How to Use THE SOIL SURVEY REPORT

FARMERS who have lived in one locality for a long time come to know about the soil differences on their own farms and on those of their immediate neighbors. What they do not know, unless a soil survey has been made, is how nearly their soils are like those on experiment fields or farms from which higher yields are reported. They do not know whether these higher yields are from soils like their own or so different that they could not hope to get equally high returns, even if they adopted the practices followed in these other places. The similarities and differences among soils are known only after a map of the soils has been made. Knowing what kind of soil one has and comparing it with soils on which new developments have proved successful will remove some of the risk in **trying new methods and varieties.**

SOILS OF A PARTICULAR FARM

To find what soils are on any farm or other land, locate the tract on the soil map, which is in the envelope inside the back cover. This is easily done by finding the locality the farm is known to be in and locating its boundaries by such landmarks as roads, streams, villages, and other features.

Each kind of soil is marked with a symbol on the map; for example, all soils that are marked DST are of the same kind. To find the name of the soil so marked, look at the legend printed near the margin of the map and find DST. The color of the symbol as it appears in the legend will be the same as the color in which it appears on the map. DST stands for Dewey silt loam, slightly eroded undulating phase. A section of this report tells what this phase is like, for what it is mainly used, and some of the uses to which it is suited.

Suppose one wishes to know how productive is Dewey silt loam, slightly eroded undulating phase? Find the soil name in the left-hand column of table 7, and in the columns to the right note the expected acre yields for important crops. Compare the yields given for this soil with those listed for other soils in the county.

Or suppose one wants to know what is good use and management for Dewey silt loam, slightly eroded undulating phase. This information is given in the section on Soil Use and Management: the soils are grouped according to similarity in management, and the management requirements in each soil group are discussed.

SOILS OF THE COUNTY AS A WHOLE

If a general idea of the soils of the county is wanted, read the introductory part of the section on Soils. This tells where the principal kinds are found, what they are like, and how they are related to one another. Then study the soil map and notice how the different kinds of soils tend to be arranged in different localities. These patterns are likely to be associated with well-recognized differences in type of farming and land use.

A newcomer who considers purchasing a farm in the county will want to know about the climate as well as the soils; the types and sizes of farms; the principal farm products and how they are marketed; the kinds and conditions of farm tenure; kinds of farm buildings, equipment, and machinery; availability of schools, churches, highways, railroads, and telephone and electric services; water supplies; industries; and towns, villages, and population characteristics. This information will be found in the sections on General Nature of the Area and on Agriculture.

Students and others interested in how the soils of the county were formed and how they are related to the great soil groups of the world should read the section on Morphology, Genesis, and Classification of Soils.

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

SOIL CONSERVATION SERVICE
ROBERT M. SALTER, *Chief*
CHARLES E. KELLOGG, *Chief, Soil Survey*
ALABAMA DEPARTMENT OF AGRICULTURE AND INDUSTRIES
JOE N. POOLE, *Commissioner*
L. G. BRACKEEN, *In Charge Soil Survey*
ALABAMA AGRICULTURAL EXPERIMENT STATION
E. V. SMITH, *Director*
and the
TENNESSEE VALLEY AUTHORITY

Series 1941, No. 5 Issued March 1953

SOIL SURVEY OF LIMESTONE COUNTY, ALABAMA

By A. H. HASTY, in Charge, K. V. GOODMAN, and ROBERT WILDERMUTH, Division of Soil Survey,[1] Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, United States Department of Agriculture, and HOYT SHERARD, Alabama Department of Agriculture and Industries, and E. D. McCALL, H. R. BENFORD, and H. J. WESSON, Alabama Agricultural Experiment Station

Area inspected by J. W. MOON, Principal Soil Scientist, Division of Soil Survey

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

CONTENTS

[1] The Division of Soil Survey was transferred to the Soil Conservation Service November 15, 1952.

LIMESTONE COUNTY forms the central part of the most northern tier of Alabama counties. Agriculture has been the principal activity since settlement began, and except for a cheese factory at Ardmore and several scattered sawmills, there is little industrial development. Cotton, corn, and hay are the main crops, with cotton being the chief cash crop. Rye, oats, barley, and wheat are grown to a limited extent, and peaches, apples, pears, and cherries are produced mainly for home use. Livestock is an important source of income. Some dairying is carried on in all parts of the county, but the largest dairies are in the southern part where there are also a few herds of beef cattle. Swine and poultry are grown for home use and the surplus is marketed. Most of the farm products are shipped out for processing and manufacture. Ardmore, Elkmont, and Athens, the county seat and largest town, are market and supply centers along the railroads.

To provide a basis for the best agricultural uses of the land a cooperative soil survey was made by the United States Department of Agriculture, the Alabama Department of Agriculture and Industries, the Alabama Agricultural Experiment Station, and the Tennessee Valley Authority. Field work was completed in 1941 and, unless otherwise specifically mentioned, all statements in this report apply to conditions in the county at that time.

GENERAL NATURE OF THE AREA

LOCATION AND EXTENT

Limestone County forms the central part of the most northern tier of Alabama counties (fig. 1). It is bounded on the north by the Alabama-Tennessee State line and on the south by the Tennessee River, which flows from southeast to northwest. The county has an aggregate area of 568 square miles, or 363,520 acres. The county seat, near the center of the county, is 90 miles north of Birmingham, 175 miles northwest of Montgomery, and 310 miles northeast of Mobile.

PHYSIOGRAPHY, RELIEF, AND DRAINAGE

Limestone County is a part of the Highland Rim section of the Interior Low Plateaus physiographic province of the United States (*1, 10*).[1a] It lies in the Tennessee Valley and is comprised of three

[1a] Numbers in parentheses refer to Literature Cited, p. 139.

physiographic subdivisions: The Limestone Valleys, the Plateau, and the Alluvial Plains (fig. 2). The first two of these subdivisions cover most of the county, whereas the Alluvial Plains occur along the rivers and creeks throughout the area.

The Limestone Valleys, locally called the red lands, include the southeastern quarter of the county, or practically all the part south of township 3, south, as well as other smaller areas along the Elk River and the eastern border of the county. This section ranges from about 12 miles in width in the eastern part to about 1 mile in the western. The area has an undulating to rolling relief, the elevation

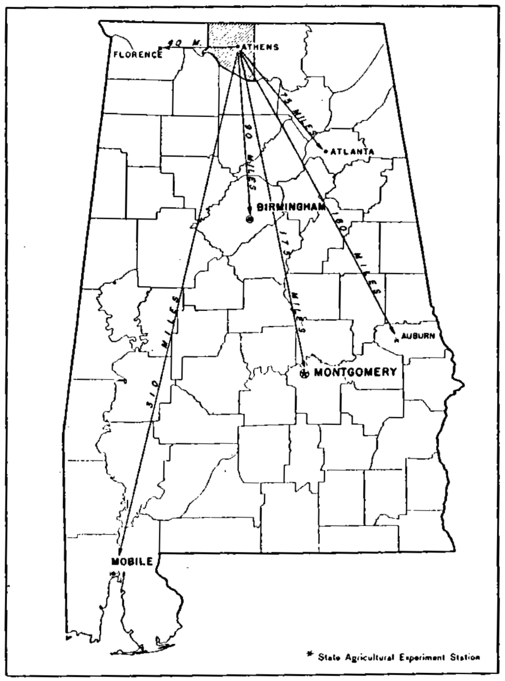


FIGURE 1.—Location of Limestone County in Alabama.

ranging from about 556 feet above sea level at the surface of Wheeler Reservoir to 719.9 feet at the courthouse in Athens.[2] The smoothest parts are on the broad ridge tops between the main creeks. Greenbrier, Mooresville, Bella Mina, and Harris are settlements on some of the smoother areas. The surface is generally more rolling adjacent to the major stream channels and especially so near the Tennessee River.

The Plateau section, locally known as the gray lands, occupies the rest of the county north of the Limestone Valleys. This section has

[2] Elevation data from U. S. Coast and Geodetic Survey and U. S. Geological Survey topographic maps or bench marks.

wide variations in surface relief—several large areas are almost level to undulating or gently sloping, while other areas, particularly in the northwestern and western parts of the county, are badly dissected. The largest of these extends northeastward from north of Blackburn School to a point near the northeastern corner of the county. The highest elevations on the Plateau are 800 to 850 feet above sea level,

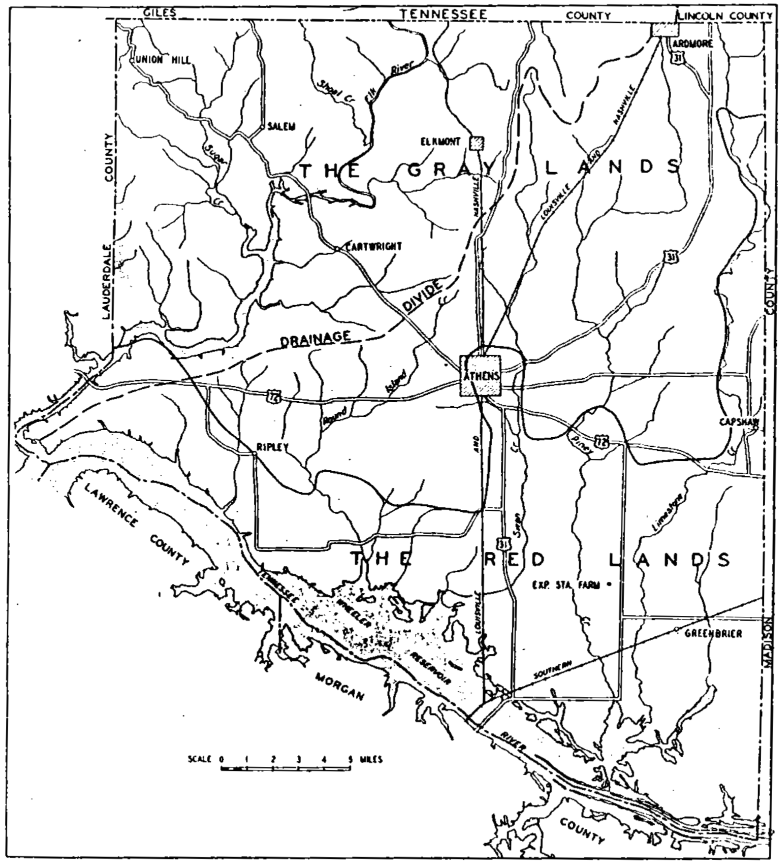


FIGURE 2.—Physiographic map of Limestone County, Ala., showing the drainage system.

and the elevation at the railroad station in Elkmont is 803.9 feet. The roughest and most broken areas are along the Elk River and Sugar Creek in the northwestern part of the county. The larger streams in that area have cut narrow gorges 75 to 200 feet deep, and in places along these streams there are bedrock precipices up to 100 feet or more in height. This dissected area is characterized by narrow valleys and narrow, winding, steep-sided ridges and knolls. The slopes often range to 60 or 70 percent.

