drainage. Under good management none of these soils are subject to severe erosion.

Well suited to most of the crops commonly grown, these soils can be conserved in a rotation including a clean-cultivated crop once in 2 or 3 years if other management requirements are met. They generally require applications of lime and phosphorus for continued high production and may require potash if used intensively for tilled crops. Maury and Mimosa soils are exceptions, and crops on them generally do not respond to phosphorus.

In a rotation consisting of corn, small grain, red clover, and grass, used successfully by some farmers, good crop response has been obtained by fertilization of the hay crop with the equivalent of 300

pounds an acre of 20-percent superphosphate and 50 pounds of muriate of potash. Red clover generally requires moderate applications of lime for good production. The eroded phase requires slightly more intensive management than the other soils, and the use of a green manure to raise the content of organic matter and nitrogen and to improve the physical condition of the surface layer is advisable. The rotation may be modified by replacing red clover with alfalfa, which commonly remains on the land for about 4 years. Alfalfa requires heavy applications of lime, and good results have been obtained by applications of 2 to 2½ tons an acre of limestone, the equivalent of 500 pounds of 20-percent superphosphate, and 50 to 100 pounds of muriate of potash. This crop is difficult to establish on the eroded phase, and heavy applications of manure are also helpful in obtaining good stands.

These soils can be tilled throughout a relatively wide range of moisture conditions without impairing their tilth. Where feasible, tillage on the contour is helpful. The soils must not be left bare of vegetation for extended periods. Terracing and other engineering methods for the control of runoff are generally not necessary if management requirements are otherwise fulfilled.

These soils produce good pastures. All require applications of lime for good results, and all except Maury and Mimosa soils require phosphorus. Heavy applications of lime at long intervals are more desirable than light applications at short intervals. It is especially important that the initial application be heavy if the soils have not been limed for a long time. These practices are intended to promote the growth of legumes, which can be depended upon to fix nitrogen if they are properly inoculated. To this same end relatively close grazing favors legumes at the expense of grasses, and clipping of uneaten herbage periodically has a similar effect. Scattering the droppings provides uniform distribution of the potash and nitrogen content and prevents cattle from leaving the herbage uneaten around them.

GROUP 5

Group 5 consists of rolling or sloping well-drained soils of the uplands and terraces. They differ from those of group 4 chiefly in having stronger slopes and in being generally more eroded. They also have more difficult problems in control of runoff, maintenance of good tilth, and increase and maintenance of the content of plant nutrients.

The soils can be conserved in a rotation that includes an intertilled crop once in 4 or 5 years, if other management requirements are met. Good results have been obtained with a rotation of corn, small grain, and alfalfa for 3 years, fertilized with the equivalent of 500 pounds an acre of 20-percent superphosphate and 50 to 100 pounds of muriate of potash under the alfalfa seeding. Alfalfa requires heavy applications of lime, and heavy manuring of eroded areas has aided in establishing the seeding. Phosphorus may be omitted on most areas of Maury and Mimosa soils.

A rotation of corn, small grain, red clover, and timothy or orchard grass 2 years, and of small grain, and red clover and timothy or orchard grass 2 years has been used successfully by a few farmers under fertilization and liming that includes application of the equivalent of 2

tons an acre of ground limestone, 300 pounds of 20-percent superphosphate, and 50 pounds of muriate of potash under the hay seedings. Phosphorus may be omitted on most areas of Maury and Mimosa soils. The rotation can be shortened by the use of a leguminous green-manure crop. Green manures or barnyard manure are highly beneficial on eroded areas.

Tillage can be performed throughout a relatively wide range of moisture conditions without destruction of good tilth, but considerable care must be taken to till the more severely eroded areas under favorable moisture conditions. Tillage in fall is not desirable unless a winter cover crop is grown to control runoff. Cultivation on the contour where feasible aids in the control of runoff, and contour strip cropping is beneficial on the longer slopes. Terracing may be advisable on long uniform slopes if it is necessary to use these soils for intertilled crops a large part of the time.

These soils produce good pastures under management similar to that described for the soils of group 4, but applications of manure to eroded areas aid in establishing a good pasture sod.

GROUP 6

In group 6 are heavy-textured moderately fertile soils of mild slopes. They are shallow or moderately shallow over bedrock, moderately difficult to till, and difficult to maintain in good tilth. Water penetrates slowly, and movement within the soil is slow. These soils are generally deficient in phosphorus, except in areas associated with Maury or Mimosa soils, but they are relatively well supplied with potash. Some areas of the more shallow soils are moderately well supplied with lime. Two of the outstanding management problems are maintenance of good tilth and control of water on the land.

These soils are limited in their suitability for crops. Hay and pasture plants produce moderately well, except on areas of very shallow soil. Talbott silty clay loam, eroded phase, is the deepest soil and has the widest range of suitability for crops requiring tillage.

For tilled crops, it is desirable to grow deep-rooted legumes, as alfalfa, sweetclover, and sericea lespedeza, to improve the physical condition of the soil and to help maintain organic matter and nitrogen. Crimson clover or vetch and small grain can be grown as green manures to good advantage. A row crop can be grown safely once in 3 years if other management requirements are met, and a rotation of corn, small grain, and sweetclover can be used. Alfalfa can be substituted for sweetclover in a rotation that is lengthened to accommodate a longer period of hay.

Rotations such as those suggested generally require liming and an application of phosphorus under the hay crop. Legumes are commonly difficult to establish, and manure is generally helpful in obtaining stands. Application of phosphorus may not be necessary on areas of Colbert and Dowellton silt loams that overlie the phosphatic limestone of the outer Central Basin.

Tillage is recommended within a relatively narrow range of moisture conditions to avoid destruction of good tilth, and on the contour, if feasible, to help control runoff. Terracing and strip cropping are generally not advisable. Fall plowing to provide opportunity for im-

provement of tilth is desirable if cover can be provided to prevent excessive runoff and erosion during the winter.

Pastures generally respond to applications of phosphorus, except on some areas of Colbert and Dowellton soils in the outer Central Basin. Lime requirement varies considerably from place to place, but an application of 1 to 1½ tons an acre every 5 years is generally sufficient. Graze moderately close, clip excess herbage, and scatter the droppings.

GROUP 7

The soils of group 7 are characterized by rolling relief, moderately rapid internal drainage, moderate water-holding capacity, and relatively low content of plant nutrients. They are medium to slightly acid and less subject to severe erosion than most soils of similar slope. Their management requirements center about the increase and maintenance of the content of plant nutrients.

The soil can be conserved in a 4- to 5-year rotation if other management requirements are met. Crops that do not require high nutrient levels are generally most successful, although those with higher requirements can be grown under proper management. A rotation that consists of corn, small grain, and lespedeza and redtop has been used successfully by many farmers. Good results have been obtained with application of the equivalent of 300 pounds an acre of 20-percent superphosphate, 50 pounds of muriate of potash, and 2 tons of ground limestone under the lespedeza-small grain seeding and the equivalent of 50 pounds of sodium nitrate and 50 pounds of muriate of potash under the corn. Corn responds well to applications of manure, and if manure is used, potash may be omitted from the fertilizer mixture. Cotton may replace corn in this rotation.

Tillage on the contour and winter crops can be used to help control runoff. Terracing is ordinarily not necessary if other management requirements are met, but it may be advisable in some circumstances. Slopes are commonly short and not well suited to terracing or strip cropping.

Pastures are poor on these soils unless fertilized heavily with lime and phosphorus, heavy initial applications being followed by moderate applications at short intervals. Extremely close grazing is to be avoided, but undergrazing also is harmful. Droppings should be scattered, and uneaten herbage mowed periodically.

GROUP 8

The soils of group 8 have slow internal drainage as a result of a hardpan or very compact subsoil. They are low in organic matter and plant nutrients. Slope gradients are 2 to 7 percent except on Pickaway silt loam, rolling phase, which has a gradient of 7 to 15 percent. These soils are susceptible to erosion on the steeper slopes. Although internal drainage is slow it is adequate for most of the crops grown except alfalfa, which generally "runs out" in 3 years on Dickson and Pickaway soils and is poorly suited to Taft silt loam. Good management requires maintenance of the plant nutrient content and control of runoff.

A 3-year rotation of corn, small grain, and lespedeza and redtop hay is well suited to these soils, except Pickaway silt loam, rolling

phase, on which the hay crop probably should be on the land an additional year. Red clover may be substituted for lespedeza in this rotation, but it requires heavier liming and fertilization. Good results have been obtained by a few farmers who use the 3-year rotation by turning under a leguminous crop as green manure once during the rotation. A rotation of corn, small grain, and alfalfa, which remains 2 or 3 years, has been used successfully. This rotation is not well suited to Taft silt loam.

Crops respond well to applications of lime and phosphorus. There has generally been some response to fertilization with potash or to the use of manure. The equivalent of 2 or 3 tons an acre of ground limestone, 300 pounds of 20-percent superphosphate, and 50 pounds of muriate of potash applied under the legume seeding has given good results for the rotations suggested. Alfalfa requires heavier fertilization and liming than lespedeza. The equivalent of 50 pounds of muriate of potash or an application of manure under the corn crop, in addition to fertilization and liming of the leguminous crop, has given good response.

Control of runoff requires precautions in tillage particularly on Pickaway silt loam, rolling phase. Tillage on the contour is needed. Growing winter cover crops will help prevent the soil from becoming bare of vegetation for extended periods. Contour strip cropping and terracing generally are not necessary if the soil is well managed. A few farmers terrace Dickson silt loam with good results where a large number of intertilled crops are grown, and the terraces are usually given more fall and are more closely spaced than ordinarily recommended.

Establishment of good permanent pastures generally requires heavy liming and fertilization with phosphorus. Seeding may be necessary on some areas to establish desirable pasture plants. Scattering of droppings, clipping of weeds and uneaten herbage, and regulation of grazing are parts of good pasture management.

GROUP 9

Dellrose cherty silt loam, the only member of group 9, has gradients of 15 to 30 percent and though variable in plant-nutrient content is commonly fairly well supplied with phosphorus. This type apparently receives considerable seepage water from the underlying level-bedded rocks, and crops are injured less by droughts than on most soils with similar slope. The soil is open and porous and absorbs water well. It is less erosive than most soils of similar slope, but steepness of slope (pl. 6, A) limits its suitability for crops.

A good rotation that has been used consists of corn followed by a small grain that is seeded to red clover, sweetclover, or lespedeza and grasses. After the third year the soil is reseeded to small grain and a leguminous crop with a contour furrow seeder. This practice can be repeated for several years without plowing. Corn has been grown every sixth year with good results by a few farmers (pl. 6, B), but it can be omitted from the rotation, which then consists of small grain and a leguminous hay crop repeated by the use of the contour furrow seeder without plowing until weediness makes the use of an intertilled crop desirable.

Crops on some areas respond to phosphorus, but in many areas this fertilizer is not necessary. Generally an acre application of 2 tons an acre of ground limestone under the legume seeding has been satisfactory, while in a few places the leguminous crop responded well to the equivalent of 50 pounds of muriate of potash.

Tillage on the contour is needed, but it should be held to a minimum. To prevent the soil from being bare of vegetation in winter, legumes can be used to good advantage for a cover crop to be plowed under as green manure before corn. Strip cropping may be beneficial if the slopes are long, but terracing generally is not feasible on such steep slopes (pl. 6, *C*).

Good permanent pastures can be obtained if properly managed. Lime is the principal amendment to be applied, but in some places phosphorus is also limiting. Some potash is supplied by scattering the droppings. Clip uneaten herbage periodically if feasible.

GROUP 10

The soils of group 10 are poorly suited to crops that require tillage, but are fairly well suited physically to permanent pasture. They differ widely in management requirements and in the feasibility of following some practices of good soil management.

Pastures usually respond to liming, but the response to lime generally is less on more shallow soils of the stony land types than on others of this group. Pastures respond to phosphorus on the stony land types and on the Colbert soils of the inner Central Basin; they do not respond to applications of phosphorus on many areas of the Mimosa and Dellrose soils and on areas of Colbert soils and of stony land types associated with Maury soils of the outer Central Basin. Generally application once in 5 years of 1½ to 2 tons an acre of ground limestone has been satisfactory on soils that need lime. An application of 300 pounds of 20-percent superphosphate every 3 years has been sufficient for good pastures on soils that need phosphorus.

As on other soils, mowing of excess herbage and scattering of droppings are desirable practices, but mowing is generally not feasible on the Dellrose soil and on the stony land types. Removal of shrubs by hand is advisable on these soils.

GROUP 11

The soils of group 11 are poorly suited both to crops that require tillage and to pasture. Forestry is a better use in most places, except in areas of limestone outcrop. Bodine cherty silt loam is fairly well suited to forestry, as it requires no special soil management practices. Reforesting of badly mutilated rough gullied land (Mimosa soil material) is needed after provision has been made to check the gullying and sheet erosion. Kudzu may be more effective in stabilizing the soil against further sheet erosion, and check dams are effective in arresting gully erosion.