The Alluvial Plains section includes nearly level to undulating first bottoms and stream terraces along the Tennessee and the Elk Rivers and along some of the larger creeks. The areas in this physiographic subdivision are from a few feet to more than a mile wide. The first bottoms are subject to overflow from streams where they are not protected by the system of dams upstream on the Tennessee River and its tributaries. In addition to the areas of general alluvium there are some large shallow depressions, or sinks, throughout the county that consist of local alluvium. Most of these depressions are subject to at least temporary inundation during periods of heavy rainfall. The stream terraces are often as much as 100 feet above overflow.

The Tennessee River and its tributaries comprise the drainage system of the county. Some drainage is through subterranean outlets in sinks, and in localities where most of the drainage is through these underground passages the surface drainage system is not developed. Surface drainage is adequate for agriculture, except in parts of the first bottoms and in some of the sinks and depressions.

Water for farm use is obtained chiefly from wells, springs, and streams. Some farmers depend on cisterns for drinking water, and artificial ponds are sometimes the source of water for livestock. Springs are numerous in the gray lands section. The entire water supply for Athens is piped from a group of springs in a valley in that part of the county. Water is obtained from wells in the Plateau section at depths of 25 to 40 feet. Springs occur much less frequently in the Limestone Valleys section, and well water is at a depth of 60 to 120 feet.

CLIMATE

The county has a temperate and continental climate. Winters are moderate, the cold periods being short and erratic. Summers are warm but maximum temperatures of 100° F. are rare. The difference between the average summer and winter temperatures is 35.2°. The highest temperature on record is 108°, and the lowest, −12°. The average total precipitation is 48.72 inches; the total precipitation for the driest year is 34.70 inches; and that for the wettest, 68.75 inches. Snowfall averages 2.3 inches.

Moisture conditions are favorable for crop growth through spring and early summer, but late in summer and early in fall there is relatively little precipitation. In July and August the rainfall is about as heavy as in any of the spring months, but the high prevailing rate of evaporation nullifies its effectiveness to a considerable extent, and reserve moisture from earlier months is also reduced by transpiration and evaporation. Consequently, tillage late in summer and early in fall is not favorable for optimum growth of pasture or for winter wheat, crimson clover, vetch, or similar fall-sown crops. The dry period, however, is favorable for harvesting.

Wind is of low average velocity; hailstorms, tornadoes, or other extremes of weather are infrequent. Rains are usually heavy enough to cause considerable runoff, and erosion is often great. Erosion hazard is greatest late in winter and early in spring because precipitation is heavy. Alternate freezing and thawing have the greatest loosening effect on the surface soil, and vegetation growth almost ceases. A good growing cover can be maintained through winter if the right crops are selected.

The average frost-free season extends from March 27 to November 7, a period of 224 days. This is sufficient time for practically all field crops grown in this part of the United States to mature. Late spring frosts occasionally damage fruit crops, but early fall frosts are seldom if ever harmful to any but susceptible late-planted truck crops. In winter, field work is greatly reduced but many outside farm activities can be continued. The ground is rarely frozen to a depth of more than a few inches, and it usually thaws in a few days. Alfalfa and fall-sown crops are sometimes damaged slightly by the recurrent periods of freezing and thawing, which is characteristic of late fall, winter, and early spring. Frost also increases the erosion hazard by loosening the soil.

Normal monthly, seasonal, and annual temperature and precipitation data representative of weather conditions in the county are given in table 1. These data are compiled from records at the United States Weather Bureau station at Decatur, which is just across the Tennessee River, in Morgan County, Ala.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Decatur, Morgan County, Ala.*

[Elevation, 573 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	45.5	76	0	5.04	4.50	9.68	0.6
January	42.4	79	−5	4.63	1.90	8.46	.6
February	44.0	84	−12	4.43	1.25	6.91	.9
Winter	44.0	84	−12	14.10	7.65	25.05	2.1
March	53.1	93	4	5.62	7.60	3.89	.1
April	61.8	92	26	4.48	2.78	4.25	(1)
May	70.0	100	34	3.83	3.04	1.97	0
Spring	61.6	100	4	13.93	13.42	10.11	.1
June	77.9	108	47	3.79	1.51	6.53	0
July	80.3	107	54	4.35	5.39	4.05	0
August	79.3	106	52	3.91	2.91	8.09	0
Summer	79.2	108	47	12.05	9.81	18.67	0
September	74.1	104	36	2.37	1.60	2.37	0
October	62.2	100	27	3.07	.30	8.83	0
November	50.9	85	10	3.20	1.92	3.72	.1
Fall	62.4	104	10	8.64	3.82	14.92	.1
Year	61.8	108	−12	48.72	[2] 34.70	[3] 68.75	2.3

[1] Trace. [2] In 1904. [3] In 1932.

WATER SUPPLY

The water supply is generally good for all purposes. Springs are numerous along many of the larger streams, especially in the northwestern part of the county, and consequently there is a good supply of running water for cattle and livestock on many farms. Where running water is not available, artificial ponds for cattle, work stock, and hogs can usually be constructed with little effort or cost. Springs, wells, or cisterns for drinking water may be had on most farms without exceptional expense.

Wheeler Dam blocks the Tennessee River about 6 miles below the southwestern corner of the county and forms Wheeler Reservoir (pl. 1). The reservoir, extending the full length of the county and for several miles up the tributary Elk River, affords much fishing, swimming, and boating and is within an hour's drive of practically all residents of the county. Limestone, Piney, Swan, Sugar, Beaver Dam, Shoal, and Round Island Creeks flow their full length nearly all year, and in their lower stretches, the year round.

VEGETATION

Forest occupies about 94,520 acres in the county (*16*), chiefly on steep slopes and the wetter areas. Nearly 60 percent of this acreage is upland hardwood, about 26 percent is bottom-land hardwood, and about 10 percent is mixed yellow pine and hardwood. Reestablished forest on previously tilled areas is commonly pine, either loblolly or shortleaf. Pure loblolly pine stands established in this way are common and are a valuable asset to any farm (pl. 2, *A*).

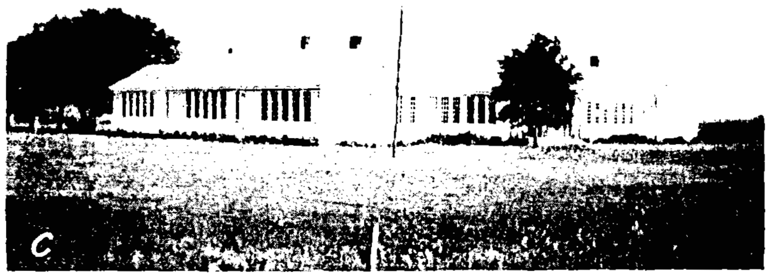
Originally the red lands part of the county supported a heavy hardwood growth of tuliptree (yellow-poplar); beech; hackberry; white, post, and red oaks; blackgum; hickory; and other similar trees. Timber on the level part of the gray lands is generally scrubby, and little of it is grown to sizes suitable for sawing. Post, white, Spanish, and red oaks; hickory; and blackgum are the principal trees. The hilly parts grow white, red, and black oaks; hickory; tuliptree; and other trees.

Little merchantable timber is left in the county and that remaining is confined largely to the steep slopes and wet lands. Only a small quantity of saw timber is harvested, a large part of the trees being cut for firewood before they become large enough for lumber. A few small areas of pine large enough to saw remain on the upland, and some hardwood stands remain in the bottoms. Little tree planting is being done except on those areas purchased by the Tennessee Valley Authority in connection with Wheeler Reservoir. The principal trees planted thus far on the reservoir areas are loblolly and shortleaf pines and black locust. Nearly all except the steeper areas and wet lands of the county have been cleared.

ORGANIZATION AND POPULATION

Limestone County was organized in 1819, mainly from lands purchased from the Indians by the United States in 1816. A small part of the northeastern corner had been secured in an earlier purchase. Settlers came in rapidly from States farther north and east. Largely because of better health conditions prevailing on higher ground, settle-

Wheeler Reservoir, approximately 30,000 acres of which is in Limestone County, affords considerable fishing and recreation.



A, Stand of loblolly pine established on abandoned area of Dickson silt loam, eroded undulating phase.
B, Elementary school in a rural district.
C, Consolidated school in a rural district.

ment was on the more elevated areas along Limestone Creek and other creeks in the eastern part of the county.

The population of the county has shown a fairly steady increase, and in 1950 there were 35,766 inhabitants. Athens, the largest town and county seat, had a population of 6,309; Ardmore, 408; Elkmont, 179; and Mooresville, 101. Most of the present population is native-born, and settlement is fairly uniform throughout the county. The Negro population is confined almost entirely to the red lands section.

INDUSTRIES

Except for the cheese factory at Ardmore and a few small scattered sawmills, there is little industrial employment in the county. A large percentage of the agricultural products produced in the county are shipped out for processing and manufacture.

TRANSPORTATION AND MARKETS

Two main-line railroads cross the county. The Louisville and Nashville Railroad (Nashville to Birmingham) crosses north to south through the central part of the county. From Athens southward this is a double-track road; northward from Athens to Nashville are two single-track routes, one through Ardmore and the other through Elkmont. The Chattanooga to Memphis division of the Southern Railway crosses the southeastern corner of the county.

United States Highway No. 31, extending north to south across the county, intersects east-west Highway No. 72, at Athens. Freight and bus services are good on both of these main highways. Several miles of paved county highway are in service, and more paving is being done. Graveled roads extend to most parts of the county and additional roads are being improved. At Decatur, Ala., 15 miles south of Athens, there is a dock for waterway shipping on the Tennessee River.

A number of small crossroad stores and gasoline stations exchange poultry products and some dairy products for merchandise. Nearly all parts of the county are served at least weekly by one of the numerous traveling stores that take poultry and some dairy products in trade for goods.