ADDITIONAL INFORMATION ON SOIL AND CROP MANAGEMENT

The Tennessee Agricultural Experiment Station has accumulated much information relative to management requirements of various crops, fertilizers, and fertilizer practices, and the suitability of vari-

ous crops and varieties of crops to Tennessee conditions. Some of that information relates to specific soil types; a considerable part of it is of a more general nature. To include details of the results of the numerous experimental projects is not within the scope of this report but the reader is referred to the following publications of the State Agricultural Experiment Station for more specific information:

Bulletins

- 112. The Small Grains in Tennessee.
- 126. Varieties of Corn and Their Adaptability to Different Soils.
- 136. The Oat Crop.
- 141. The Comparative Values of Different Phosphates.
- 142. The Effects of Various Legumes on the Yield of Corn.
- 149. Fertilizers and Manure for Corn.
- 154. Lespedeza Sericea.
- 165. Clovers and Grasses for Hay and Pasture.

Circulars

- 6. The Value of Farmyard Manure.
- 9. Nitrogenous Fertilizer Materials.
- 10. A Select List of Varieties of Farm Crops.
- 11. Rates and Dates of Planting for Tennessee Farm and Garden Crops.
- 12. Alfalfa and Sweet Clover Culture.
- 14. Austrian Winter Peas.
- 27. A Select List of Varieties of Vegetables.
- 30. Three New Varieties of Lespedeza.
- 34. Increasing the Profits from Phosphates for Tennessee Soils.
- 45. Balbo Rye.
- 52. Rye for Pasture and Seed in Tennessee.
- 60. Fertilizers for Tennessee Soils.

ESTIMATED YIELDS AND PRODUCTIVITY RATINGS

Yields that may be expected from various crops are given in table 8 for each soil in the county. Three yields are given for most of the crops, corresponding to estimated yields under each of three levels of management (columns A, B, and C under each crop listed). Expected yields vary widely on most soils, according to the way the soil and crop are managed, and management itself differs greatly among the farms.

In column A, are the estimated yields without special practices to rehabilitate, maintain, or increase productivity. No manure or commercial fertilizer and no lime or other amendments are used, and no special effort is made in the selection and rotation of crops to return organic matter and nitrogen to the soil. Most of the yields in this column are those that would be produced on land cleared of forest for 5 years or more.

In column B, are the estimated yields under the present dominant soil-management practices. The management practices used on any one of the soils are as varied as the farms on which the soil exists, and the degree of that variation is not the same for all soils. Strict definition of the current management of any soil or group of soils resolves into definition of management of that soil for a great many individual farms, or for fields within those farms. It is usually possible, however, to give a general description of one or two of the major types of management commonly practiced on a soil or group of soils. That type of management is chosen to represent the approximate modal

level of management of the various soils. A similar level of management is obtained on many farms by different combinations of management practices.

In general, the choice of crops is commonly influenced to a considerable extent by the physical suitability of the soil, but in most places choice and rotation are not in complete adjustment with physical suitability. Rates of application and kinds of fertilizers and other amendments used are usually determined by the crop to which they are applied without much consideration for the needs of the soil on which the crop is grown. Crops on first bottoms are noticeable exceptions. Cultivation is influenced to some extent by the nature of the soil, principally by the ease with which tillage is accomplished. Engineering methods of water control are not generally practiced.

In column C, the yields given are those that are thought to represent the expectation under good management. The term "good management" refers to the proper choice and rotation of crops; the correct use of lime, commercial fertilizers, and manure; proper tillage methods; the return of organic matter to the soil; and engineering methods of water control, where necessary, carried on to the end of maintaining or increasing soil productivity within feasible limits.

Although present knowledge of the management requirements of particular soils for specific crops is limited, some of the deficiencies of the soils are known with a reasonable degree of certainty and others are considered to be probable. On this basis some of the requirements are discussed in the section on Management Requirements, to which the reader is referred for the definition of the level of management for which the yields of column C are given.

Just as the management requirements of different crops on the same soil may be different, so the management requirements of the same crop on different soils may also be different. Moreover, the point at which it is no longer profitable for a farmer to intensify practices that make for good management depends not only on the soil and the crop but also on the other soils and other crops of the farm, the combination of enterprises of the farm, prices, and numerous other considerations. Because, therefore, of lack of knowledge and lack of constancy of feasible limits of good management, these limits are not here rigidly defined.

Inability to define precisely good management for each soil and crop is further complicated by the scarcity of data on crop yields obtained under conditions thought to approach good management. The estimated yields in column C, therefore, are based largely on the judgment of men who have had experience with both soils and crops. Their estimates are determined by the responses crops would be expected to make over and above the yields commonly obtained (column B) if known deficiencies were corrected to the extent thought feasible. The estimates are subject to judgment not only with respect to the response of crops to corrective practices on specific soils, but also with respect to the intensity of the corrective management practices now possible. They are also subject to errors that arise from lack of knowledge of deficiencies of minor elements that might be corrected.

The yields in column C are intended as production goals that may be reached generally by use of feasible good practices of soil and crop management. The same goal probably can be attained on most soils

by several different combinations of the management practices suggested in the section on Management Requirements. Some of these practices may supplement or replace others; some are essential to good management. The best choice depends upon the farm business as a whole. On one farm it may be desirable to manage the soil in such way that the yields exceed the goal; on others such management may not be feasible. The most feasible management for a farm unit may give yields in excess of the goal for one crop on one soil and yields below the goal for another crop on the same soil. Yields in column C should be used in comparison with yields in columns A and B to give an idea of the response that may be expected of crops under a feasible good level of management.

The common use and management of the soils of Bedford County as set forth in table 9 constitute a statement of the management under which the yields in column B of table 8 may be expected. The material includes information based on observation and data collected during the progress of the survey, supplemented by facts gathered by extension service workers subsequent to the completion of the field work. It shows the common forest and pasture plants and crops commonly grown in the rotations, and also the character of the common crop rotations, the amendments and quantities applied to the acre for the different crops, and the common engineering measures employed for water control.

The estimated yields of crops on the soils of Bedford County have been converted into indexes in table 10, and the soils grouped according to their relative physical suitability for the agriculture under prevailing conditions.

Each rating in table 10 compares the productivity of each soil for each crop under each level of management to a standard yield for the crop. This standard index equals 100 and represents the approximate average acre yield obtained without the use of fertilizers and other amendments on the more extensive and better soils of the regions in the United States where the crop is most widely grown. A soil with an index of 50 is about half as productive of the specified crop under the specified level of management as the soil with the standard index of 100. Soils that are well managed, or unusually productive, may have productivity indexes of more than 100 for some crops.

The productivity indexes of table 10 are the estimated yields of table 8, expressed as a percentage of the standard yields adopted for the crop in the United States.

$$\text{Productivity rating index} = \frac{\text{Estimated yield}}{\text{Standard yield}} \times 100.$$

The standard yields on which the indexes are based are given in the table under the names of the crops for which the ratings are given. Columns A, B, and C under each crop refer to three levels of soil management and correspond to similar columns in table 8 of estimated yields, for which levels of management are defined.

The soils are listed in the productivity rating table in the approximate order of their general relative physical suitability for agriculture under prevailing conditions. This was done chiefly on the basis of information acquired through field observation and consultation with farmers in the county and with competent agricultural workers in the State.

The table gives a characterization of the productivity and relative suitability of the soils, but it does not present the relative place each soil has in the agriculture of the county. One cannot determine the total production of crops by soil areas without consideration of the acreages of each soil used for each crop. The ratings cannot be interpreted directly into land values. Distance to market, relative prices of farm products, association with other soils of different capability, and many other factors influence the values of soils at specific places. The indexes can be used for comparison of productivity for specific crops (1) on different soils under similar levels of management within the county, (2) on the same soil under different levels of management within the county, and (3) on the soils of Bedford County and of other parts of the United States. They show the response that may be expected of crops under different levels of management on the various soils. They may be used with other information in estimating the total production of crops by soil areas and the total productive capacity of soil areas, and as a part of the information necessary in arriving at land values. In many problems the indexes are useful guides concerning agriculture, but they are usually most useful in connection with other information relative to the problem.

WATER CONTROL ON THE LAND

Water control on the land consists of practices having to do with the maintenance of the most favorable soil moisture conditions for the growth of a particular crop or group of crops, and with the regulation of runoff. These practices may be grouped as follows: (1) Control of rapid runoff, (2) protection from flood, (3) drainage, and (4) irrigation.

Control of rapid runoff is the chief problem in Bedford County, almost all parts of which contain some rolling, hilly, or steep land from which water flows more rapidly than is desirable. Most floods occur early in spring before crops are on the land. Little has been done to protect areas from floods, although considerable damage is done occasionally from overflow of streams. Drainage is not a serious problem on most farms. Improvement of some areas of poorly drained soils, however, has been accomplished by open ditches, but little tiling has been done. Irrigation is of little importance at present, although it doubtless would increase production of crops on many soils in dry seasons. Its use to supplement rainfall might be practicable under some conditions, especially on gardens and on small areas of vegetable and other high-value crops.

In the Tennessee Valley, of which Bedford County is a part, a series of dams has been constructed to control and use the water in the streams toward the betterment of social and economic conditions. These dams make waterways for navigation possible, decrease floods on areas below the dams by regulating the volume of flow, and provide a head of water for generating electrical energy. Their effectiveness is dependent to a large extent on their capacity to regulate the column of flow of the large streams. The smaller streams are feeders of the Duck River, which drains the county; and any measures that regulate the flow of water from the land they drain have a bearing on the effectiveness of the entire system of dams below their mouths.

Moreover, the principal means of controlling floods on these feeder streams is through holding the water on the land where it falls.

Water is a natural resource to be exploited on the land as well as in the streams. It is necessary for plant growth, and even in a region as high in rainfall as Bedford County lack of water is commonly a limiting factor in plant growth during certain periods. Any measures that result in a more adequate and even supply of water during the growing season promote increased production of the plants on which the people on the land depend for their livelihood. The control of runoff is, therefore, important to all who live in the watershed and, in varying degrees, to all who are affected by the social and economic conditions there.

Two direct undesirable results of too rapid runoff on the soil as a medium for the growth of plants are loss of water and loss of soil. Loss of water always results; loss of soil material may or may not accompany it. Of the two, the loss of soil material is the more apparent, because it leaves the soil in an eroded condition and its effects are generally cumulative. The conditions contributing to loss of water and to loss of soil are so interrelated in their effects, however, that they cannot be corrected separately. Accordingly, the practices designed to promote the conservation of soil and water must be a part of a single procedure directed toward the control of the water after it falls on the land.

The effective use of water by plants is conditioned on other factors of crop production that may be limiting. If the water that falls on the land is to be used effectively by crops, the soil must be used for plants to which it is suited; water must remain in the soil in quantities sufficient for, but not in excess of, the needs of the plants; an adequate supply of plant nutrients must be available; the physical condition of the soil must be suitable for the root systems of plants; and insects, diseases, and weeds must be controlled. These are the principles upon which good soil management is based. These same principles apply also to control of runoff. Such control is a part of good soil management, and the practices that make it possible include most of those necessary for good soil management. Good soil management for continued efficient crop production, therefore, provides control of runoff and affects not only the land on which it is practiced but also the entire river system through which the runoff flows.

Runoff is retarded by vegetation in proportion to the density of the cover and the tendency of the vegetation to induce a soil condition that favors absorption and retention of water. In addition, the vegetative cover, its root system, and its debris decrease the loss of soil material in the runoff that does occur by reducing its rate and by binding the soil particles together. Forests are very effective in this respect; sod-forming plants, as hay and pasture grasses and legumes, also are effective; somewhat less effective are small grains and other close-growing crops; and intertilled crops are generally least effective.

Different soils that have similar slopes are not equally subject to rapid runoff, but the quantity and rate increase with an increase of slopes on soils that are similar in other respects. In general, crops that retard runoff effectively should be grown more of the time on the steeper than on the less steep phases of the same soil type. The very steep phases of a given soil type should be used as far as prac-

licable for forests, less steep phases for pasture; still less steep phases for close-growing crops; and only the gently sloping phases, on which runoff is not rapid, should be used frequently for intertilled crops. Crop rotation should be so adjusted that the more steeply sloping soils under cultivation are in sod-forming crops as much of the time as is consistent with good farm management, but the steepness of soils that are well suited to a particular rotation varies among the soil types.

If the vegetative cover is to be effective, it should have a vigorous growth. Suitable applications of lime, manure, and fertilizers and the use of legumes in the rotation are management practices that will help to that end. Agricultural lime supplies the plant nutrient calcium and adjusts the acidity of the soil. Manure supplies nitrogen, potash, and organic matter and aids in maintaining the soil in good physical condition. Mineral fertilizers supply nitrogen, phosphorus, potash, and minor nutrients. Legumes properly inoculated fix nitrogen from the air, and their root systems add organic matter and aid in the maintenance of good soil condition. These practices promote vigorous growth of crops in the rotation, which is desirable not only in the control of runoff but also in the effective use of water in the production of crops.

The soil should be tilled in such manner that it will be in condition to retard runoff and absorb water. Tillage at such times and in such manner that the soil will be bare of vegetation as little of the time as possible is essential. Contour tillage is desirable on many slopes to retard the rate of runoff. Contour strip cropping may be recommended on the steeper slopes, and generally it is more practicable and more desirable on long slopes.

Terracing and other engineering methods of water control are commonly expensive. Terracing leaves many soils in such condition that considerable effort may be required to restore them to high productivity. The terraces also require maintenance to be effective, and unmaintained terraces may be worse than none. Such practices have a place in water control under certain conditions, but they are generally to be resorted to only where effective control of rapid runoff cannot be accomplished by other methods that consist essentially of good soil management for good production.

Like all other management problems, the best method for the control of too rapid runoff depends not only on the soil but also on the particular conditions that exist within each farm unit. Each farmer will do well to choose the particular combination of practices that fulfills the requirements of his farm business and provides the maximum control of runoff within practical limits. He will choose those practices that provide not only good control of runoff but also the proper medium for the growth of plants and the plant nutrients necessary for effective use of the water he conserves. Effective control of runoff is obtained on many farms in the county and can be obtained on many more by the use of management practices that would ordinarily be considered sound from the standpoint of efficient production.

The control of too rapid runoff is not an isolated problem. It involves all the practices of good soil management that would ordinarily be considered a part of successful crop production. It can be accomplished largely through good farming practices, including proper

choice and rotation of crops, proper fertilization, proper tillage, control of insects, pests, and diseases, and, in some places, the use of engineering methods.

ASSOCIATIONS OF PHYSICAL LAND CLASSES

The soil map of Bedford County shows the extent and distribution of the soil types, phases, and miscellaneous land types, and from these detailed data a considerable number of useful interpretive maps can be derived. One such map (fig. 3) shows (1) the areal extent and

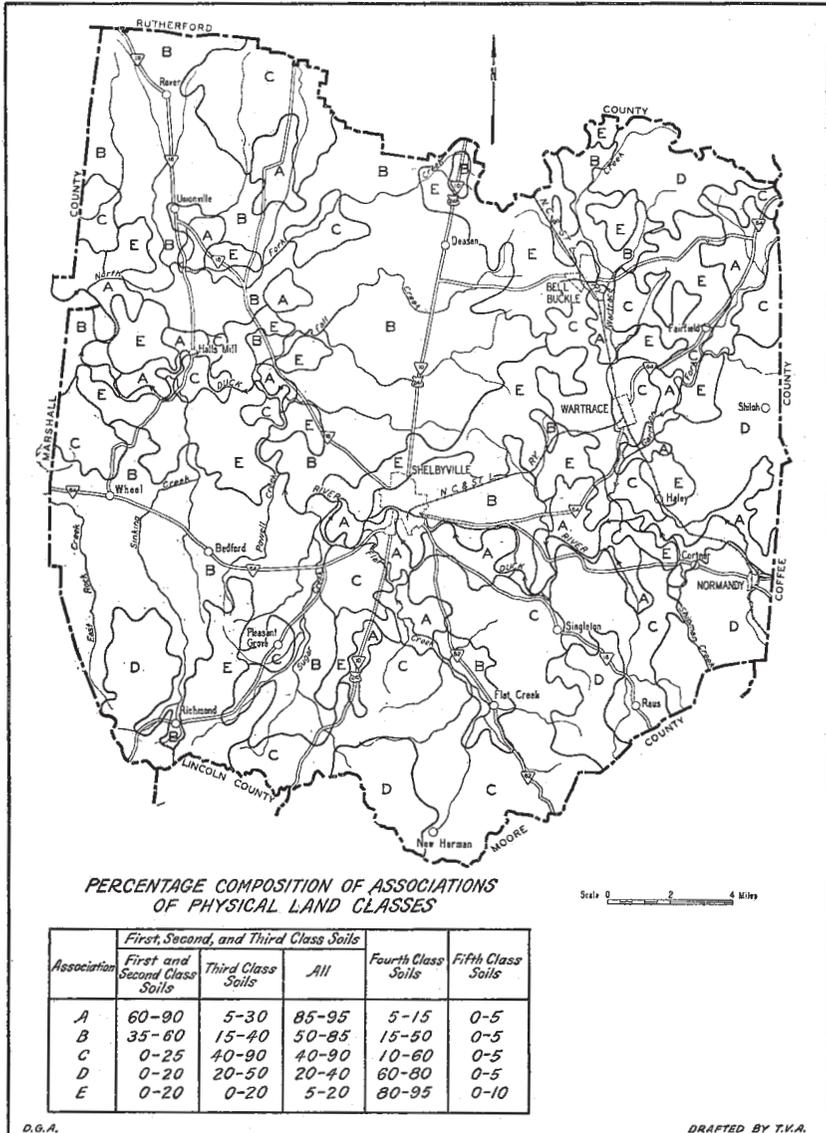


FIGURE 3.—Areas of five associations of physical land classes of Bedford County, Tenn.

geographic distribution of associations of physical land classes; (2) the general capability for agriculture of the soils within areas larger than the average-sized farm; and (3) the general physical capability of broad areas. The map is not intended to serve as a basis for making recommendations for land use, because many factors other than the physical capability of soils enter into the complex physical-economic environment that determines best use. Because the map is generalized, a particular farm within any one association may or may not have the particular combination of physical capabilities that characterizes the association as a whole, so that it can not be used in determining the physical capability of that farm. It can be used, however, in characterizing rather broad areas in terms of the combination of different physical capabilities for agriculture that exist in the area and for visualizing the distribution of these combinations within the county.

The soils that make up any one of the associations may vary in different parts. The physical capability for agriculture is relatively uniform within any one association, but the management practices required for its maintenance may vary widely.

ASSOCIATION A

Association A consists dominantly of First-, Second-, and Third-class soils, which are at least fairly well suited to the production of cultivated crops. Between 85 and 95 percent of the area is of soils of these three classes; between 5 and 15 percent of Fourth-class soils; and less than 5 percent of Fifth-class soils. Less than 15 percent is poorly suited to the production of cultivated crops. Between 60 and 90 percent consists of First- and Second-class soils and is good to excellent cropland. This association is characterized by broad uniform areas of good to excellent cropland. Areas of First- and Second-class soils are broad and of such size and shape that large fields of uniform shape can be laid out on most farms without the inclusion of soils poorly suited to cultivation. The areal extent of First- and Second-class soils is generally in excess of the acreage of cropland required by most farm units. This association includes an abundance of soils that are suited to the most intensive cropping practices of the county.

The areas of association A are largely along the Duck River and its larger tributaries and on the edge of the Central Basin where Maury soils exist. Almost all of it is cleared and used for crops and pasture. Less than 15 percent is still in forest.

ASSOCIATION B

Association B contains a somewhat smaller proportion than association A of soils well suited to the production of cultivated crops and a correspondingly larger proportion that are poorly suited. Between 50 and 85 percent of the area consists of First-, Second-, and Third-class soils. The combined acreage of First- and Second-class soils makes up 35 to 60 percent of the association. Third-class soils occupy between 15 and 40 percent. Soils that are poorly suited to crops (Fourth-class soils) constitute between 15 and 50 percent, but almost none of that area consists of soils poorly suited to pasture. Areas well suited to crops are generally of such size and shape that large and

uniform fields can be laid out without the inclusion of soils poorly suited to cultivation. These areas are commonly interspersed with rather broad areas of Fourth-class soils. The distribution is such that some farms in this association may contain good cropland in areas that are inadequate for the needs of the farm unit, but most units have a sufficient acreage of good cropland for its needs. Considerably more variation in the quality of soils of the same farm and among farms exists in association B than in association A.

Most of this association is in the Central Basin in the areas dominated by Hagerstown, Talbott, and associated soils. Most of the First- and Second-class soils belong to the Hagerstown and Talbott series; much of the Third-class soils belong to the Pickaway and Talbott series; most of the Fourth-class soils is stony land. Small areas along streams are exceptions. In general, less than 20 percent of the association is still in forest; the rest is used either for crops or for pasture. Although the extent of good cropland is limited on some farms, this association represents a part of the county that supports a prosperous agriculture. Livestock enterprises generally make good use of the Fourth-class soils.

ASSOCIATION C

Association C includes some soils that are at least fairly well suited to the production of cultivated crops similar to that of association B, but the quality of potential cropland is generally inferior. Between 40 and 90 percent of the area is at least fairly well suited to cultivation; between 10 and 60 percent is poorly suited to crops but at least fairly well suited to pasture; an insignificant part is unsuited to both crops and pasture. Third-class soils dominate the association in most areas, but the pattern of their distribution varies in different parts of the county. Generally the areas are sufficiently large for laying out large fields of uniform shape without the inclusion of Fourth-class soils. In some places where Fourth-class soils exist in broad areas, a few farms may have insufficient First-, Second-, or Third-class soils to satisfy the needs of the farm unit. In most places cropland requirements can be satisfied without including soils poorly suited to cultivation.

Areas of association C are widely distributed. The land suitable for crops is generally characterized by one or more of the conditions of productivity, workability, or conservability that are inferior to those of the soils suitable for crops in association B. The management requirements of the cropland in this association vary within wide ranges in different parts of the county. A small part of the association is in forest but in most areas more than 80 percent is cleared and is used for crops or for pasture.

ASSOCIATION D

Association D is 60 to 80 percent poorly suited and between 20 and 40 percent is at least fairly well suited to the production of cultivated crops, but less than 20 percent is good cropland. A small part is poorly suited to both crops and pasture. This association is characterized by an intricate pattern of long narrow areas of Third-class soils interspersed with long somewhat broader areas of Fourth-class

soils. The distribution is such that large fields of uniform shape usually include a large proportion of Fourth-class soils. Soils fairly well suited to crops are generally in long narrow areas on ridge crests, on the gentler parts of ridge slopes, or in narrow valleys. Soils poorly suited to cultivation are generally on the steeper slopes of ridges. Those at least fairly well suited to crops are similar in quality to those of association C but are present in smaller proportions and exist in areas that are narrow and difficult to work without the inclusion of Fourth-class soils.

Association D is mostly on the Highland Rim escarpment. It is characteristic of the more highly dissected areas that are dominated by Dellrose and Frankstown soils.

ASSOCIATION E

Association E is dominated by Fourth-class soils. Between 80 and 95 percent of the area consists of soils poorly suited to cultivation; less than 20 percent of soils at least fairly well suited to crops; and less than 10 percent of soils poorly suited both to crops and to pasture. Most of the potentially fair cropland consists of soils of the Third-class. The association is characterized by extensive areas of Fourth-class soils that include small areas of Second- or Third-class soils, without consistent shapes or patterns of distribution. Few farms in this association have areas even fairly well suited to cultivation. Most farms are dominated by poor cropland but have fair to good pasture land.

The association is in all parts of the county, and the component soils range widely in physical characteristics. In the western part the soils are largely stony land, with 65 to 90 percent still forested. In such areas the boundaries of cleared land commonly follow very closely the boundaries between the Fourth-class and the First-, Second-, or Third-class soils. In other parts the areas of the association generally are more than 70 percent cleared, but the soils are commonly limited in their suitability for crops by such features as steepness of slope, poverty of plant nutrients, or extreme chertiness. This is the least desirable association for the agriculture of the county.

FORESTS¹²

At the time of its formation in 1807, most of Bedford County was covered by dense canebrakes and vast forests, both almost impenetrable (3). Conspicuous species in the forest on the so-called "mulatto" soils were described as ash, poplar, black walnut, white walnut, elm, buckeye, sugar maple, oak, redbud, sumac, dogwood, hickory, beech, boxelder, linden, and black gum (6). Sugar maple, ash, poplar, beech, and white oak were the prevailing timber trees. Black walnut, although plentiful then, is now becoming scarce. The western corner of the county north of the Duck River, where stony land types with some Hagerstown soils predominate, was noted for its virgin stand of redcedar. Many of the redcedars in this belt were 50 to 75 feet in height and 3 to 3½ feet in diameter, but the best timber was obtained from trees 15 to 20 inches in diameter.

¹² Prepared by G. B. Shivery, extension forester, University of Tennessee.

The operation of sawmills in all parts of the county resulted in the cutting of much of the timber, as evidenced by the fact that in 1909 there were only 14 active sawmills left and none was cutting more than five million board feet (4, 6). Highly prized forest products consisted of poplar lumber, cedar wood, wood for shingles and rails, and white oak and black oak boards. Some redcedar was rafted to Paducah, Ky., Memphis, Tenn., New Orleans, La., and intermediate points by way of the Duck and Tennessee Rivers. In 1940 there were 18 wood-using plants, one of which was producing 880,000 board feet of redcedar and 1,615,000 board feet of hardwoods for use as lumber and staves.¹³ Of the total area of the county, 92.8 percent was in farmland, an average of 15.7 percent of which was classified as woodland, according to the 1940 census. The average acreage of woodland to the farm was 15 acres, compared with 22 acres for the State.