Some cream and milk routes extend into the more important dairying sections of the county. Milk produced in the county is sold retail in Decatur and Athens or to the cheese factories at Decatur and Ardmore.

PUBLIC FACILITIES AND FARM AND HOME IMPROVEMENTS

Limestone County, exclusive of Athens, has 5 senior high schools, 3 junior high schools, and 51 white and 31 colored grammar schools. The Athens schools, both white and colored, offer a full 9-month schedule for all grades through high school. Athens College for Women, a coeducational school, has an enrollment of 400 to 600 students and offers degrees in a number of college courses. School buildings of the county are generally kept in fair to good repair, and many have two, three, or more rooms (pl. 2, *B*). Some schools are consolidated (pl. 2, *C*), and busses transport students to them from the more distant parts of the county.

Churches of various denominations accommodate practically all communities.

Rural electrification lines are being extended to nearly all parts of the county, and on May 1, 1941, there were a few more than 1,100 users in the rural sections. Numerous additions were expected to be made during the immediately succeeding months. In addition to lights, many farm homes are adding radios, washing machines, refrigerators, and other electrically operated home conveniences. Eighteen rural telephone lines, serving approximately 100 customers, extend into the surrounding county from Athens.

Rural homes vary from the one- or two-room shacks (pl. 3, *A*) to large, well-constructed and well-maintained brick homes. Much of the red lands part of the county is owned by people living out of the area, and the average tenant home is of poor construction, consisting of three to four rooms, often unceiled and seldom kept painted. The owners who live in the red lands usually have good to excellent homes. A larger part of the gray lands section of the county is owner-operated, and there the average home is a well-constructed five- to six-room frame house, all ceiled or plastered and painted (pl. 3, *B*). In 1945, 358 farms reported running water; 1,335, electricity; and 152, a telephone within the farm dwelling.

In 1945, 1,303 farms reported 1,363 automobiles; 485 farms, 540 motor trucks; and 601 farms, 732 tractors. Much of the red lands is farmed by tractors and other improved farm machinery. The plateau lands lend themselves less readily to the use of tractors and other heavy farm machinery, and consequently a greater use is made of mules and horses. Many farmers in both sections have tractors, however, and use of heavy machinery is increasing. Temporary barbed-wire fences are used in most instances, even around pastures. Only a few fields are fenced.

AGRICULTURE

During Indian occupation of the area now included in the county, deer, bears, elk, turkeys, squirrels, fish, and other wild game were so plentiful that little attention was given to growing crops. Actual agriculture began about 1807 when the first settlers arrived.

Agriculture was the main activity in early days, just as it is now. All the settlers had a garden or a farm and grew crops largely for home use. Soon they began raising corn, wheat, and livestock for shipment, producing flax for clothing, and making maple sirup and sugar for home consumption. Most o fthe clothing, shoes, and furniture were made at home. The principal foods included wild game, salt pork, potatoes, beans, turnips, corn bread, coffee, and milk.

As the county developed, large tracts of the red lands were cleared because of their relatively high productivity. These lands soon proved valuable for cotton and other common crops of the area. Before railroads were built the crops were transported down the Tennessee River to New Orleans, where a ready market usually could be found. Farm produce was usually loaded on flatboats early in spring, because the high spring floods were an advantage in getting over Muscle Shoals, near Florence. Until Wilson Dam was constructed just above Florence about 1918, Muscle Shoals was one of the chief obstacles to shipping on the Tennessee River. Cotton Port, an abandoned town a little southwest of Mooresville, was the chief shipping point for the county. Some supplies were brought down the Tennessee River and sold to early settlers.

Because rapid shipping facilities were lacking, and for other reasons, agriculture was somewhat retarded at first, but each farmer grew crops ample for home consumption. The first rapid transportation was furnished by the Southern Railway, which was constructed across the southern part of the county about 1856.

CROPS

Cotton was planted on more land than any other single crop until 1939. Corn for grain usually ranked a close second, but in 1929 the cotton acreage almost doubled that of corn. Since then cotton acreage has declined about 40 percent, and corn has held its own.

Wheat and oats undoubtedly occupied an important place in the earlier agriculture of the county. The acreage of both increased from 1929 to 1944.

The acreage of the principal crops and number of fruit trees in the county for stated years are given in table 2.

TABLE 2.—*Acreage of the principal crops and number [1] of fruit trees in Limestone County, Ala., in stated years*

Crop	1919	1929	1939	1944
	Acres	*Acres*	*Acres*	*Acres*
Cotton	60,768	106,844	59,776	60,589
Corn harvested for grain	58,001	56,287	67,027	57,963
Wheat	1,269	133	355	2,716
Oats	470	68	405	2,525
Rye	48	20	41	250
Soybeans	(2)	6,466	10,500	9,306
Cowpeas	454	1,800	1,579	3,914
All hay and forage	18,854	14,724	31,853	10,891
Lespedeza	(2)	(2)	16,182	7,395
Alfalfa	(2)	63	781	1,070
Timothy and clover	(2)	233	778	175
Clover alone	(2)	1,183	[3] 472	(2)
Grains cut green	4,303	1,035	414	225
Legumes cut for hay	6,269	9,444	11,030	(2)
All other tame and wild grasses	6,373	1,816	1,531	2,026
Coarse forage	1,909	950	[4] 665	(2)
Potatoes	207	659	770	578
Sweetpotatoes and yams	251	318	476	443
All other vegetables	30	81	62	97
Sorghum cane (for sirup)	775	359	398	(2)
Tobacco	2	2	8	5
	Number	*Number*	*Number*	*Number*
Peaches ... trees	16,502	16,852	35,695	37,499
Apples ... do	14,660	11,701	20,253	18,688

[1] Number of bearing fruit trees given for 1919, 1929, and 1939; trees of all ages given for 1944.

[2] Not reported.

[3] Sweetclover only.

[4] Corn for forage.

COTTON

Cotton is the chief cash crop, and on a large percentage of the farms the farming program is built around its production. Limestone County usually ranks among the first six or eight counties of the State in cotton production. Cotton has been planted on a greater acreage than any other crop in the county for recent census years except 1939, when corn exceeded this crop.

In 1929 the cotton acreage almost doubled that of corn, the crop of second importance. Since then cotton acreage has greatly decreased, largely because of Federal control, while that of corn has increased. In 1944 the total cotton acreage was only 60,589, as compared with the 106,844 acres planted in 1929. Though the acreage has decreased almost 50 percent since 1929, the total yield has not been reduced in proportion because there has been a better selection of land and the use of improved management practices.

Nearly all the cotton is planted in April and May, the time of planting depending largely on the weather the farmers encounter in preparation for seeding. In preparing for planting the general practice is to plow the soil 5 to 6 inches deep, either in fall or early in spring. After the ground is broken, it is harrowed with a disk or spike-toothed harrow, or both. The winter cover crop is usually planted before corn, but in some instances it is planted before cotton. Where cotton is to follow a cover crop, the ground is broken in spring after the cover crop has made enough growth to produce 12 to 20 pounds of green tops to each 100 square feet (*18*).

After the ground has been broken and harrowed, various methods are used in preparing the seedbed. Most of the farmers on the more level areas use 2-row tractors and planters, applying fertilizer and planting seed in one operation. Where the land is more rolling or where the farms are small, the fertilizer is applied with a 1-horse distributor and then bedded. The seeds are then planted on the ridge. Part of the fertilizer is bedded, while the rest is applied at the time of planting. A common practice is to use 400 to 700 pounds of 6–8–4[3] fertilizer.

As soon as the cotton begins to grow, the ground is plowed or harrowed to kill the young grass and weeds. When the plants are 3 to 4 inches high, they are thinned to 10- to 18-inch hills, one or two stalks being left in each hill. Soon after thinning, the cotton is cultivated in a manner that will work some of the soil back against the plants. After this, the crop is cultivated at 10- to 15-day intervals, depending largely on frequency of rains. Cultivation kills the young weeds and grass and gradually works the soil around the stalks. Usually the cotton is gone over once or twice with hoes to thin the cotton and cut out the weeds not killed by cultivators. The tillage season lasts from 6 to 8 weeks, or until the stalks are large enough to shade the ground and check the growth of grass and weeds.

All cotton produced in the county is sold, shipment being by truck or railroad. Much of the seed is marketed and shipped, though some is retained for the next year's seeding and some is used for cow feed.[4]

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

[4] TISDALE, H. B., and DICK, J. B. RESULTS OF COTTON VARIETY TESTS IN ALABAMA. Ala. Agr. Expt. Sta. leaflet, 13 pp., 1940. [Processed.]

CORN

Corn has ranked a close second to cotton throughout most of the history of the county. In 1939 corn for grain exceeded cotton by more than 7,000 acres, but in 1944 it reverted to second place again. The acreage of hybrid corn is increasing rapidly. The county produces somewhat more corn than is consumed on the farms, and the greater part of the surplus is shipped by truck to markets in Decatur, Florence, and Huntsville, or sold to feed mills in Athens where it can be ground and shipped in mixed feeds. Most of the surplus is produced on the bottom lands along the rivers and larger creeks.

The average long-term yield has been slightly less than 17 bushels an acre for the county. The shift of corn from bottom lands to uplands as a result of flooding large parts of the bottom land along the Tennessee and Elk Rivers and larger creeks is probably reflected in the somewhat lower than average acre yield reported for 1939. Many farmers feel that they can increase the acre yield considerably through careful choice of land and better management practices. In 1944 the yield was 20.8 bushels per acre.

Many farmers plant vetch or some other winter cover crop in the center of the cotton row the latter part of August or in September. This cover crop is allowed to make growth until early in spring and is then plowed under as a green-manure crop, usually for corn. In preparation for corn the land is plowed broadcast and harrowed in much the same way as the cotton land.[5]

At planting time rows are marked off 3 to 4 feet apart, and varying quantities and kinds of fertilizer are applied in the drill. As with cotton the fertilizer is applied in the bottom of the furrow, and a small quantity of soil is allowed to roll in on top before the corn is dropped in the same furrow. Fertilizing and seeding are usually done in one operation, either by the 2-row tractor-drill or by the 1- or 2-row horse-drawn planter. Corn is planted in a deeper furrow and covered deeper than cotton. The seed is spaced 10 to 12 inches apart, and after the stalks are a few inches high, the plants may be thinned to 24 or 36 inches. Hybrid corn is spaced more closely and fertilization is at a higher rate. Corn is planted somewhat later than cotton, generally during May.

Cultivation is practiced chiefly to eliminate weeds that compete with the corn. As with cotton, corn is cultivated at 10- to 15-day intervals, depending on the weather, until about the time tassels begin to show. About 6 weeks after planting many farmers apply 50 to 75 pounds of nitrate of soda or its equivalent to the corn. The fields are generally gone over at least once with a hoe to cut out the weeds and small sprouts not killed by plowing. In tillage an effort is made to work the soil up around the cornstalks gradually so that they will be well braced when they reach maturity.

HAY

Alfalfa, clover or timothy, lespedeza, small grains cut for hay, and other tame and wild hay occupied 10,891 acres in 1944, a decrease of 20,962 acres from 1939 when the highest hay acreage was reported.

[5] MAYTON, E. L. RESULTS OF CORN VARIETY TESTS IN ALABAMA. Ala. Agr. Expt. Sta. leaflet, 5 pp., 1941. [Processed.]

Much of the hay planted in past years has been cowpeas and soybeans, with some red clover and timothy. Lespedeza, sericea lespedeza, and alfalfa are becoming more important. Most of the alfalfa acreage is on red soils, because little is known about its growth on the gray soils. A large part of the hay produced is consumed on the farms. Though many work animals have been replaced by tractors, the increase in dairy and beef cattle has tended to maintain or increase the need for hay. A moderate quantity of hay is used in mixed feeds and some is shipped by truck.

Lespedeza is sown on a large acreage, mostly for hay but to some extent for seed. Yields of ½ to 1½ tons of hay an acre are obtained, some of which is sold on outside markets. The crop is generally planted during March, either in a small-grain field or alone on a freshly prepared seedbed. In some instances the seed is broadcast on unplowed land and the soil is then scarified. For hay, 25 to 50 pounds of seed an acre is sown. The seed is broadcast by various hand-operated blowers and covered lightly or planted by small grain drills with a lespedeza attachment. Little fertilizer is applied directly under lespedeza, but in some instances a moderate quantity of phosphate may be used. Only one planting is needed, as lespedeza reseeds itself.

Unless care has been exercised in previous years to keep down weeds on the land, there are likely to be many weeds on the lespedeza field. To prevent these weeds from interfering with harvesting, many farmers prefer to eradicate them by going over the field once or twice during summer with a mowing machine set to cut high. The weeds are then raked off so that the hay will be as clean as possible.

Sericea lespedeza is an important hay and grazing crop. In preparing for seeding, the land is plowed in fall or early in spring and then harrowed a few times to kill weeds and grass. From 30 to 40 pounds an acre of seed is planted during March, April, May, or July. If covered, the covering should be extremely light. During the first year little if any hay is expected, because the stands are irregular and the growth is not vigorous enough to keep down weeds, but during successive years yields are good. The crop is cut once or twice each year when the stems are 15 to 18 inches high. The use of 600 to 1,000 pounds of basic slag or the equivalent in phosphate per acre is recommended (*6*). Sericea lespedeza, being a perennial, will probably continue to produce hay for at least 4 years or more (*2*).

Cowpeas and soybeans for hay are sown broadcast by grain drill or by hand, usually during June or early in July. In some instances these crops are sown following the harvest of a small-grain crop, but in others they are planted on land left idle since the removal of a crop the previous year. For hay, cowpeas and soybeans are not tilled and little fertilizer is applied. Cowpeas are seeded at the rate of 1 to 1½ bushels an acre, but the rate of seeding for soybeans differs somewhat, depending on the variety planted, because the size of seed varies considerably according to variety. For the smaller varieties, ½ bushel of seed an acre is sufficient; for larger varieties, 1 bushel is used. Yields of ½ to 1½ tons of hay an acre are produced.

Alfalfa is becoming a more important hay crop, especially in the red lands part of the county (pl. 3, *C*). To provide a favorable seedbed for alfalfa, a good growth of vetch or some other winter cover crop is turned under late in spring. During summer the ground is harrowed often enough to keep down or kill the weeds. A few weeks before seeding, 3 to 4 tons of ground agricultural limestone, about 50 pounds of muriate of potash (potassium chloride), and 500 pounds of superphosphate or 1,000 pounds of basic slag an acre are applied and thoroughly worked into the soil. An annual top dressing of about 50 pounds of muriate of potash and 500 pounds of superphosphate or 1,000 pounds of basic slag an acre is recommended (*6*). The top dressing is usually applied in spring after the first hay cutting or in fall after the last cutting. After top dressing is broadcast, the land is harrowed with a disk harrow set at a very slight angle and then cross-harrowed with a section harrow.

Seeding is done in August or September with a wheelbarrow seeder, a cyclone seeder, or by hand. Twenty-five pounds or more of seed an acre are planted. After the stand has become well established, hay is cut two or three times a year, depending on the rapidity of growth. A good sod of alfalfa will remain 4 to 6 years or more. The length of time alfalfa will remain on a given field is dependent on the type of soil, the fertilization, the care of the sod, and the effort used to eradicate weeds. Some fairly good alfalfa fields have been established in the county, and more interest is being shown in the crop each year. Annual yields of 2, 3, or more tons an acre are obtained. Some of the hay is sold for shipment out of the county, but a large part is fed on the farms.

Kudzu is being tried on only a few farms as a hay crop, but some interest is being shown in its use on badly eroded areas, since it serves as a check to erosion and as a temporary grazing crop and hay crop. Kudzu is usually propagated by 2-year-old crowns set about 10 feet apart each way. These crowns are set in about the same manner as sweetpotato plants.

For a good hay crop from kudzu, the land is thoroughly plowed and harrowed in order that a mowing machine and rake can be driven over the ground readily. The ground is fertilized with 400 to 600 pounds of basic slag, or its equivalent, and good applications of manure are made when available. The manure is applied so that it does not come in direct contact with the plants. The ground should be well tilled for 1 or 2 years so that weeds and grass will not choke out the kudzu. Cotton, corn, or similar clean-cultivated crops are planted between the rows, and their cultivation serves to control weeds. After 1 or 2 years of good care, the kudzu plants will have formed a good stand by rooting from the joints and spreading.

SMALL GRAINS

The acreage planted to wheat, oats, rye, and barley varies considerably from year to year. Wheat usually produces only fair yields, though fairly high returns can be obtained with proper selection of land and correct fertilization. Yields of 25 to 30 bushels or more an acre have been reported, but the county average is generally less than 10 bushels. A small part of the wheat is ground into flour for home use, some is used in mixed feeds, and some is sold and shipped out of the county. Small combines are used in harvesting much of the wheat and oats.

Oat yields are good under good management; yields of 60 to 75 bushels an acre have been reported, but the average for the county is generally below 15 bushels an acre. The better farmers average 30 to

60 bushels an acre. For the best crop, a rust-resistant variety is chosen and the seed is treated to prevent smut. Oats sown during September or the first part of October usually average nearly twice as large a yield as the spring-seeded crop. Where oats are seeded after a well-fertilized crop of cotton, fertilizer is generally not applied except as a top dressing. From 100 to 300 pounds of nitrate of soda an acre is applied late in February or in March. Oats are used as feed for work stock, hogs, and poultry; but some are shipped, used in the preparation of mixed feeds, or planted for spring and early summer grazing.

Rye and barley are planted mainly for spring and summer grazing. A small acreage of both crops is harvested for seed, but the county probably produces less seed from these two crops than is used in sowing the following year (*8*).

WINTER COVER CROPS

Vetch and crimson clover are the chief winter cover crops, but Austrian winter peas are used to a limited extent. Some of the vetch varieties used are hairy, Willamette, monantha, and common. Crimson clover produces seed rather abundantly and is preferred to vetch on the more fertile areas. The hard-seeded strains generally produce a stand each succeeding year.

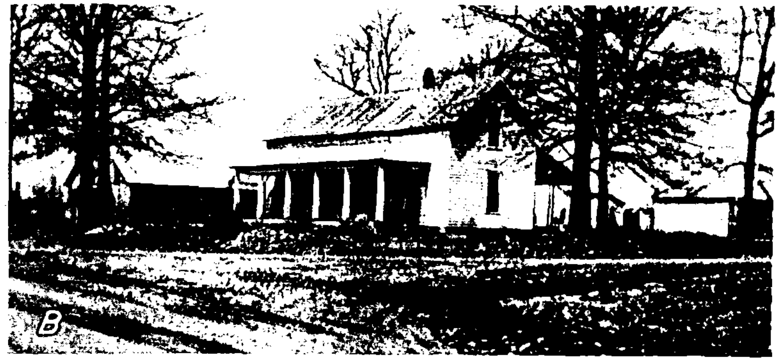
During the latter part of August or in September vetch is planted in cotton or corn middles, commonly with a 2-row planter. The fertilizer, usually 400 to 600 pounds of basic slag or 200 to 400 pounds of superphosphate per acre, is drilled with 20 to 30 pounds of seed, all in one operation. If basic slag is used, the seed and fertilizer are sometimes mixed. When superphosphate is used, care is exercised to keep the seed separate, because the inoculation is killed by superphosphate.

Unless fall rains are plentiful, the cover crop will not make any considerable growth until spring. When used as a cover crop, the growth is turned under when it has produced 12 to 20 pounds of green tops per 100 square feet. Complete coverage of all growth is aimed at in this turning. Where vetch is grown for seed, as a small part of the crop is, the plants are allowed to mature, and the seed is then harvested by combine. Some farmers harvest seed for home use or for market, but the majority prefer buying seed. Some difficulty has been met in producing seed from the more desirable winter cover crops, but this is being overcome somewhat by a proper choice of varieties.