By 1890 the county had become a center for redcedar wood, and about the same time the export of high grade pencil-casing wood to Germany began (10). In 1917 a mill was built at Shelbyville for the manufacture of pencil slats from redcedar wood, although it was not until 1925 that the manufacture of pencils, Shelbyville's best-known product, began. The loss of export markets and competition from cheaper western redcedar brought about the manufacture of complete pencils in the county. The growth of complementary industries attended the development of the pencil industry from cedar wood in the original redcedar glades; and three pencil factories at Shelbyville were primarily responsible for the establishment of a graphite plant and a paper-box plant at that place. Depletion of the supply of Tennessee redcedar resulted in the reservation of this wood for better grade higher priced pencils and in the use of California incense cedar for the cheaper grades. Shelbyville makes more cedar pencils than any city in the world and is second only to New York in the manufacture of pencils of all types. The production in 1937 amounted to nearly 137,000,000 pencils.

A distinctive though limited forest type designated as oak-chestnut is common to the ridges, hills, and knolls of the Highland Rim escarpment, a conspicuous land feature in the extreme southeastern, and northeastern parts of the county. This is associated with Baxter, Bodine, and Frankstown cherty silt loams on the ridge tops and with the Bodine type and the steep phase of the Dellrose type on the slopes. It occurs mainly on south and west exposures and merges with the upland-hardwood types on the north- and east-facing slopes. Aside from dead chestnut trees, species on these soils include white, post, black, southern red, and chestnut oaks, scalybark and white hickories, dogwood, black gum, red maple, sourwood, sassafras, and redbud. The principal trees that occupy the hollows and the superior growing sites on northern and eastern exposures are yellow poplar (tuliptree), beech, black walnut, white oak, sugar maple, and white ash.

Upland hardwoods is an extensive forest type in the Central Basin and is associated with the more productive soils, including the Dellrose, Frankstown, Mimosa, Mercer, Maury, and Colbert in the outer Central Basin and the Hagerstown, Talbott, and Pickaway in the inner Central Basin. Species growing on these soils include white

¹³ Information obtained from TVA Forestry Relations Department, Forest Resources Planning Division, Forest Economics Section.

oak, white and green ashes, yellow poplar, black locust, hackberry, sugar maple, white elm, southern red oak, scalybark hickory, chinquapin oak, black walnut, black oak, basswood, northern red oak, and black gum. Associated with Lindside, Melvin, and Dunning soils, which are imperfectly or poorly drained, are sweetgum, silver maple, boxelder, swamp white oak, swamp chestnut oak, overcup oak, sycamore, and green ash. The bottom land-hardwood type is characterized by willow and water oaks, red maple, willow, and sweetgum, which may be found in association with Guthrie silt loam, a slowly drained soil.

The most extensive forest type in the county is known as the redcedar-hardwoods type (11). It constitutes more than half the forest in the outer Central Basin and practically all the forest in the inner Central Basin. Trees of this type grow on the eroded phases of Hagerstown, Talbott, Mimosa, and Colbert soils. This type is also characteristic of smooth stony land (Hagerstown soil material), smooth stony land (Colbert soil material), rolling stony land (Colbert soil material), and, where growth conditions permit, of limestone outcrop. Redcedar comprises 25 to 75 percent of the total dominant and codominant stems. A variety of hardwoods, including scalybark, white and pignut hickories, scarlet oak, white ash, blue ash, mulberry, holly, black walnut, persimmon, elm, black locust, hackberry, white oak, chinquapin oak, southern red oak, black oak, and ironwood (*Ostrya virginiana*) comprise the rest of the type. The redcedar-forest type, which is restricted to 1 percent of the total forest area, as also are the oak-chestnut and bottom land-hardwood types, may occur in situations similar to those of the redcedar-hardwood type. The large expanse of land west of Shelbyville north and south of the Duck River, consisting principally of smooth stony land (Colbert soil material) and smooth stony land (Hagerstown soil material), supports only small and slow-growing redcedars and scrubby hardwoods, which range from 6 to 8 inches in diameter breast high when about 40 years old. Grazing and root competition during droughts appear to interfere with the younger age classes. As the grass stand among the trees is sparse, it does not provide sufficient grazing for livestock.

It is necessary that fire protection be assured, not only to avoid loss of the forest stand but also to control runoff and conserve organic matter. The avoidance of livestock grazing in the forests is necessary to obtain natural reproduction, especially of deciduous trees, because hogs eat the acorns, and sheep, cattle, and other livestock nip the buds and leaves of desirable species, leaving the less desirable trees unmolested. A conscious effort must be made to improve the timber stands by saving the desirable trees, no matter how small, for growth into valuable timber and by cutting the crooked, diseased, limby, and stubby trees, the slow growers, and the poor kinds of unsalable quality for stovewood and firewood. Bluegrass comes up in openings in the forests on glady land early in spring and to some extent in the cool weather that follows rains. Whether woodland characterized by the redcedar-hardwood and redcedar types are to be grazed is a matter to be decided by the individual farmer. There will be instances where farm economy dictates controlled grazing of palatable forage grasses that thrive under locust plantings, well established and grown beyond the reach of livestock. Both black locust and black walnut are suit-

able for growing in pastures, provided they are protected while small against injury from livestock. Locust and black walnut, especially improved varieties, have a definite place for widely spaced planting on permanent pastures on soils that have sufficient depth and favorable internal drainage.

The growth of persimmon and sassafras on severely sheet-eroded areas of Dellrose, Dickson, Bodine, Frankstown, and Baxter soils is a natural effort to replace the losses occasioned by improper land use. These trees should be considered as a temporary forest type to be replaced by the upland hardwoods or other more permanent type as growing conditions become more favorable. Black locust is useful for reclaiming severely eroded areas, as those represented by eroded conditions on rough gullied land (Mimosa soil material); Dellrose cherty silt loam, steep phase; Mimosa silty clay loam, eroded hilly phase; and small badly eroded areas of Maury and Hagerstown soils. The soil must be prepared carefully before planting, however, if a satisfactory stand is to be established. This advance preparation includes such measures as plowing the galled spots and mulching them immediately with old straw or similar material; contour furrowing the sheet-eroded slopes; and building low rock or cedar-brush check dams in the gullies. Incidentally, areas reclaimed in this manner can be made into favorable habitats for quail and other wildlife.

Shortleaf pine is considered suitable for planting, especially on south and west slopes of hills and ridges in the Highland Rim escarpment. Loblolly pine is suitable as a supplement to black locust in the Central Basin, and yellow poplar can be used satisfactorily as part of a mixed planting on the more productive soils. Red cedar is of considerable value on the glady or limestone outcrop land. It establishes itself by natural reproduction and is well suited to this kind of land.

Some tree planting with stock furnished by the Tennessee Valley Authority has been done by farmers. The county agricultural agent gave instructions as to how to prepare the ground and plant the trees, and was instrumental in establishing 7 projects totaling 17 acres in 1940, 11 projects totaling 20 acres in 1941, and 9 projects totaling 12 acres in 1942.¹⁴

MORPHOLOGY AND GENESIS OF SOILS ¹⁵

Soil is the product of the forces of weathering and soil development acting on the soil materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point depend on (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil material has accumulated and has existed since accumulation; (3) the plant and animal life in and on the soil; (4) the relief, or lay of the land; and (5) the length of time the forces of development have acted on the material (5). The climate, and its influence on soil and plants, depends not only on temperature, rainfall, and humidity, but also on the physical characteristics of the soil or soil material and on the relief, which in turn,

¹⁴ Information obtained from records of the Watershed Protection Division, Department of Forestry Relations, Tennessee-Valley Authority.

¹⁵ Prepared by M. G. Cline, Division of Soil Survey, Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture.

strongly influences drainage, aeration, runoff, erosion, and exposure to sun and wind.

Climate and vegetation are the active factors of soil genesis. They exert their influences on the parent material and change it from a heterogeneous mass of inert material to a body that has a definite genetic morphology. The effects of climate and vegetation on the parent material are guided, or limited, to varying degrees by the modifying influence of relief as it affects such conditions as drainage, the quantity of water that percolates through the soil, the rate of natural erosion, and the vegetation that grows on the soil. The nature of the parent material itself also guides the course of action that results in determining internal soil conditions and the kinds of vegetation that grow on the soil. Finally, time is involved for the changes to take place, and age becomes a factor and a measure of soil genesis as it reflects the degree of development of the soil into a body that is in equilibrium with its environment. The degree of such development depends not only on time but also on the rate of action of the forces of climate and vegetation, as that rate is guided by the factors of relief and parent material.

The factors of soil genesis are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effects of any one unless conditions are specified for the other four. They are so complex in their interrelations that many of the processes that take place in the development of soils are unknown.

This section presents the outstanding morphological characteristics of the soils of Bedford County and relates them to the factors of soil formation. Physical and chemical data are limited for these soils, and the discussion of soil genesis and morphology is correspondingly incomplete. The first part of the section deals with the environment under which the soils exist; the second, with specific soil series and the part environment has played in determining the morphology of the various soil types.

ENVIRONMENT AND CHARACTERISTICS OF THE SOILS

The parent materials of soils of Bedford County may be considered in two broad classes: (1) Materials residual from the weathering of rocks in place; and (2) materials transported by water or gravity and laid down as unconsolidated deposits of clay, silt, sand, and larger rock fragments. Materials of the first class are related directly to the underlying rocks from which they were derived; materials of the second class, to the soils or rocks from which they were washed or fell.

The residual parent materials are the residuum from the weathering of consolidated sedimentary rocks—mainly limestones—and the character of these materials is strongly reflected in many of the characteristics of the soils developed from them. Geologically, the rocks belong chiefly to the Ordovician and Mississippian systems and strata are almost horizontal. They were laid down as unconsolidated sediments that were gradually converted into consolidated rocks.

Certain soils developed from residual materials of the underlying rocks are generally associated with particular rock formations or parts of rock formations (1). On the Highland Rim plateau and escarpment, soils of the Dickson and Baxter series are generally associated

with St. Louis and Warsaw limestones; soils of the Frankstown series with Fort Payne chert; and soils of the Bodine series with both the Warsaw limestone and the Fort Payne chert. All these formations belong to the Mississippian system. The Warsaw is a thick-bedded, fine-grained limestone of grayish-blue, bluish, or dark color, and blocks of yellow angular solid chert are on soils underlain by this rock. The Warsaw limestone consists of about the same proportions of limestone, shale, and calcareous sandstone, and when weathered a small quantity of hard chert and an abundance of soft easily disintegrated cherty rock is left. Fort Payne chert is massive siliceous to argillaceous limestone, weathering to great quantities of blocky yellow chert. This rock caps all the high hills of the southern two-thirds of the Central Basin and covers much of the Highland Rim plateau.

In the outer Central Basin, soils of the Mimosa series are associated with Cannon limestone; those of the Maury series with the Hermitage formation; those of the Mercer series with the Mermitage formations and the Tyrone member of Lowville limestone; and those of the Colbert series with the Cannon limestone, the Hermitage formation, and the Lowville limestone. These rock formations are all of the Ordovician system. Cannon limestone is gray- and dove-colored and massive. The Hermitage formation consists of thin-bedded argillaceous limestone, containing yellow shale and sandy strata. The Tyrone member of the Lowville limestone is pure nonmagnesian limestone, which in part is somewhat argillaceous and contains chert.

In the inner Central Basin, soils of the Hagerstown series are associated with the Carters member of Lowville limestone and with Lebanon limestone. Soils of the Talbott series are associated with Lowville and Lebanon limestones, those of the Colbert and Dowellton with Lebanon; and those of the Pickaway with Lebanon and Ridley. These formations belong to the Ordovician system. Lowville limestone consists of dove-colored and gray magnesian limestones. The Carters member of Lowville limestone is massive, usually magnesian. Lebanon limestone is prevailingly blue and thin-bedded, although some is dove-colored. The thin limestone beds are separated by seams of blue and yellow clay shale less than an inch thick. Ridley limestone is dove-colored, massive, and dense.

Transported materials have given rise to soils of more series than have residual materials in place. Although these materials originated in uplands underlain almost wholly by limestone, they differ somewhat, depending on the composition of the upland soils and residuum, and their differences are reflected in some of the characteristics of the derivative soils. General alluvium has given rise to soils belonging to the Cumberland, Etowah, Wolftever, Taft, Robertsville, Huntington, Lindside, Egam, Dunning, and Melvin series. The Cumberland, Etowah, Wolftever, Taft, and Robertsville soils occupy positions on stream terraces, and the other soils of this group occupy positions on first bottoms near streams. Soils of the Greendale, Burgin, Abernathy, and Ooltewah series have formed from local colluvium and alluvium or from waste and slough deposited at the base of the immediate slopes. Soils of the Guthrie and Dellrose series were derived from local colluvium.