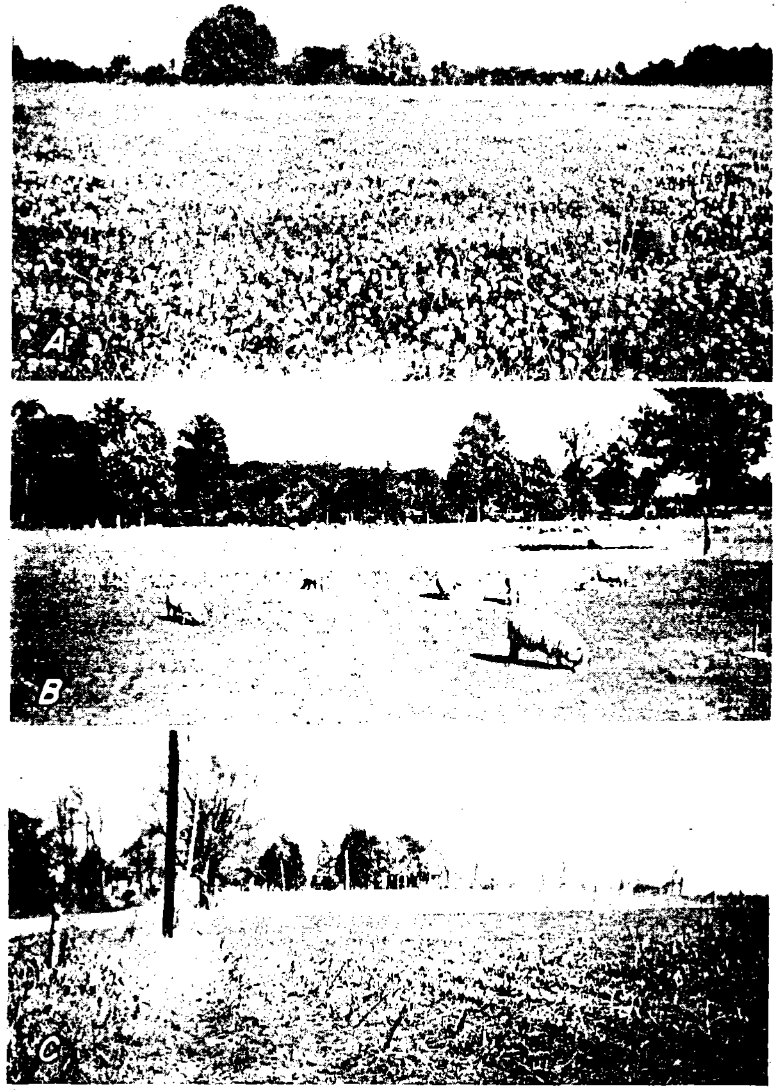
SEED CROPS

Lespedeza seed is harvested and marketed by many farmers, and common white clover is grown for seed by a few farmers (pl. 4, *A*). Nearly all the seed from both crops is used in this or nearby counties. Lespedeza is planted in February or March, the same as when sown for hay, and allowed to mature on a smooth seedbed where weeds and sprouts have been kept off fairly well. The seed is harvested in September or October. Good seed crops have been harvested from some fields, especially those well fertilized and on which a good stand has been obtained.

To grow common white clover seed, the land is well prepared some time in advance of seeding time, which is September 1 to October



A, Meager tenant quarters in the red lands.
B, Typical home on an owner-operated farm in the gray lands.
C, Good yields of alfalfa on Decatur, Dewey, and Abernathy soils.



A, Seed crop of common white clover on Decatur silty clay loam, eroded undulating phase.
B, Sheep on closely grazed pasture on Melvin silt loam.
C, Landscape showing Abernathy silt loam, level phase, in foreground and Decatur silty clay loam, eroded undulating phase, in background.

15 or the latter part of February. A smooth firm seedbed is desirable, and just before seeding the surface is scratched lightly with a harrow. From 5 to 10 pounds of seed an acre is broadcast and then covered only lightly, if at all. The ground is kept exceptionally clean in order that harvesting machinery can be used safely. Harvesting is done with a mowing machine and rake, as in hay harvest, or by use of a small grain combine. Yields of 100 to 200 pounds an acre have been obtained.

OTHER CROPS

Potatoes, sweetpotatoes, and other vegetables and fruits are grown largely for home consumption and local markets. Nearly all farmers owning homes have a few fruit trees, including peaches, apples, pears, and cherries, but many of the trees are not kept well pruned and sprayed. Some grapes are grown by many farmers, but few are produced for other than home use. Many farmers produce sorghum for family consumption. Few special crops are grown; burley tobacco is grown in a few small fields, most of which are north of Elkmont.

ROTATIONS AND FERTILIZERS

Rotation systems vary greatly in the county. The red lands (Decatur and Dewey soils) are planted to cotton almost continuously, whereas corn is planted almost every year on the better bottom lands or basins. A 3-year rotation is practiced on some upland farms. The land is planted to cotton and a crop of vetch is sown between the rows the first year. The vetch is plowed under in spring and followed by a crop of corn. After the corn, or for the third year, the land is planted to small grain, which is in turn followed by lespedeza, cowpeas, or such hay crops.

Some fields are planted to corn the first year and then sown to lespedeza for 1 or 2 years before another crop of corn is grown. This type of rotation is used more frequently on the imperfectly drained bottom and colluvial soils where cotton is not grown successfully. Often a farmer may rotate crops on some of these fields regularly, but because of some peculiar condition sometimes prevailing, he may use no rotation at all.

In 1939, 91 percent of the farms in the county used fertilizer, as compared with 71.8 percent in 1919 and 89.3 percent in 1929. Education in improved farming methods, the recent expansion in use of legumes, and the rapid loss of soil fertility through use and erosion are probable factors contributing to the increased use of commercial fertilizer. In recent years the desire to increase production on cotton lands has been an influence toward greater use of commercial fertilizer. The county agricultural agent's office estimates that approximately 28 percent of the fertilizer used in the county in 1940 was mixed on the farm, indicating that the majority of farmers used ready-mixed fertilizer (*4*).

In general most of the fertilizer is used for cotton. The approximate average quantity used is 200 pounds an acre of 6–8–4, the range being from 100 to 600 pounds. Other mixtures are used, but this is the most common. Some farmers add 50 to 100 pounds of nitrate of soda as a top dressing soon after the cotton begins to put on squares.

849450—53——2

Only a few farmers plant vetch as a cover crop ahead of cotton, because this makes the cotton crop rather late and its cultivation somewhat difficult. There is much difference in the kinds and quantities of fertilizer used on various farms (*4*).

For corn, many farmers plant vetch early in fall as a cover crop, especially on farms in the red lands. The vetch is turned under in spring when it has formed about 15 pounds of green weight per 100 square feet. Superphosphate or basic slag is often used with the vetch to encourage better growth (*5*). When the phosphate is used with vetch, none is applied to the following crop of corn. If acid phosphate is not used on vetch, 100 to 200 pounds of 16-percent acid phosphate an acre is frequently applied to corn at the time of planting, and in addition to this many farmers apply about 75 pounds of nitrate of soda as a side dressing. Frequently no fertilizer is used for corn, especially if it is grown on the bottom lands.

Considerable lime and phosphate are used under alfalfa, hay crops, and permanent pasture (*15*, *17*). Lespedeza does not receive much lime, but phosphate is frequently applied. The use of phosphate has increased considerably in recent years. Many farmers apply 100 to 300 pounds of basic slag an acre under a winter legume at the time of planting. Little fertilizer is used for corn when it follows a winter legume treated in this manner. Large quantities of lime and other mineral fertilizer are applied in growing alfalfa, and phosphate and lime are used where improved pastures are being established. Little fertilizer is used for small grains, but a top dressing of 100 to 250 pounds of nitrate of soda is commonly applied to oats in spring.

PERMANENT PASTURES

Permanent pastures are important in the agriculture of the county. Most of them are on the lowlands along streams; the larger areas are in the red lands, or southern part of the county, but many small pastures are in other parts. Until recently the pasture grasses were largely those that grew voluntarily—Bermuda, carpet, and Dallis grasses; common lespedeza; and a little white clover. They came more or less voluntarily, and a great many pastures contained only Bermuda grass. During recent years, however, much attention has been given to the better preparation of seedbeds for permanent pastures and to their seeding and fertilization.

Various fertilizers have been used, but farmers generally use about 2 tons of ground limestone an acre on the red lands pastures and 3 tons on the gray lands. For applications intended to last several years, they have been using the equivalent of 1,000 pounds of 16-percent superphosphate and 200 pounds of potash, in addition to the lime. Where the application is made annually, the rate is 300 pounds of 16-percent superphosphate and 25 pounds of potash. Basic slag has been used in some instances to take the place of both lime and superphosphate. Slag is applied before seeding at the rate of 1 ton plus 200 pounds of potash an acre, or annually at the rate of 500 pounds of basic slag plus 25 pounds of potash.

Some of the grass mixtures now used are 2 to 4 pounds of common white clover, 10 pounds of lespedeza, 5 to 10 pounds of Kentucky blue-

grass, 5 to 10 pounds of orchard grass, and 3 to 10 pounds of Dallis grass. Many variations and combinations of these seed are used, and in some mixtures other plants may be added or substituted.

In 1929, 1,634 farmers reported 20,404 acres of plowable pasture; 2,803 farmers, 37,891 acres in 1939; and 2,243 farmers, 34,716 acres in 1945. Besides the increased number of farms reporting pasture and increased acreage in pasture, the quality of pasture crops has improved considerably.

LIVESTOCK AND LIVESTOCK PRODUCTS

Farmers reported 17,401 head of cattle on farms in 1944, as compared with 10,991 head in 1929. Considerable attention is being given to the establishment of permanent pastures over the county, and there will undoubtedly be further increase in the number of cattle as better pastures are developed. Probably more than half the cattle added in the period 1929 through 1944 were of dairy breed, though many beef cattle have been added, especially in the most recent years. Some large beef herds were being established in the southern part of the county at the time of survey. In this county Hereford, Shorthorn, and Aberdeen Angus are the principal beef breeds and Jersey, Guernsey, and Holstein-Friesian the main dairy breeds.

A few large dairies are located in the southern part of the county, one or two of them producing about 1,000 pounds of milk daily. Some dairies sell milk at retail in Athens and Decatur and others sell to cheese factories. Many farmers in the vicinity of Ardmore keep a few milk cows to supplement other farm enterprises, because the cheese factory in Ardmore provides a market for their milk.

The total number of work animals decreased from 11,647 in 1929 to 8,242 in 1944, probably because of the greatly increased use of tractors. The number of horses and colts was 1,849 in 1944, as compared with 4,584 in 1919; whereas the number of mules and mule colts was 6,958 in 1919 and 6,393 in 1944, or approximately the same.

Sheep (pl. 4, *B*) have shown a decrease from 781 in 1919 to 539 in 1944. The number of swine has fluctuated from year to year, the greatest number, 22,364, being reported in 1919, as compared with 13,822 in 1944. Some of the more common breeds of hogs are Ohio Improved Chester (O. I. C.), Poland China, Hampshire, and Duroc. A large part of the total number of hogs produced are butchered on the farm for home use, but a few are sold. Weekly auctions at Athens provide the chief market for hogs and sheep and for many of the beef cattle.