Although a rather consistent relationship exists between the kinds of parent material and some of the characteristics of the soils, other

soil characteristics, especially those of regional significance to soil genesis, are not related to parent materials but are attributable to other factors.

The climate is temperate and continental—characterized by long warm summers, short mild winters, and relatively high rainfall. The moderately high temperatures favor rapid chemical reactions under the moist conditions that exist in the soil most of the time. The high rainfall favors rather intense leaching of soluble materials, such as bases, completely from the soil and the downward translocation of less soluble materials and colloidal matter. The soil is frozen for only short periods and to only shallow depths during the winter, which further intensifies the weathering and translocation of materials.

Climatic conditions vary somewhat within the county. The Highland Rim escarpment is cooler than the rest of the county. The growing season here is a little shorter, and the soil is frozen for longer periods than in the Central Basin. Doubtless some of the differences between the soils of these two districts are the result of differences in climate; but they are also associated with marked differences in parent material, and the influence of each of these two factors has not been determined.

The climate of the Central Basin is relatively uniform throughout. The same is true of the Highland Rim escarpment. Within each of these districts, differences in climate cannot account for differences among the soils. In each district, however, they can account in part for some of the outstanding characteristics that many of the soils have in common.

Higher plants, micro-organisms, earthworms, and other forms of life on and in the soil contribute to its morphology. The nature of the changes they bring about depends, among other things, on the kinds of life and on their peculiar life processes. The kinds of plants and animals that live on and in the soil are determined by the kinds of climate, parent material, relief, and age of the soil and by other organisms. The influence of climate is most apparent, though not always most important, as a determinant of the kinds of higher plants that grow on the well-drained, well-developed soils. In this way climate exerts a powerful indirect influence on the morphology of soils. Climate and vegetation acting together are the active factors of soil genesis.

A general oak-hickory-chestnut forest association was on all the well-drained well-developed soils of the county, as nearly as can be determined. There were probably differences in the density of stands, in the relative proportions of species, and in the associated ground cover. It is probable that some of the greater differences in these respects were between the vegetation of the Highland Rim escarpment and that of the Central Basin, not only because of climatic differences but also because of differences in the kind of soil that developed. Few marked differences in the morphology of the well-drained well-developed soils, however, appear to be directly caused by differences in the vegetative cover.

Trees common to this area are deciduous and moderately deep to deep feeders on plant nutrients. Among the species the leaves range

considerably in content of the various plant nutrients; but in general, the quantities of bases and phosphorus returned to the soil in the leaves is high compared with those returned by coniferous trees. In this way, essential plant nutrients are returned to the upper part of the soil from the lower and retard the depleting action of percolating waters. Much organic material is added to the soil in the form of dead leaves, twigs, roots, and entire plants. Most of it is added to the topmost layer, where it is acted on by micro-organisms, earthworms, and other forms of life and by direct chemical reactions. The rate of decomposition of such materials is rather rapid, as a result of the favorable temperature and moisture conditions, favorable character of the organic material itself, and presumably favorable micropopulations. Organic material does not accumulate on well-drained sites to the same extent as in cooler regions under similar conditions of drainage. Little is known of the micro-organisms, earthworms, and other animal life of the soil, but their importance probably is no less than that of the higher plants.

The well-drained well-developed soils have been formed under relatively similar conditions of climate and vegetation. On these soils climate and vegetation have had the maximum of influence with a minimum of modification by relief and parent material. As a result, the soils developed from various kinds of parent materials have many characteristics in common.

In the virgin condition, all the well-drained well-developed soils have a layer of organic debris in varying stages of decomposition on the surface. All have dark-colored A_1 horizons, and their A_2 horizons are lighter in color than either the A_1 or the B. The B horizon is generally a uniform yellow, brown, or red and is heavier textured than the A_1 or A_2 . The C horizon is variable in color and texture among the different soils, but usually is light red or yellow mottled with gray or brown.

Analysis of samples of a number of comparable soils from Jefferson County, Tenn., may be expected to apply to these soils (9). The silica content decreased and the alumina and iron contents increased with depth. The content of organic matter was moderate in the A_1 horizon, less in the A_2 , and very low in the B and C horizons. The soils were low in bases and phosphorus within the solums. In general, the loss of ignition was low, indicating a low content of very tightly held water. They were medium, strongly, or very strongly acid throughout the solums. In general, the quantity of silt decreased and the quantities of clay and colloids increased with depth from the A_1 through the C horizon. The colloid content of the B horizon was much higher than that of the A_2 horizon.

The characteristics mentioned are common to all well-developed well-drained soils that have been subjected to similar conditions of climate and vegetation. They are, therefore, common to soils of zonal extent, and all soils that exhibit them can be called zonal soils. Zonal soils are members of one of the classes of the highest category in soil classification and are defined (13, p. 987) as "great groups [of soils] having well-developed soil characteristics that reflect the influence of the active factors of soil genesis—climate and living organisms (chiefly vegetation)."

Where the parent materials have been in place a long time and have not been subject to extreme conditions of relief or where the parent materials themselves do not possess extreme characteristics of texture and chemical character, the soils that have been developed have the characteristics of zonal soils. Where the parent material has been in place only a short time, as in very recently deposited transported materials, the soils have very poorly defined or no genetic horizons. These soils are young and have few if any of the characteristics of zonal soils and, therefore, are called azonal soils. Azonal soils are members of a second class of the highest category of soil classification and are defined (*13, p. 987*) as a group of soils "without well-developed soil characteristics either because of their youth or because conditions of parent material or relief have prevented the development of definite soil characteristics."

Azonal soils are characterized by A_1 horizons that are moderately dark to very dark in color and apparently have a moderate to fairly high content of organic matter; by the absence of a zone of illuviation, or B horizon; and by parent material that is usually lighter in color than the A_1 horizon and in texture that may be similar to, lighter than, or heavier than the A_1 horizon. They may be referred to as AC soils because of the absence of a B horizon.

The relief of soils ranges from level to steep. On some steep areas where relatively little water percolates through the soil and where the large quantity that runs off the soil and the rapid rate of that runoff contribute to relatively rapid geological erosion, the soils are young. The materials are constantly renewed or mixed, and the changes brought about by vegetation and climate may be so slight that the soils are essentially AC soils. These soils are also azonal soils.

On some nearly level areas where both internal and external drainage are restricted or where geologic erosion is very slow, soils whose materials have been in place a long time have certain well-developed profile characteristics that zonal soils do not have. Such soils are associated geographically with the zonal soils and are called intrazonal soils (*13, p. 987*). They are defined as soils with "more or less well-developed soil characteristics that reflect the dominating influence of some local factor of relief or parent material over the normal effect of the climate and vegetation." The characteristics of such soils are generally the result of level relief influenced greatly by the character of the parent material and the kinds of vegetation that grow in such environments.

Soils of each of the three broad classes—zonal, azonal, and intrazonal—may be derived from similar kinds of parent materials. Within any one of these classes, major differences appear to be closely related to differences in the kinds of parent materials from which they were derived. The thickness of soils developed from residual materials over the rock from which they were derived is due partly to the resistance of the rock to weathering, to the volume of the residue after weathering, and to the rate of geologic erosion. The chemical and physical nature of the parent material modifies the rate and direction of chemical changes that result from climate and vegetation. The kind

of parent material also exerts a pronounced influence on the kinds of vegetation that grow on the soil.

Rocks have contributed to differences among soils also through their effects on relief. The rocks of much of the county are composed of moderately old formations that lie as almost horizontal strata. The present relief is largely a product of geologic weathering and erosion of these formations; the higher lands are capped by the more resistant rocks, and the valleys are underlain by those that are less resistant. The ridges are capped in many places by cherty limestone; and the valleys are underlain by more or less pure limestone.

The character of the soils developed from residual materials is closely related to the underlying rocks; therefore, the distribution of soils is also related to the valleys and ridges. Mimosa, Maury, Mercer, Colbert, Hagerstown, Talbott, and Pickaway soils are in the valleys of the Central Basin; and Dickson, Baxter, Frankstown, and Bodine soils are on the ridges of the Highland Rim plateau and escarpment. Streams in the escarpment generally have steeper gradients than in the Central Basin, and, as a result of faster stream cutting and stronger relief, many of the soils of the escarpment have steeper slopes than those of the valleys, but some soils on the interfluves have mild slopes. In this way the character of the rock has contributed indirectly to the character of some soils through relief.

The internal drainage of soils of nearly level relief in the limestone areas is exceptionally good as a result of good subterranean drainage through caverns and crevices in the rocks. This excellent subterranean drainage in the areas underlain by limestone counteracts the usual effects of level relief on drainage and allows the nature of the parent rock to dominate in determining local differences among the well-developed well-drained soils derived from residual materials—soils that are subject to similar forces of climate and vegetation.

CLASSIFICATION OF SOILS

In the following classification of soil series in great soil groups and soil orders, the morphology and genesis of the soils of each series are discussed, and some of their relationships to and differences from soils of other series of the same great soil group are pointed out. The classification of soil series in higher categories is based on limited data, principally on characteristics observable in the field. The correct classification of some of the soil series is not known; that of others is reasonably well known. An attempt has been made to place each series in the correct great soil group, but further study may prove the classification to be incorrect in some instances.

Bedford County is in the region of Red and Yellow Podzolic soils and contains zonal order soils of both the Red Podzolic and Yellow Podzolic great soil groups. The intrazonal order is represented by soils of the Planosol and Half Bog great soil groups; the azonal order, by certain soils of the alluvial and Lithosol great soil groups. The classification of the soil series in higher categories and some of the factors that have contributed to their morphology are given in table 11.

TABLE 11.—The soil series of Bedford County, Tenn., classified in higher categories, and some of the factors that have contributed to their morphology

Order	Great soil group	Series or land type	Parent material	Relief	Internal drainage	Age ¹
Zonal	Red Podzolic	Hagerstown ²	Residuum from the weathering of— High-calcic limestone	Undulating to rolling	Moderate	Old.
		Maury	High-calcic phosphatic limestone	do	do	Do.
		Talbot	Moderately clayey limestone	do	Slow	Do.
		Baxter	Cherty limestone	Rolling	Moderate	Do.
		Cumberland	General alluvium derived mainly from uplands underlain by limestone.	Gently sloping to sloping.	do	Do.
		Etowah	do	do	do	Old to young.
	Yellow Podzolic	Mimosa	Residuum from the weathering of— High-calcic (slightly phosphatic) cherty limestone.	Undulating to hilly	do	Old.
		Mercer	Thin-bedded impure limestone, containing thin strata of shale.	Undulating to rolling	Slow	Do.
		Greendale	Colluvium and local alluvium derived from up- lands underlain mainly by limestone.	Gently sloping	Moderate	Old to young.
	Lithosolic	Colbert	Residuum from the weathering of— Argillaceous members of limestone formations	Level to rolling	Slow to very slow	Young.
		Bodine	Cherty limestone	Rolling to steep	Moderate	Do.
		Frankstown	do	Rolling	do	Do.
Planosols	Pickaway	Residuum from the weathering of— Argillaceous limestone	Undulating to rolling	Slow	Old to very old.	
	Dickson	Cherty limestone	Undulating	do	Do.	
	Wolftever	General alluvium derived mainly from uplands underlain by limestone.	Nearly level to gently sloping.	do	Do.	
	Taft	do	do	do	Very old.	
	Robertsville	General alluvium, colluvium, and local alluvium from uplands underlain by limestone.	Nearly level to level	Very slow	Old.	
Intrazonal	Gray soils with a glei layer.	Guthrie	do	do	do	Old to young.
		Dowellton	do	do	do	Do.
		Melvin	do	do	do	Young.
		Burgin	Colluvium and alluvium mainly from uplands underlain by limestone.	Level to gently sloping	do	Old to young.
	Half Bog	Dunning	do	Nearly level	do	Young.

Azonal	Alluvial soils	Huntington	General alluvium derived mainly from uplands underlain by limestone.	Nearly level to gently sloping.	Moderate	Do.
		Lindside	do	Nearly level	Slow to very slow	Do.
		Egam	do	do	do	Do.
		Alluvial soils, undifferentiated.	do	do	Moderate to very slow.	Very young to young.
		Abernathy	Local colluvium and alluvium from— Hagerstown and Meury soils and in places Cumberland soils.	do	Moderate	Young.
	Ooltewah	Hagerstown, Talbott, and Pickaway soils.	do	Slow	Do.	
	Lithosols	Smooth stony land: Colbert soil material Hagerstown soil material.	Residuum from the weathering of limestone.	Undulating	Moderate to slow	Very young.
		Rolling stony land, Colbert soil material.	do	do	Moderate	Do.
		Limestone outcrop	do	Rolling to hilly	Slow	Do.
		Dellrose	Local colluvium or wash consisting of soil material and chert sloughed or washed off upper slopes and ridge tops.	Undulating to steep Hilly to steep	Very slow Moderate to slow	Do. Young.
Rough gullied land, Mimosa soil material.		Residuum from the weathering of limestone.	Undulating to hilly	Moderate	Very young.	