Many farms raise more poultry than needed for home use, but few farmers make a specialty of poultry production. Chickens are the main kind of poultry raised. Poultry and poultry products are sold to local markets and to the travelling stores that cover most of the county weekly; they are often exchanged for groceries, clothing, and other supplies needed in the home. The stores serve as collection points, and later the poultry and poultry products are sold to truckers who haul to the more distant markets outside the county.

Recent trends in the number of livestock on farms are indicated in table 3, and the quantity of livestock products produced is shown in table 4.

TABLE 3.—*Livestock on farms in Limestone County, Ala., for stated years*

Livestock [1]	1919	1929	1939	1944
	Number	*Number*	*Number*	*Number*
Horses	4, 584	2, 528	2, 124	1, 849
Mules	6, 958	9, 119	7, 585	6, 393
Cattle	14, 908	10, 991	12, 301	17, 401
Sheep	781	461	665	539
Goats	1, 083	771	1, 044	1, 425
Swine	22, 364	10, 415	13, 327	13, 822
Chickens	133, 505	119, 635	122, 772	163, 434
Other poultry	8, 291	(2)	6, 286	(2)
Beehives	1, 783	792	717	(2)

[1] Figures for 1919, 1929, and 1944 give the total number of livestock of all ages, except for 1929 only chickens over 3 months old are reported and for 1944 only those over 4 months old are reported. Figures for 1939 are for all horses, mules, and cattle over 3 months old; hogs, goats, and chickens over 4 months old; and sheep and lambs over 6 months old.
[2] Not available.

TABLE 4.—*Specified livestock products produced and sold in stated years, Limestone County, Ala.*

Product	1919	1929	1939	1944
Milk produced ....gallons	1, 467, 129	2, 745, 313	2, 893, 640	3, 510, 764
Milk sold ....do	13, 494	85, 761	352, 423	987, 777
Cream sold ....do	323	2, 459	(1)	(1)
Butterfat sold ....pounds	3, 581	47, 957	72, 171	56, 296
Butter churned ....do	560, 890	826, 458	697, 442	(1)
Butter sold ....do	36, 082	55, 468	43, 368	24, 230
Wool shorn ....do	1, 841	1, 193	2, 532	2, 296
Honey produced ....do	14, 586	5, 326	7, 163	(1)
Chickens raised ....number	168, 726	252, 913	225, 811	253, 686
Chickens sold ....do	30, 584	72, 273	69, 145	(1)
Chicken eggs produced ..dozen	477, 958	738, 140	631, 785	850, 928
Chicken eggs sold ....do	217, 949	342, 461	(1)	(1)

[1] Not available.

TYPES OF FARMS

Classified by total value of farm products in 1944, there were 611 farms producing products primarily for farm household use; 113 general farms; 61, livestock; 49, dairy; 10, poultry; 5, fruit and nut; 2, horticultural specialty; 1, vegetable; 1, forest products; and 3,514 farms producing other crops. Some part-time farmers live near Athens and in some of the villages.

SIZE OF FARMS

The farms of the county range in size from 3 to more than 1,000 acres, but most of them are from 30 to 99 acres. In 1944 there were 1,188 farms less than 30 acres in size, of which 985 were from 10 to 29 acres; 2,432 farms in the 30 to 99 acre range; 779 farms from 100 to more than 1,000 acres or more, of which 514 ranged from 100 to 179 acres and 9 were more than 1,000 acres. A slow trend toward smaller farms at the expense of the larger ones has been evident through most of the history of the county.

The larger farms are along the rivers in the red lands area, mainly on the Decatur, Dewey, and Cumberland soils; whereas the smaller farms are in the northern and northwestern parts of the county and near towns and villages, usually on the Cookeville and Dickson soils. Many of the large farms are used for cotton production, but some are being converted for raising either dairy or beef cattle.

LAND USE

In 1945, 316,055 acres, or 90.6 percent of the county, was in farms. The total number of farms was 4,399, the average size being 71.8 acres. The percentage of improved land in farms has increased from 65.1 percent in 1919 to 71.8 percent in 1944. In the same period the percentage of improved land per farm increased from 36.3 percent to 51.6 percent.

In 1944, 227,015 acres were in cropland, of which 164,928 acres were used for crops. The cropland is mostly on smooth, rolling, or hilly lands. Pasture occupies wet or imperfectly drained lands, and the woodland (63,335 acres in 1944) is most frequently on the steep slopes or the wet areas. The red lands tracts are nearly all in crops or pasture because they were first settled, and consequently nearly all of the smooth to rolling areas remaining in woodland are in the gray lands section.

The tendency through most of the history of the county has been toward conversion of more and more forest land to cropland. Until recently, the figures indicated a gradual change from small-grain to clean-tilled crops. Recently, however, farmers have shown much interest in soil improvement, which they are accomplishing partly by growing more pasture, hay, winter cover, and various other close-growing crops. During the past 15 years farmers have turned more land to pasture, the acreages of all land pastured being 67,133 in 1944 as compared with a total of 55,226 acres in 1929.

FARM TENURE

In 1944, 1,538 farms were operated by full owners; 279, by part owners; 2,575, by tenants; and 7, by managers. Of the tenants, croppers numbered 1,060; cash tenants, 169; share-cash tenants, 6; share tenants, 1,176; and other tenants, 164. In 1919 the percentage of owner-operated farms was 39.0, but in 1944 it had increased to 41.5 percent.

Several rental systems are practiced. Some tenants in the red lands furnish labor and half the fertilizer and receive 40 percent of the crop. Another system, probably the one most commonly used, requires that the owner furnish land and buildings and one-fourth of the fertilizer needed for cotton and one-third of that for corn; in return the owner receives one-fourth of the cotton crop and one-third of the

corn crop. When farms are rented for a specified cash sum, the tenant furnishes everything except land and buildings, but he receives all of the crops. The extensive use of tractors is causing a readjustment of rentals in some parts of the county.

FARM INVESTMENT AND EXPENDITURE

A great number of tractors and some combines were purchased in the period 1935–40, and in 1945 there was an increase of 329 tractors over 1940. The majority of the combines and tractors are used on the larger fields of the red lands, though many are used in the gray lands. Plows and other equipment have been purchased for use with the tractors. In 1940, $67,567 was spent for gasoline, distillate, kerosene, and oil. Much of the fuel and oil was used in tractors and other farm engines. The expenditure for fuel was not reported in 1945, but it was probably increased by the greater number of tractors.

The number of work animals has decreased, probably because tractors have replaced much teamwork, but the number of cattle has increased. A total of 2,463 farms reported purchasing $299,035 worth of feed for domestic animals and poultry in 1944.

In 1939, 4,340 farms reported using $233,931 worth of commercial fertilizer, the average cost per farm being $53.90. A total of 279 farms used 3,513 tons of liming materials at a cost of $7,028. The liming materials were used in addition to commercial fertilizer and consisted mostly of ground limestone, though some marl and gypsum were probably used. The fertilizer expenditure was higher in 1929, the total being $429,829. The decrease in 1939 may have been due to the following: (1) A somewhat reduced price for some fertilizers, (2) a reduction of total acreage of farm land resulting from inundation of some areas by Wheeler Reservoir, and (3) an increased use of winter cover crops, which take the place of some costly nitrogenous fertilizers. Comparisons between 1939 and 1944 cannot be drawn because expenditures for fertilizers were not reported in 1945.

An expenditure of $768,637 was reported by 2,152 farms for labor in 1944, the average being slightly more than $73 per farm. Labor is supplied largely by local colored people and in parts of the county by white laborers.

SOIL SURVEY METHODS AND DEFINITIONS

In making a soil survey the soils are examined, classified, and mapped in the field and their characteristics recorded, particularly in regard to the growth of various crops, grasses, and trees.

The soils and underlying formations are examined systematically in many locations. Test pits are dug, borings made, and highway or railroad cuts and other exposures studied. Each reveals 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, consistency, texture, and content of organic matter, roots, gravel, and stone are noted. The chemical reaction of the soil and its content of lime are determined by simple

tests.[6] Other features taken into consideration are drainage, both internal and external; relief, or lay of the land; and the interrelations of soil and vegetation.

The soils are classified according to their characteristics, both internal and external, with special emphasis on the features that influence the suitability of the land for growing crops, grasses, and trees. On the basis of these characteristics they are grouped in the following classification units: (1) Series, (2) types, (3) phases, (4) complexes, and (5) miscellaneous land types.

The series is a group of soils having the same genetic horizons, similar in important characteristics and arrangement in the soil profile and having similar parent material. Thus, the series comprises soils having essentially the same color, structure, natural drainage, and other important internal characteristics except those caused by accelerated erosion.[7] 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. Baxter, Cumberland, Decatur, and Dewey are names of important soil series in Limestone County.

Within a soil series are one or more soil types, defined according to the texture of the upper part of the soil—in uneroded soils this is the surface, or A layer; in eroded soils, the plow layer. Thus, the class name of this texture—sand, loamy sand, sandy loam, loam, silt loam, clay loam, silty clay loam, or clay—is added to the series designation to give the complete name of the soil type. Ennis silt loam and Ennis cherty silt loam are soil types within the Ennis series. Except for texture of the surface soil these types have approximately the same internal and external characteristics. Soil types and phases are the principal units of mapping, and because of their specific character are usually the units to which agronomic data are definitely related.

A soil phase specifically named is a variation within the type, differing from the normal phase of the type in some feature, generally external, that may be of special practical significance but not differing in the major characteristics of the soil profile. For example, within the total range of relief of a soil type some areas may have slopes

---

[6] The reaction of a soil is its degree of acidity or alkalinity expressed mathematically as the pH value. A pH value of 7 indicates precise neutrality; higher values, alkalinity; and lower values, acidity. Terms used in this report that refer to reaction are defined in the Soil Survey Manual (*11*) as follows:

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

The presence of lime in the soil is detected by the use of a dilute solution of hydrochloric acid.

[7] Accelerated erosion is erosion of soil or rock in excess of the normal erosion brought about by changes in the natural cover or ground conditions, including changes brought about by human activity, rodent invasion, and lightning (*18*).

that allow the use of machinery and the growth of cultivated crops and others may not. Differences in relief and degree of accelerated erosion may be shown as phases. Even though no important differences may be apparent in the soil profile or in its capability for the growth of native vegetation throughout the range in relief, there may be important differences in respect to the growth of cultivated crops. Baxter cherty silt loam, hilly phase, and Baxter cherty silt loam, eroded hilly phase, are phases of the type, Baxter cherty silt loam.