¹ Age refers to the degree to which the soil has developed properties that are characteristic of a mature soil. The terms used are relative. A very young soil has few if any of the characteristics of a mature soil; a young soil has these characteristics weakly to moderately well developed; an old soil has them well developed; and a very old soil has them developed to a greater degree than is common for mature soils of the region.

² The designation of the Hagerstown soils as Red Podzolic is tentative, pending further investigation, and cannot be considered generally applicable to other areas where these soils are mapped.

DESCRIPTION OF SOILS REPRESENTING THE GREAT SOIL GROUPS

RED PODZOLIC SOILS

Soils of the Red Podzolic great soil group are a zonal group of soils having thin organic and organic-mineral layers over a yellowish-brown leached layer which rests upon an illuvial red horizon; developed under a deciduous or mixed forest in a warm-temperate moist climate (13). The soil-forming processes involved in their development are laterization and podzolization. Soils of the Hagerstown, Maury, Talbott, Baxter, Cumberland, and Etowah series are tentatively considered to be the Red Podzolic soils of Bedford County. They appear to have the common characteristics of Red Podzolic soils, and apparently all have developed under relatively similar conditions of climate and vegetation. All are at least moderately well drained, and, although they range somewhat in degree of maturity, all are sufficiently old to have at least a moderately well-developed Red Podzolic soil profile. Their range in relief is from undulating to rolling and from gently sloping to sloping, but the differences among them are probably not caused primarily by slope. There are rather marked differences in the parent materials, and these are associated with the major differences among these soil series.

HAGERSTOWN AND MAURY SERIES

Probably the most important soils in the county having mature profiles are those of the Hagerstown and Maury series. Soils of both are developed from weathered material of high-calcic limestone and their most important difference is the high content of phosphorus in the Maury soil. They are similar in color, texture, consistence, structure and other physical characteristics. The limestone formations from which they are developed are different in that the Hermitage formation, from whose weathered materials the Maury soil is developed, is high in phosphorus; and the Carters limestone member of the Lowville limestone, from the weathered material of which the Hagerstown soil is developed, is comparatively low or deficient in that element.

The following profile description which may be considered typical of either the Hagerstown or the Maury series, is of virgin Hagerstown silt loam, observed 3 miles north of Shelbyville, where a forest of oak, hickory, and some maple covers the soil.

1. 0 to 2 inches, dark-brown partly decomposed litter consisting of leaves, twigs, and fine roots. It is neutral in reaction.
2. 2 to 12 inches, dark-brown friable silt loam of crumb structure, containing many roots of shrubs and grass. It is neutral in reaction.
3. 12 to 40 inches, reddish-brown friable but firm silt loam or silty clay loam of crumb structure and of neutral reaction. This horizon contains many dark-brown or black accretions or concretions about the size of bird shot, which are well distributed throughout the layer and are soft enough to be crushed by the thumbnail.
4. 40 to 60 inches, light reddish-brown moderately compact silty clay loam or silty clay, finely mottled and splotched with yellow, gray, and red. This material has a fine nut structure and is neutral in reaction. There are small accretions or concretions, similar to those in the layer above but they are less numerous. Limestone bedrock is at a depth of 4 to 8 feet.

TALBOTT SERIES

The Talbott soils are characterized by heavy-textured B and C horizons, a characteristic associated with the argillaceous limestone from which the parent materials are derived. They are relatively thin over bedrock limestone, most of which is of the Lebanon formation. Their position, relief, and thickness suggest that the limestone from which they are derived weathers rapidly and leaves a relatively small quantity of insoluble residue after weathering. They erode readily when cultivated, and may have eroded relatively rapidly under natural vegetation, which probably accounts in part for their thinness over bedrock. Like the other zonal soils, they have developed under a deciduous forest vegetation and a warm-temperate moist climate. The soils are medium to strongly acid throughout the profile.

The following is a profile description of Talbott silt loam :

1. 0 to 2 inches, dark-brown friable silt loam.
2. 2 to 7 inches, grayish-yellow to grayish-brown friable silt loam.
3. 7 to 30 inches, yellowish-red heavy plastic silty clay that breaks to blocky lumps. The lower part of this layer is splotched with yellow and gray.
4. 30 inches+, intensely mottled yellow, reddish-brown, and gray tough plastic clay. Bedrock of argillaceous limestone is at a depth of 3½ to 6 feet.

BAXTER SERIES

The only soil of the Baxter series is an acid well-developed Red Podzolic, formed in place over limestone of the St. Louis and Warsaw formations. It is well drained and occupies positions on narrow ridge tops in association with Bodine, Dickson, and Frankstown soils. Developed under better internal drainage conditions than the Dickson soils, it appears to differ from the Frankstown in being somewhat more mature; and from the Bodine in being much more mature. In general, it has developed from limestone of higher carbonate and lower silica content.

Following is a description of a typical profile of Baxter cherty silt loam :

1. 0 to 2 inches, dark-brown cherty silt loam.
2. 2 to 6 inches, light-brown cherty silt loam.
3. 6 to 30 inches, brownish-red moderately friable but firm cherty silty clay loam with a medium nut structure and a variable quantity of small, rounded, dark-brown concretions.
4. 30 inches+, reddish-yellow faintly splotched with yellow, red, and gray friable cherty silty clay or silty clay loam. Bedrock limestone is at a depth of 10 to 20 feet or more.

CUMBERLAND SERIES

The Cumberland soils are developed on old high well-drained alluvial terraces, most of which are in the vicinity of the Duck River and Flat Creek. Their profiles resemble those of the Hagerstown and Maury soils in many respects, the chief difference being in mode of origin of parent material. They are acid throughout their entire depth. Water-worn gravel is common in some places.

Following is a profile description of Cumberland silt loam :

1. 0 to 3 inches, very dark-brown friable silt loam. The organic-matter content appears to be noticeably higher than for the layer below.
2. 3 to 10 inches, dark-brown friable silt loam.

3. 10 to 40 inches, dark reddish-brown to yellowish-brown firm but friable silty clay loam or silty clay. A few dark small concretions are throughout this layer.
4. 40 inches +, dark reddish-brown to yellowish-brown moderately splotched with yellow and gray moderately compact slightly plastic silty clay loam or silty clay. Small dark concretions are more abundant, especially in the lower part, than in the layer above. An irregular layer of water-worn gravel lies at a depth of 4 to 10 feet in many areas.

ETOWAH SERIES

The only soil of the Etowah series is an acid moderately well-developed Red Podzolic soil on low alluvial terraces along the Duck River and its larger tributaries. The parent material probably does not differ greatly from that of the Cumberland soils. The soil differs from those of the Cumberland chiefly in being less mature and having a less well-defined profile.

Following is a profile description of Etowah silt loam :

1. 0 to 2 inches, dark grayish-brown friable silt loam.
2. 2 to 15 inches, grayish-brown to brown friable silt loam.
3. 15 to 40 inches, yellowish-brown to reddish-brown friable but firm silt loam or silty clay loam.
4. 40 inches +, yellowish-brown splotched with gray and yellow silty clay that breaks from small to fairly large angular fragments. The consistence of this material ranges from friable to plastic.

YELLOW PODZOLIC SOILS

Soils of the Yellow Podzolic group are a zonal group of soils having thin organic and organic-mineral layers over a grayish-yellow leached layer, which rests on a yellow horizon; developed under the coniferous or mixed forest in a warm-temperate moist climate (13). The soil-forming processes involved in their development are podzolization with some laterization. Soils of the Mimosa, Mercer, and Greendale series are of this group. They have the common characteristics of the Yellow Podzolic soils and apparently have developed under similar climatic and vegetative conditions and are mature or nearly so. Internal drainage, though sufficient for most agricultural requirements, is on the whole somewhat more impaired than that of the Red Podzolic soils. The relief is gently sloping to rolling. The chief morphological differences between them appear to be related to differences in parent rock and mode of origin of parent material.

MIMOSA SERIES

The Mimosa soils are developed in place over the argillaceous high carbonate limestone of the Cannon formation, and the areas are in the outer Central Basin. Internal drainage is noticeably impaired as compared with the Hagerstown and Maury soils. Mimosa soils are acid and are not poor in phosphate.

The following profile description taken from a site in Lincoln County, Tenn., is representative of these soils in Bedford County :

1. 0 to 3 inches, mellow light-brown silt loam stained dark with organic matter.
2. 3 to 7 inches, grayish-brown friable silt loam.
3. 7 to 9 inches, reddish-brown friable heavy silt loam of coarse crumb structure that dries out to yellowish-brown. There are some incipient accretions and these are easily crushed between the fingers.

4. 9 to 30 inches, brownish-yellow to light-yellow moderately tough silty clay loam to silty clay. When dry, this material falls apart to structure particles that are coated with fine material. The lower part of this layer is commonly faintly spotted with gray.
5. 30 to 45 inches, yellow spotted with gray tough plastic silty clay, the gray increasing with depth. Both hard and soft accretions are characteristic of this layer.
6. 45 inches +, mottled gray, yellow, and brown plastic clay or silty clay. Limestone bedrock is at a depth of about 6 feet.

MERCER SERIES

Mercer soils are developed in place over the interbedded argillaceous limestone and shale of the lower part of the Hermitage and the Tyrone members of the Lowville formation. Practically all of the areas are in the outer Central Basin. The surface layer is lighter colored, the depth to mottled material is less, and the subsoil has a finer texture and heavier consistence than are characteristic of the Mimosa soils. Internal drainage is slower than for the Mimosa soils. Mercer soils are acid.

Following is a profile description of Mercer silt loam :

1. 0 to 2 inches, dark-brown silt loam containing a noticeable quantity of organic matter.
2. 2 to 10 inches, grayish-brown friable silt loam.
3. 10 to 21 inches, light brownish-yellow or yellowish-brown silty clay loam with a fine to medium nut structure. This material is slightly plastic when wet. A varying quantity of small dark-brown accretions is present throughout this layer.
4. 21 inches +, mottled yellow, gray, and brown stiff plastic clay. This material breaks into small angular fragments that have a glossy surface. The dark-brown accretions are less abundant than in the layer above.

GREENDALE SERIES

The Greendale soil is on colluvium transported chiefly from soils developed in place in the Highland Rim escarpment and outer Central Basin, chiefly the light-colored Bodine, Dickson, Mimosa, and Mercer soils, although some areas are composed of material washed from the darker Maury, Hagerstown, and Talbott soils. The mantle of colluvium varies in thickness from less than 4 to about 15 feet, and the underlying material in most areas is similar to the parent material of the Mimosa and Mercer soils. The Greendale soil has a lighter colored more mature profile, a somewhat more impaired internal drainage in places, and a smoother surface than those of the Dellrose series. Both are developed on colluvium, but the source of the Dellrose material is almost wholly from Bodine, Dickson, and other Highland Rim soils; whereas that of the Greendale is from soils of the outer Central Basin as well as from those of the Highland Rim escarpment. Greendale soil is acid.

Following is a profile description of Greendale silt loam :

1. 0 to 16 inches, dark grayish-brown friable silt loam.
2. 16 to 30 inches, dark-brown to yellowish-brown friable silt loam or silty clay loam. The breakage planes of the subsoil have a mottled gray and grayish-brown coating of colloidal material. The mottled appearance is lost by crushing. Worm casts are common to this layer, and a few small dark-brown accretions are present.
3. 30 inches +, brownish-yellow faintly mottled with gray moderately compact slightly plastic silty clay, breaking into small angular fragments. This material becomes heavier with depth.

LITHOSOLIC SOILS

Intermediate in profile development between zonal and azonal soils, none of the soils of this group have well-defined eluviated and illuviated layers, although some zonation has taken place. Included are the Colbert, Bodine, and Frankstown series.

COLBERT SERIES

The Colbert soils have a heavy sticky plastic consistence and a shallow depth to bedrock. This heavy nature and the resultant slow percolation of water are chiefly responsible for the retarded development of the zonal profile. The base exchange capacity is greater than in most lighter textured soils, which results in slower impoverishment of mineral materials in the upper part. The soils are developed in place from several argillaceous limestones. Their surface is gently undulating to rolling, internal drainage is impaired, and a great part of the acreage is associated with the Talbott and Hagerstown soils of the inner Central Basin. As both the Talbott and Colbert soils are developed from argillaceous limestone, their chief differences appear to be related to difference in consistence and in maturity of solum. Colbert soils are acid throughout.

Following is a profile description of Colbert silt loam:

1. 0 to 5 inches, light grayish-brown friable silt loam. In virgin areas the upper inch or two is noticeably darker, owing to a higher content of organic matter.
2. 5 to 26 inches, light brownish-yellow to grayish-yellow splotched with red, gray, and brown plastic sticky silty clay that breaks into small angular particles when dry but is a massive plastic mass when wet. The cleavage surfaces are heavily coated with colloidal material.
3. 26 inches+, mottled brownish-yellow, gray, and brown heavy plastic massive clay. Limestone bedrock is at a depth of 30 to 40 inches.

BODINE SERIES

Compared with the Colbert soils, the Bodine soils are cherty and more permeable, depth to bedrock is much greater, and the relief is rolling to steep. The lack of zonal profile development evidently is due chiefly to the steep slope and consequent relatively rapid geologic erosion. The Bodine soils are developed from cherty limestone of the Fort Payne and Warsaw formations, and most of their acreage is within the Highland Rim escarpment physiographic area. The reaction is acid.

Following is a profile description of Bodine cherty silt loam:

1. 0 to 2 inches, dark grayish-brown cherty silt loam.
2. 2 to 10 inches, grayish-yellow friable cherty silt loam.
3. 10 to 25 inches, brownish-yellow cherty silt loam or cherty silty clay loam.
4. 25 inches+, mottled light brownish-yellow, light-brown, and gray cherty silty clay loam on bedrock.

FRANKSTOWN SERIES

The Frankstown soil is developed in place from Fort Payne chert and in profile development appears to be intermediate between the Bodine and Baxter. Occupying narrow ridge tops associated with these soils in the Highland Rim escarpment physiographic area, it has a smooth to rolling surface, and is well drained. It is browner than the Bodine soils, and compared with the Baxter it is lighter colored

and does not have so well-developed a color and texture profile. The reaction is acid.

Following is a profile description of Frankstown cherty silt loam :

1. 0 to 10 inches, dark-gray friable cherty silt loam. The surface inch or two is somewhat darker in virgin areas than the rest of this layer.
2. 10 to 36 inches, dark grayish-yellow or brownish-yellow friable cherty silty clay loam. The thickness of this layer ranges from 12 to 36 inches.
3. 36 inches+, yellow or light grayish-yellow friable cherty silty clay loam, splotched in the lower part with reddish yellow. Bedrock limestone is at a depth of 10 to 20 feet or more.

PLANOSOLS

Planosols are an intrazonal group of soils with eluviated surface horizons underlain by B horizons more strongly illuviated, cemented, or compacted than associated normal soils, developed upon nearly flat upland surface under grass or forest vegetation in a humid or sub-humid climate (13). Soils of the Pickaway, Dickson, Wolftever, and Taft series are in this group, but some doubt exists as to whether the Wolftever is properly included. All these soils are nearly level to undulating and all are characterized by a B layer that is more dense or compact than in most of the zonal soils, but its degree of development varies among the soils of these series.

Climatic conditions are similar to those under which the zonal soils developed, but internally these soils are more moist and less well aerated much of the time than are the related zonal soils. There probably were some differences between the original vegetation on the Planosols and on the Red and Yellow Podzolic soils, although deciduous forest predominated on both. Morphologically, the Planosols in general appear to be older than the Red and Yellow soils, but the causes of development of these morphologically older soils are not known. The relief is such that geologic erosion would be slow, but that factor alone is probably not the cause of their distinguishing character. The material itself is not older than that of the associated zonal soils of similar relief. It is possible that relatively dense layers in the parent material caused slow internal drainage, which, combined with slow external drainage and unusual siltiness of the parent material, resulted in abnormal concentration or cementation of the material in or below the illuviated or B layer.

PICKAWAY SERIES

The Pickaway soils are developed over limestone of the Ridley and Lebanon formations of the inner Central Basin. They are associated with the Talbott and Hagerstown soils but are lighter colored in the upper part, more mottled in the lower part, and have a well-developed siltpan layer in the lower part of the illuviated or B layer. These soils are acid.

Following is a profile description of Pickaway silt loam :

1. 0 to 6 inches, gray or light grayish-brown friable silt loam low in organic matter. Wooded areas are covered by a thin veneer of forest litter and leafmold, and the surface inch or two of the mineral soil is stained slightly dark with organic matter.
2. 6 to 15 inches, a yellow friable heavy silt loam containing some concretions in places.
3. 15 to 25 inches, light brownish-yellow to yellow friable silty clay loam with faint splotches of gray, yellow, and brown. Considerable concretionary material is characteristic.

4. 25 to 36 inches, predominantly brown, compact, tight but brittle silty clay loam with dull splotches of yellow and gray; dark concretionary material abundant; breaks into definite angular blocks $\frac{1}{4}$ to 1 inch in diameter; material difficult to disrupt but friable when disrupted; it is not tough or plastic even when highly moist; appears to be slowly permeable. Hardpan layer.
5. 36 inches +, conspicuously mottled reddish-brown, yellow, and gray silty clay loam or silty clay; both content of concretions and compactness less than above horizon; extends to bedrock, usually at a depth of 6 to 10 feet.

DICKSON SERIES

The Dickson soil is a well developed Planosol or hardpan soil developed over limestone of the St. Louis and Warsaw formations. It is probably the most characteristic soil of the Highland Rim plateau in Tennessee and occupies the smoother parts of the ridge tops of this physiographic area and is characterized by a grayish silty surface or A layer, a yellow upper subsoil or B layer, and a hardpan layer directly below this. The soil is of moderately low fertility, and the internal drainage is noticeably impaired by the hardpan. The reaction is acid.

Following is a profile description of Dickson silt loam:

1. 0 to $1\frac{1}{2}$ inches, dark-gray friable silt loam.
2. $1\frac{1}{2}$ to 7 inches, brownish-gray or grayish-yellow loose friable silt loam.
3. 7 to 24 inches, light brownish-yellow firm but moderately friable silt loam or silty clay loam, becoming heavier and faintly mottled in the lower part.
4. 24 to 40 inches, mottled yellow, gray, and brown cherty silty clay loam having a brittle, hard, or resistant consistence that is very slowly pervious to moisture. This is the hardpan.
5. 40 inches +, mottled brown, red, and gray firm cherty silty clay loam. Cherty limestone bedrock is at a depth of 5 feet or more.

WOLFTEVER SERIES

The Wolftever soil is on low-lying terraces and is subject to occasional inundation. It is developed chiefly from alluvium washed from soils underlain by limestone and in this respect is similar to the Etowah soils. Being younger, the profile is less well developed than in the Cumberland and Hagerstown soils. The depth to the hardpan layer is not so great as in the Dickson soils. The relief is nearly level to sloping, and the external drainage is fair to good, but internal drainage is impeded by the compact layer of the subsoil. External climate, vegetation, and relief are similar to those of the Etowah soils, but internal climate is more moist and aeration is slower. The reaction is acid.

Following is a profile description of Wolftever silt loam:

1. 0 to 7 inches, light grayish-brown friable silt loam.
2. 7 to 20 inches, yellowish-brown compact silty clay loam to silty clay that breaks easily to coarse angular particles. The soil mass in place is hard and resistant to digging.
3. 20 to 40 inches, yellowish-brown faintly to moderately mottled with gray and yellow compact silty clay loam or silty clay.
4. 40 inches +, the material below this depth is variable. In places it is mottled gray, yellow, and brown silty clay loam; in others, it is a bed of gravel.

TAFT SERIES

The only soil of the Taft series has level or slightly depressed positions on low terraces and, like the Wolftever and Etowah soils, the parent material has been washed chiefly from soils overlying limestone.

Internal drainage is slower than for either Etowah or Wolftever soils, the surface layer is grayer, and the upper part of the illuviated layer is less compact than in the Wolftever, but there is a compact very slowly pervious hardpan in the lower part of the B or illuviated layer. The entire profile is acid.

Following is a profile description of Taft silt loam :

1. 0 to 7 inches, brownish-gray friable silt loam. When dry, it is ashy-colored. The surface inch in virgin areas is dark-gray silt loam.
2. 7 to 20 inches, grayish yellow to brownish yellow, grading with depth to mottled yellow and gray moderately friable silty clay loam.
3. 20 to 32 inches, mottled yellow, gray, and brown very compact slowly pervious silty clay.
4. 32 inches +, intensely mottled yellow, gray, and brown heavy silty clay, less compact than the layer above.

GRAY SOILS WITH A GLEI LAYER

The gray soils with a glei layer are distinguished by their gray surface layers and predominantly gray (glei) sublayers. The poor internal drainage favors the soil-forming process of gleization. Although poorly drained, the soils are not permanently wet in the upper layers. They are saturated for extended periods, however, and the sublayers are permanently wet. The soils of this group are of the Robertsville, Guthrie, Dowellton, and Melvin series. In respect to the presence of a hardpan or clay pan, the Robertsville qualifies also as a Planosol, as do some of the areas of the Guthrie. The hardpan layer is not usually sufficiently well developed in the Melvin soils to distinguish it as a Planosol.

ROBERTSVILLE SERIES

The Robertsville soil has level or slightly depressed positions on low terraces composed chiefly of material washed from soils overlying limestone. Having very slow internal drainage, it may be considered the most poorly drained member of a catena comprising the Etowah, Wolftever, Taft, and Robertsville series. The surface layer is highly leached, and the subsoil is mottled and grayer than the subsoils in the other three series. The reaction is acid.

Following is a profile description of Robertsville silt loam :

1. 0 to 7 inches, gray friable silt loam. The surface inch in virgin areas is dark-gray silt loam.
2. 7 to 15 inches, yellowish-gray silt loam, compact in place but breaking easily to aggregates. Splotches of gray and yellow are common.
3. 15 to 50 inches, mottled gray, brown, and yellow moderately compact silty clay loam or silty clay.

GUTHRIE SERIES

The Guthrie soil is developed either in place over limestone or on local alluvium or colluvium in closed depressions associated with soils developed over limestone. It resembles the Robertsville soil in profile features and in having very slow internal drainage. The parent rock from which the material of these two soils weathered was predominantly limestone. The soil as mapped is considered the most poorly drained member of the Abernathy-Ooltewah-Guthrie catena and is acid throughout.

Following is a profile description of Guthrie silt loam :

1. 0 to 7 inches, gray friable silt loam.
2. 7 to 20 inches, gray mottled with yellow and brown moderately friable silty clay loam.
3. 20 to 32 inches, mottled gray, yellow, and brown silty clay loam.
4. 32 inches +, bluish-gray heavy plastic clay with some splotches of yellow and brown ; not uncommonly within 20 or 30 inches of the surface.

DOWELLTON SERIES

The Dowellton soil is developed from either highly argillaceous limestones or calcareous clay shales on mild to moderate slopes of the uplands. It is associated with the Colbert soils. External drainage is fair to good, but internal drainage is very poor. The reaction is acid throughout.

Following is a profile description of Dowellton silt loam :

1. 0-1 inch, gray mellow silt loam, darkened by organic matter.
2. 1-6 inches, medium-gray to light-gray friable silt loam.
3. 6-10 inches, very pale yellowish-gray or whitish-gray friable heavy silt loam that is sticky when wet.
4. 10-48 inches, predominantly whitish-gray, very sticky and plastic silty clay, mottled with orange, yellow, and brown, extending to bedrock.

MELVIN SERIES

The Melvin soil is of the first bottoms, derived from limestone. It is the most poorly drained member of the Huntington-Lindsay-Melvin catena and is characterized by a gray surface layer and a predominantly gray subsoil. Subject to periodic flooding, the subsoil is nearly permanently wet, but the surface layer evidently becomes sufficiently drained for periods to favor oxidation of the organic matter. Chiefly because of its younger age, the profile characteristics in general are more variable than in the Robertsville soil. The reaction is slightly acid to slightly alkaline throughout the entire depth.

Following is a profile description of Melvin silt loam :

1. 0 to 8 inches, gray, faintly mottled with yellow and brown friable silt loam. Small dark-brown concretions are common to this layer as well as the layers below.
2. 8 to 36 inches, bluish-gray mottled with brown silty clay loam or silty clay.
3. 36 inches +, fine gravelly material.

HALF BOG SOILS

Half Bog soils are an intrazonal group of soils with mucky or peaty surface soil underlain by gray mineral soil; developed largely under swamp-forest types of vegetation, mostly in humid or subhumid climate (13). The principal soil-forming process of these soils is organic-matter accumulation in the surface layer and gleization. Conditions under which they are formed are such that there is an excess of water throughout the soil much of the time. Aeration is poor, and organic matter does not decay so rapidly as on better drained soils; consequently, organic matter accumulates in the surface layer. This accumulation, however, is not so marked in the Half Bog soils of Bedford County as in certain members of this group in other parts of the country. The lower part of these soils is subjected to reducing conditions most of the time, and as a consequence the subsoil is bluish gray. The Burgin and Dunning series belong to this group.

BURGIN SERIES

The Burgin soils are developed on colluvial-alluvial material washed chiefly from soils underlain by limestone. They are characterized by a dark surface layer, a gray plastic clay subsoil, and a slightly acid to slightly alkaline reaction. Although these soils are imperfectly or poorly drained, they are not so much so as typical Half Bog soils. It is thought that the organic matter has been preserved more by the relatively high calcium concentration than by impaired oxidation. Dark-brown concretions are common on the surface and throughout the entire soil mass.