The slope classification used in defining, naming, and mapping the slope phases is as follows: Nearly level phase has a slope range of 0 to 2 percent; undulating, 2 to 5 percent; rolling, 5 to 12 percent; hilly, 12 to 30 percent; and steep, 30 to 60 percent. The erosion classification followed in defining, naming, and mapping erosion phases in this county is as follows: The eroded phase has the subsoil within plow depth on half or more of the delineated area, and 50 to 75 percent of the original A horizon has been lost. The severely eroded phase has practically all the original surface soil (A horizon) lost. Ordinary tillage of phases classified as eroded will bring parts of the upper subsoil to the surface, and the character of the original A horizon will be altered by the admixture of subsoil material. A limited number of short shallow gullies may be present. For phases classified as severely eroded, tillage is almost entirely in the subsoil, because practically all the original surface soil has been lost and part of the subsoil may be lost. Small short gullies are usually of common occurrence in phases in this classification, a few of them being too deep to be obliterated by tillage.

A few soil types, particularly those on first bottoms, do not have sufficient range in slope or erosion to justify their division into phases. Huntington silt loam, for example, is nearly level and uneroded and therefore is not divided into phases.

In some places, two or more soils are in such intimate or mixed pattern that they cannot feasibly be separated on a small-scale map. Such areas are mapped as complexes, an example of which is Dewey-Decatur silty clay loams, severely eroded hilly phases.

Mapped as miscellaneous land types are some areas that have little or no true soil, as Limestone rockland and Rough gullied land (Decatur, Dewey, and Cumberland soil materials). The Rough gullied land consists of areas eroded to an extent that the individual owner cannot economically afford to reclaim them, except through very slow processes. These areas consist of an intricate pattern of gullies, the soil profile over most of them having been largely mutilated.

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

Some of the terms mentioned in the report are in common use and need no explanation, but others have special meaning in soil science. Texture, for example, refers to the relative amounts of clay, silt, and various grades of sand that make up the soil mass. Coarse-textured soils contain a high proportion of the coarser separates, as sands; the fine-textured soils contain much clay. Structure refers to the natural arrangement of the soil material in aggregates, structural particles, or masses. Consistence refers to such soil characteristics as friability, plasticity, stickiness, hardness, compactness, toughness, and cementation. Permeability and perviousness connote the ease with which water, air, and roots penetrate the soil.

Ordinarily surface soil refers to the lighter textured surface layer, which is usually 6 to 12 inches thick. The subsoil, which is usually of uniform color in well-drained soils, indicates the heavier and thicker layer immediately below the surface soil. The substratum, or soil material layer, is beneath the subsoil and is characteristically splotched or mottled with two or more colors. Bedrock, as used here, is consolidated rock on which the substratum rests.

Workability refers to the ease with which tillage, harvesting, and other farming operations can be accomplished, and conservability, to the ease with which soil can be kept productive and workable. Major factors in rating soil conservability are the ease of preventing loss of soil material and plant nutrients and the ease of maintaining good tilth. Productivity indicates the capacity of a soil to produce crops under prevailing practices of farming.

SOILS

The soils of Limestone County have had a great influence on the kind of farming. For example, most of the bottom-land soils are fairly well supplied with lime, organic matter, and plant nutrients and possess the characteristics suiting them to growing corn. In such areas corn production and stock raising dominate the agriculture.

The soils dominant in the gently rolling red lands areas in the southeastern part of the county, both those from high-grade limestone and those of the high-terrace lands, are inherently productive. They originally contained a relatively high quantity of organic matter, and the mantle of soil over bedrock is 15 to 20 feet thick in most places. Drainage is good and the reaction is only moderately acid.

These were the first upland tracts cleared, because their ability to produce cotton was early recognized, and of further advantage was their closeness to transportation and their position adjacent to the good corn-producing bottom lands. The larger farms are now located on the red lands areas because they can be farmed with heavier machinery and their topography lends itself well to the arrangement of large fields (pl. 5, *A* and *B*).

Soils of the red lands have a fairly wide range of suitability for crops, and a widely diversified agriculture that includes practically all crops grown in the county has therefore become established. The chief crop in the section is cotton, but some corn, wheat, oats, rye, barley, hay, and sericea lespedeza are also grown. A large part of the alfalfa, vetch, and crimson clover grown in the county is on the red lands. Some of the larger livestock farms are located in this section, and the bottom and depressional lands are used for pasture.

Two types of homes have developed in this section—the well-built, well-kept owner home and the poorly constructed and poorly maintained tenant home. A major part of the rural Negro population is in the red lands.

The gray lands part of the county is not so productive of most crops as the red lands. The soils are inherently low in fertility and usually

cold or late to warm up in spring. Many of them contain a siltpan or semisiltpan at a depth of 15 to 30 inches that prevents free movement of moisture through the subsoil. The more rolling and hilly areas are often cherty enough to hinder tillage to some extent, and on the steeper areas drainage is excessive. The mantle of soil is usually not more than 6 to 10 feet thick, and in many places it is less. The reaction is ordinarily strongly acid unless the soil has been limed. The soils respond fairly well to applications of proper fertilizer and good management.

Farms in the gray lands are smaller and more often owner-operated than those in the red lands. Most of the produce needed for home consumption is grown on these farms because more attention is given to the production of garden and orchard crops, and a larger percentage of the families have cows, chickens, and hogs. Many crops common to the county are grown, but alfalfa, vetch, and crimson clover not so much as on the red soils. Fewer tractors and other heavy farm machinery are used than on the red soils, but more 1- and 2-horse equipment is used. The homes are usually fair to good and rather well maintained.

Two distinct topographic divisions occur in the gray lands—in the area near the Elk River and the larger creeks of the northwestern part of the county the land is hilly and steep, whereas the part north of Athens and toward Ardmore is level to rolling.

The soils of the county differ widely in color, texture, consistence, depth, reaction, fertility, relief, and conditions of stoniness, erosion, and moisture, all of which are factors having a close bearing on productivity, workability, conservability, or use. In color they range from nearly white through gray, yellow, and brown to dark and deep red, the shades of red and yellow predominating in the subsoil. The texture of the surface soil ranges from fine sandy loam to tenacious clay, but soils of silt loam texture predominate.

Even in the virgin state the soils vary widely in fertility. The nature of the material from which the soils are developed is strongly reflected in the degree of natural fertility as well as in other characteristics. In spite of the fact that the majority of the soils suited to cultivation are derived from material weathered from rocks rich in calcium carbonate, most of the upland soils are deficient in lime. Practically all the lime originally contained in the rocks has been lost by leaching during the processes of weathering and soil development. In many of the upland soils the organic content was not high when they were in the virgin state, and during cultivation much of the original quantity has been oxidized, lost in drainage water, or otherwise dissipated. The quantity and nature of the organic matter differed widely when soils were in the virgin state, and the difference has been greatly increased by cultivation.

The natural tilth is generally favorable for all the surface soils except some of the silty clay loams, which are subject to puddling, surface baking, and cloddiness when they are tilled under adverse moisture conditions. Such soils are exacting in regard to moisture conditions favorable for tillage. With only a few exceptions, these refractory surface soils are really subsoil exposed through erosional loss of the original surface material.

TABLE 5.—*Characteristics of the soil series of Limestone County, Ala.*

SOILS OF UPLANDS

Series	Position	Relief	Internal drainage[1]	Parent material	Surface soil: Color[2]	Surface soil: Consistence[3]	Surface soil: Thickness[4]	Subsoil: Color[2]	Subsoil: Consistence[3]	Subsoil: Texture[5]	Subsoil: Depth of profile[6]	Productivity
				Residual material weathered in place from—			*Inches*				*Inches*	
Decatur	Smooth low upland of the Limestone Valleys.	Nearly level to rolling.	Moderate or slow.	High grade limestone.	Light brown to reddish brown.	Friable or firm	6-10	Yellowish red or brownish red.	Firm	Silty clay	48-180	Good.
Dewey	do	Nearly level to hilly.	Moderate	do	Brown or light brown	Friable	8-12	Yellowish red	Friable or firm	do	42-180	Good to very good.
Mimosa	Hilly Highland Rim	Gently rolling to hilly.	Slow	Argillaceous limestone	Grayish brown to yellowish brown.	do	8-12	Yellowish brown grading to mottled material.	Firm	Clay	18-72	Fair to poor
Maury	Rolling Highland Rim	Undulating to hilly.	Moderate	Phosphatic limestone	Brown	do	10-15	Yellowish brown	Friable	Silty clay loam or silty clay.	48-100	Fair.
Cookeville	Undulating and rolling land of the gray lands.	Undulating or rolling.	do	Mixed high-grade and cherty limestone.	Grayish brown	do	6-12	Light yellowish red	Friable or firm	Silty clay loam	44-70	Good to fair.
Baxter	Rolling and hilly land of the gray lands.	Undulating to steep.	Moderate or rapid.	Cherty limestone	do	do	6-10	do	Friable	do	38-54	Fair.
Dickson	Smooth to rolling land of the gray lands.	Nearly level to rolling.	Moderate or slow.	do	Pale yellow or grayish yellow.	do	12-22	Light yellowish brown grading to mottled material.	Friable or firm	do	36-60	Do.
Bodine	Hilly to steep land of the gray lands.	Hilly and steep	Rapid	do	Light gray or very pale brown.	do	6-10	Light yellowish brown	Firm or friable	Clay loam	16-36	Poor.
Sango	Smooth land of the gray lands.	Nearly level	Slow	do	Light gray or yellowish gray.	do	8-20	Mottled yellow, orange, and gray.	Firm	Silty clay	36-60	Poor to fair.
Lawrence	do	Nearly level or depressional.	Very slow	do	Light gray (2-inch surface layer).	Friable or firm	2-6	Mottled yellow, orange, and gray; gray increasing with depth.	Firm or very firm.	do	36-60	Poor.
Hollywood	Rolling Highland Rim	Very gently sloping.	Slow or very slow.	Argillaceous limestone	Dark grayish brown underlain by very dark gray to black.	Firm or very firm.	10-20	Light gray to gray mottled with yellow and brown.	Very firm	Clay	12-60	Poor to fair.