Following is a profile description of Burgin silty clay loam :

1. 0 to 8 inches, dark-gray to almost black heavy but moderately friable silty clay loam.
2. 8 to 24 inches, very dark-gray to nearly black compact silty clay loam to silty clay, plastic when wet and brittle when dry. The mass breaks easily to a small nut structure.
3. 24 inches +, bluish-gray intensely mottled with yellow and brown compact plastic silty clay. Limestone bedrock is at a variable depth of more than 24 inches.

DUNNING SERIES

The Dunning soils are derived from heavy-textured alluvium washed chiefly from soils underlain by limestone. They differ from the Burgin soils in being on first bottoms rather than on colluvial slopes and as a consequence are subject to periodic flooding. They differ from the Melvin soil in being more permanently wet and in having a darker colored surface layer and heavier consistence. The soils are slightly acid to slightly alkaline.

Following is a profile description of Dunning silty clay loam :

1. 0 to 6 inches, dark-gray moderately friable silty clay loam.
2. 6 to 18 inches, very dark-gray to nearly black moderately compact silty clay loam breaking into small nut-sized fragments that are coated with a film of colloidal material.
3. 18 to 44 inches, dark-gray mottled with brown heavy plastic silty clay.
4. 40 inches+, mottled gray and yellow plastic silty clay.

ALLUVIAL SOILS

Alluvial soils are an azonal group of soils, developed from transported and relatively recently deposited material (alluvium) characterized by a weak modification (or none) of the original material by soil-forming processes (13). In Bedford County these soils are on first bottoms along streams. They have nearly level to depressional relief and medium to very slow internal drainage. Their main characteristic in common is lack of a soil profile in which the horizons are genetically related. They strongly reflect the character of the alluvial deposit.

Alluvial soils derived from similar parent materials may differ in conditions of drainage, and some differences of characteristics exist because of these differences. Alluvial soils derived from similar parent materials but differing in drainage have been differentiated mainly on the basis of characteristics associated with good, imperfect, or poor drainage and, collectively, constitute a soil catena. To bring out the relations among the alluvial soils, they are discussed in relation to their positions in soil catenas.

HUNTINGTON AND LINDSIDE SERIES

Soils of the Huntington and Lindsides series are well drained and imperfectly drained, and with the poorly drained Melvin series they make up the catena of soils composed of general alluvium derived chiefly from limestone. The Huntington soil is brown or dark brown to depths of 36 to 48 inches, and the Lindsides soils are brown to depths of 12 to 18 inches, below which they are mottled gray, yellow, and brown. The range in texture is not great. The surface layers are uniformly silt loam and the underlying material is silt loam or silty clay loam. The reaction is slightly acid to slightly alkaline.

EGAM SERIES

The only soil of the Egam series is closely related to the Huntington. It is derived from similar materials but is characterized by a layer, at a depth of about 15 to 20 inches, that is heavier textured and more compact than the corresponding layers of the Huntington. Whether these soils are older morphologically or are the result of particular periods of deposition of coarse and fine materials is unknown. In many places the compact layer is dark and suggests an old surface layer that has been buried under more recent alluvium. The upper 15 inches is generally brown mellow silt loam or silty clay loam, underlain by a layer of dark-brown compact silty clay about 10 inches thick. Below this, the material is brown or dark-brown compact silty clay loam or silty clay splotched with yellow and brown. This material is stiff and slightly plastic when wet and hard and brittle when dry. The reaction is neutral or slightly acid throughout. Inasmuch as this soil is subject to flooding and commonly receives new deposits of alluvial material, it would appear that the heavy layer is not entirely the result of illuviation from layers above; therefore, the soil has been placed in the alluvial soils.

ALLUVIAL SOILS, UNDIFFERENTIATED

The alluvial soils, undifferentiated, constitute a miscellaneous land type that represents such an intricate admixture of alluvium as to make their separate delineation on the soil map impractical. All the material is young from the standpoint of soil development, and most of it is on first bottoms along the smaller streams. The texture, content of chert and rock fragments, and conditions of drainage vary widely from place to place.

ABERNATHY AND OOLTEWAH SERIES

Abernathy or Ooltewah soils are well drained and imperfectly drained members, respectively, of a catena whose soils are derived from local colluvium washed mainly from soils underlain by limestone. They are somewhat comparable to Huntington and Lindsides soils, respectively, in internal drainage. External drainage is poor on both, and most of the drainage is internal through cracks and crevices in the underlying limestone bedrock. Internal drainage is moderate to rapid in the Abernathy and slow in the Ooltewah. Areas of this material with very slow drainage have developed a glei layer and are, therefore, represented by the Guthrie series. Ooltewah silt loam has been influenced somewhat by gleization.

Abernathy silt loam is a comparatively young soil. It is brown or dark-brown mellow silt loam to a depth of 30 inches or more, below which the material may be moderately mottled. Ooltewah silt loam is generally grayish or brown mellow silt loam to a depth of 8 to 16 inches, below which is mottled gray, yellow, and brown silt loam or silty clay loam. The entire profile of the soils of these two series is acid.

LITHOSOLS

Lithosols are "an azonal group of soils having no clearly expressed soil morphology and consisting of a freshly and imperfectly weathered mass of rock fragments; largely confined to steeply sloping land" (13). Three kinds of lithosols are mapped: (1) Stony and limestone outcrop land types, (2) fresh colluvium on steep slopes (Dellrose series), and (3) rough gullied land.

STONY AND LIMESTONE OUTCROP LAND TYPES

Stony land and limestone outcrops are on highly argillaceous limestone and as a consequence have developed very slowly. Geologic erosion has more nearly kept pace with the rate of accumulation of the soil material than on the more mature associated soils, even where the surface has a gentle gradient. The soil material is of extremely variable thickness, and limestone outcrops are numerous. There is very little evidence of genetic horizons except in limited spots where the soil material is of more than average thickness (16 inches or more). In such places the profile approximates that of the Colbert, Talbott, Hagerstown, Mercer, or Mimosa soils, according to the parent rock and conditions under which the soil-forming processes have been operating. The stony land types represent areas in which there is sufficient soil material to support an appreciable grass cover; the limestone outcrop land type represents areas in which there is not sufficient soil material to support an appreciable grass cover.

DELLROSE SERIES

The Dellrose soils are azonal and are composed of a comparatively thin layer of colluvium over weathered material formed in place on steep slopes, chiefly from limestone of the Ordovician system. The colluvium was transported chiefly from Bodine, Baxter, and Dickson soils of the Highland Rim. The Dellrose soils are in the Highland Rim escarpment physiographic belt. They have steep slopes, are well drained, and the thickness of the colluvium ranges from 2 to 8 feet. Their azonal character is due chiefly to steep slope and consequent unstable nature of soil material. The soils are slightly to medium acid and apparently not poor in phosphorus content.

Following is a profile description of Dellrose cherty silt loam:

1. 0 to 15 inches, grayish-brown or brown friable cherty silt loam, varying from 6 to 30 inches deep. The surface inch or two in virgin areas is dark-brown silt loam containing some chert.
2. 15 to 45 inches, brownish-yellow or yellowish-brown moderately sticky and plastic silty clay loam, the lower part mottled somewhat with yellow.
3. 45 inches +, mottled yellow and gray plastic silty clay. Bedrock of argillaceous limestone is at a depth of 4 to 30 feet.

ROUGH GULLIED LAND

One mapping unit, rough gullied land (Mimosa soil material), represents areas so mutilated by accelerated erosion as to make their reclamation for the production of crops impractical except through very long periods of time. Nearly all of the surface soil and part of the subsoil has been lost by erosion, and most of the acreage has been reduced to an intricate pattern of destructive gullies. This land type may be considered as a man-made lithosol.

COLOR GROUPS OF THE MAP LEGEND

The soils represented on the map are arranged in eighteen groups, each represented by a distinguishing color: Groups 1 to 7 are soils of the uplands; 8, 9, 10 are soils of the colluvial slopes and depressions; 11, 12, 13 are soils of the terraces; 14, 15, 16 are soils of the bottom lands; and 17 and 18 are miscellaneous land types.

Of the seven groups of soils of the uplands, groups 1 and 2 include the soils within the Highland Rim escarpment and plateau physiographic area; groups 3 and 4 include the soils of the outer Central Basin; and groups 5, 6, and 7 include the soils of the inner Central Basin. The rest (8 to 18, inclusive) do not correlate with these three physiographic areas, but occupy topographic features (colluvial slopes and depressions, terraces, and bottom lands) or represent special land conditions (stony land types and gullied land) within the three major physiographic areas.

The groups of soils of the Highland Rim escarpment and plateau area are composed of well-drained soils. These two groups are distinguished from each other by position and by degree of slope. The soils of the first group are on ridge crests and have an undulating to rolling slope. Most of the soil areas are narrow and tortuous and are flanked invariably by soils of the second group, which have steeper slopes. The soils of the second group are on the ridge slopes and have hilly to steep slopes.

The two groups of the outer Central Basin consist principally of undulating to rolling soils. These groups are distinguished from each other by differences in degree of internal drainage. The first group has moderate internal drainage, and in this respect the individual soil members are particularly favorable for the production of most plants commonly grown. In the second group the movement of water is more retarded, and, in this respect, the soil members are less favorable for the production of most plants commonly grown.

The three groups of the inner Central Basin likewise are undulating to rolling and are distinguished by differences in degree of internal drainage. The internal drainage conditions of the first two groups are comparable with those of the respective groups of the outer Central Basin. The third group is characterized by such a retarded movement of moisture within the soil as to limit considerably the production of plants commonly grown.

The first group under colluvial slopes and depressions, terraces, and bottom lands includes soils, the internal drainage of which is particularly favorable for the production of most plants commonly grown for agricultural use; the second under each of these headings includes soils less favorable for the production of such plants; and the third group

under each of these three headings includes soils, the drainage of which is so slow as to cause them to be poorly or very poorly suited to the production of most plants commonly grown. All these soils are predominantly very gently sloping or nearly level, except the well-drained soils of the terraces. These are undulating to sloping.

The last two groups are composed of land types and are considered as miscellaneous groups. Most areas of these land types are in the upland, their internal drainage is slow, and their gradient is undulating to hilly.

This grouping shows (1) the general relationship between the individual soil units and the broad topographic and physiographic divisions of the county; (2) distinguishes the well drained, the intermediately drained, and the poorly drained soils; and (3) indicates directly or indirectly the general character of the relief of each group.

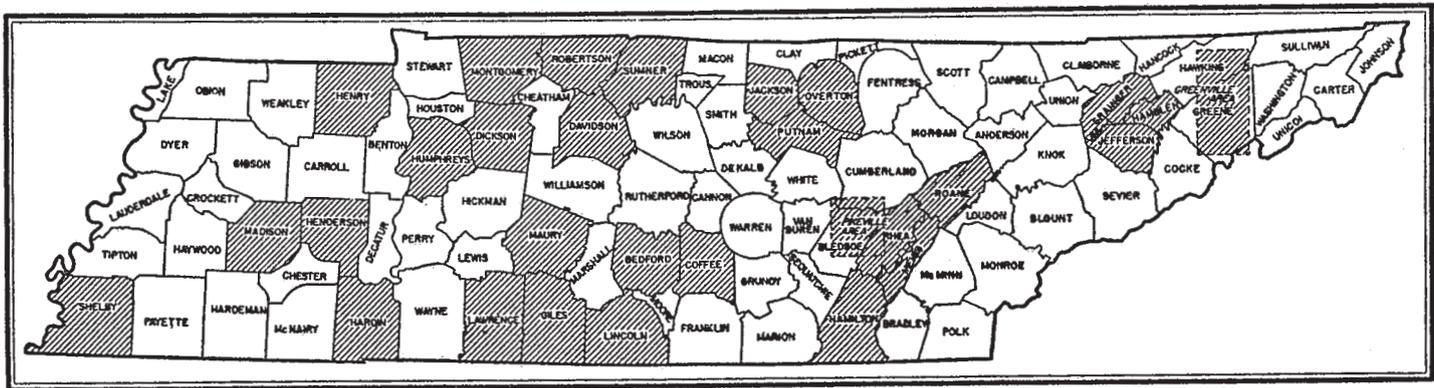
There are many objectives or purposes that this grouping does not fulfill and consequently, care must be used in interpreting or using it. It cannot be used for such objectives as determining the relative fertility, suitability for specific crops or general agricultural use, and relative conservability of the soil members of the groups. In general, such assumptions or correlations will be in error. For example, although the grouping does distinguish soils having favorable relief for agricultural use from soils having a less favorable (steeper) relief, care must be taken not to assume that all groups having the most favorable relief are the most favorable in other respects for agricultural use. Thus the slope or relief of the poorly drained soils of the bottom lands is very favorable, but other features, particularly internal drainage, are so unfavorable as to cause the soils to be poorly suited for agricultural use.

For groupings according to other objectives than those stated for the grouping expressed by color hues on the soil map see the sections on Estimated Yields and Productivity Ratings and Classification of Soils. A descriptive legend or tabular summary is attached to the last page of this report as an aid in the understanding of the individual mapping units shown on the soil map.

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Areas mapped in Tennessee shown by shading.

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