SOILS OF COLLUVIAL SLOPES AND DEPRESSIONS

Series	Position	Relief	Internal drainage[1]	Parent material	Surface soil: Color[2]	Surface soil: Consistence[3]	Surface soil: Thickness[4]	Subsoil: Color[2]	Subsoil: Consistence[3]	Subsoil: Texture[5]	Subsoil: Depth of profile[6]	Productivity
				Transported material from uplands underlain chiefly by—								
Dellrose	Rolling to steep colluvial slopes.	Hilly	Moderate or rapid.	Cherty limestone with phosphatic influence.	*Grayish brown to brown.*	Friable	6-12	Yellowish brown to brownish yellow.	Friable	Silty clay loam	24-125	Fair to good.
Greendale	Gently sloping foot slopes and depressions.	Gently sloping or nearly level.	Moderate	Cherty limestone	Grayish brown or light yellowish brown.	do	6-10	Yellowish brown	do	Silt loam or silty clay loam.	36-60	Fair.
Abernathy	Depressions	Nearly level or slightly depressional.	do	Limestone and cherty limestone.	Surface layer dark reddish brown or brown over yellowish red or reddish brown grading to mottled gray; yellow and brown silty clay below 36 inches.							Very good.
Ooltewah	do	do	Slow or very slow.	do	Reddish brown or brown *friable surface layer* grading to light-gray or gray mottled with yellow and brown silty clay below 13 to 18 inches.							Fair to good.
Guthrie	do	do	Very slow	Cherty limestone	Light gray lightly mottled *with yellow.*	Friable	2-8	Mottled gray, brownish yellow, and yellowish brown.	Firm	Clay loam or clay	18-60	Very poor.

SOILS OF STREAM TERRACES

Series	Position	Relief	Internal drainage[1]	Parent material	Surface soil: Color[2]	Surface soil: Consistence[3]	Surface soil: Thickness[4]	Subsoil: Color[2]	Subsoil: Consistence[3]	Subsoil: Texture[5]	Subsoil: Depth of profile[6]	Productivity
				Transported material from uplands underlain chiefly by—								
Cumberland	Smooth high terraces	Nearly level to hilly.	Moderate	Limestone with some shale and sandstone.	Reddish brown	*Friable*	6-10	Red	Friable or firm	Silty clay loam	24-180	Good.
Etowah	Smooth *moderately* high terraces.	Nearly level to undulating.	do	do	Brown to grayish brown.	do	8-12	Yellowish red or yellowish brown.	Friable	do	24-80	Very good.
Humphreys	Smooth moderately low terraces.	Nearly level	do	Cherty limestone	Grayish brown	do	8-14	Yellowish brown or *light* yellowish brown.	do	do	36-90	Good.
Wolftever	do	do	Moderate or slow.	*Limestone, cherty limestone, and shale.*	Grayish brown or light yellowish brown.	do	12-16	Pale brown or light yel*lowish brown.*	Firm or friable	Silty clay	48-80	Good to fair.
Capshaw	do	do	do	Limestone with some shale and sandstone.	Grayish brown	do	8-12	Light yellowish brown grading to mottled material.	do	Fine sandy clay loam.	40-60	*Good.*
Taft	Smooth low terraces	do	Slow or very slow.	Cherty limestone	Light brownish gray	do	10-18	Pale yellow or grayish yellow grading to mottled material.	Firm	*Silty clay loam* or clay loam.	36-72	Poor to fair.
Robertsville	do	do	Very slow	Limestone with some shale and sandstone.	Gray to light gray mottled with yellow and brown.	Friable or firm	2-4	Mottled gray, yellow, and brown.	*Firm or very firm.*	do	24-42	Poor.

SOILS OF FIRST BOTTOMS

Series	Position	Relief	Internal drainage[1]	Parent material	Surface soil and subsoil	Productivity
				Transported material from uplands underlain chiefly by—		
Huntington	High first bottoms	Nearly level	Moderate	Limestone with some *shale and sandstone.*	Brown to yellowish brown, becoming lighter colored with depth; below 40 inches, brown mottled with gray and yellow silty clay loam.	Good to very good.
Egam	Medium-high to high first bottoms.	do	Slow	do	Brown to yellowish brown, friable, grades to dark grayish-brown *moderately compact* silty clay; below 36 inches the material is mottled gray, yellow, and brown, and generally a little coarser in texture.	Fair.
Ennis[7]	Low first bottoms	do	do	Cherty limestone and limestone.	Brown to yellowish-brown silt loam to 12 to 20 inches; grades to heavier texture and with depth is increasingly mottled with gray, yellow, and brown.	Do.
Lindside	do	do	do	Limestone and cherty limestone.	Brown to yellowish brown to 10 to 18 inches; below this is brown silty clay loam mottled with gray and yellow	Fair to good.
Melvin	do	do	Very slow	do	*Grayish-brown to yellowish-brown* silt loam becoming mottled gray, yellow, and brown below 5 inches; mottling increases with depth and the texture generally grades to silty clay.	Poor.
Bruno	Medium or high first bottoms.	do	Moderate or rapid.	Sandstone, limestone, and *shale.*	Brown to light yellowish brown, sandy; mottled with gray, yellow, and brown below depth of 26 to 30 inches; texture becomes finer in the lower part.	Fair.

[1] The term moderate indicates optimum internal *drainage for most crops* grown in the county.
[2] Color prevailing when the soil is air dry; color of surface soil is that shown by air-dry samples taken from a plowed field, or in forested areas, from immediately below a layer of leafmold; color nomenclature is that defined in COLOR MEASUREMENT AND ITS APPLICATION TO *GRADING* AGRICULTURAL PRODUCTS, Misc. Pub. 580, U. S. Dept. Agr., 62 pp., illus., 1946.
[3] Consistence of soil when moist, not dry.
[4] Thickness of uneroded surface layer; in moderately eroded areas, 3 to 6 inches of the original surface soil generally remains and in *severely eroded* areas, usually less than 2 or 3 inches.
[5] Most of the soils become very gradually finer in texture with increasing depth; the shallow phase of the Ennis series, however, has a gra*velly subsoil in most places.*
[6] Depth of soil profile over bedrock, partly weathered rock, gravel beds, or other material *distinctly different from* that parent to the soil.
[7] *Ennis soils* in this county have a slightly developed B horizon in places, and the subsoil is mottled at a depth shallower than that normal for the series.

Abernathy	Depressions	Nearly level or slightly depressional.	--	Very good.
Ooltewah	do	do	S	Fair to good.
Guthrie	do	do	V	Very poor.

Cumberland	Smooth high terraces	Nearly level to hilly.	I	Good.
Etowah	Smooth moderately high terraces.	Nearly level to undulating.	--	Very good.
Humphreys	Smooth moderately low terraces.	Nearly level	--	Good.
Wolftever	do	do	I	Good to fair.
Capshaw	do	do	--	Good.
Taft	Smooth low terraces	do	S	Poor to fair.
Robertsville	do	do	V	Poor.

Huntington	High first bottoms	Nearly level	M	Good to very good.
Egam	Medium-high to high first bottoms.	do	S	Fair.
Ennis [7]	Low first bottoms	do	--	Do.
Lindside	do	do	--	Fair to good.
Melvin	do	do	V	Poor.
Bruno	Medium or high first bottoms.	do	M	Fair.

[1] The term modera[illegible] [illegible]dicates optimum internal drainage for m[illegible]is series, how-

[2] Color prevailing [illegible]en the soil is air dry; color of surface soil is [illegible] in forested areas, fro[illegible] immediately below a layer of leafmold; colo[illegible]ent from that AND ITS APPLICATI[illegible] TO GRADING AGRICULTURAL PRODUCTS, Misc.

[3] Consistence of soil when moist, not dry.

[4] Thickness of uneroded surface layer; in moderately eroded are[illegible]pth shallower and in severely eroded areas, usually less than 2 or 3 inches.

849450—53 (Face p. 27)

SOIL SERIES AND THEIR RELATIONS

On the basis of a great number of widely differing characteristics, the soils of Limestone County have been placed in 29 soil series and 3 miscellaneous land types. Familiarity with the important soils in the different series is necessary for the most advantageous use of this survey, and this can be achieved more readily when the major characteristics of the soil series are associated with prominent land features. Therefore, the series are presented according to prominent land features of the county in table 5 and the text following.

SOILS OF UPLANDS

Soils of uplands developed from limestone material are represented by the Decatur, Dewey, Mimosa, Maury, Cookeville, Baxter, Dickson, Bodine, Sango, Lawrence, and Hollywood series.

A great part of the Decatur soils is used for cotton, corn, oats, wheat, and hay. These soils are mostly fairly level, but where they are slightly rolling to rolling, erosion is usually severe. Where erosion is only slight, the surface soil is friable to mellow light-brown to reddish-brown silt loam to a depth of 6 to 10 inches. The yellowish-red to brownish-red subsoil is tight in place but friable when broken; it is silty clay loam to a depth of about 40 inches but below this gradually grades to a brighter red clay loam that is a little less tight. Below about 60 inches the clay loam gives way to yellowish silty clay mottled with red and gray, which extends to a depth of possibly 15 to 20 feet where it rests on a horizontally bedded high-grade limestone.

The Dewey soils differ from the Decatur in having a browner surface layer, in being more friable throughout, and in having a less tight and not so intensely red subsoil. Like the Decatur, they are underlain by high-grade limestone. In undisturbed areas the surface soil is mellow brown or light-brown silt loam to a depth of 8 to 12 inches. The subsoil is yellowish-red friable silty clay or silty clay loam; its depth varies from 8 to 20 feet or more, the average being between 12 and 15 feet. The parent material underlying the soil is dense or tough silty clay that is dominantly yellow but splotched with brown, ocher, and gray. Like much of the Decatur soil, the Dewey has in places eroded under cultivation, and in these the present surface soil tends to be brownish red. There are practically no limestone outcrops.

The Mimosa soils occupy much land that is too steep and stony for tillage, but areas that can be tilled are rather productive of most crops. These soils are much thinner over bedrock in some places and outcroppings are common. They have developed over high-grade limestone, are grayer in the surface layer, more yellow and tough in the subsoil, and more shallow over bedrock than are the Decatur and Dewey. They are derived from weathered material having its source in a somewhat more cherty limestone. The virgin soil is a mellow grayish-brown silt loam stained dark with organic matter to a depth of about 4 inches. Below this layer and continuing to about 12 inches is a dark yellowish-brown silty clay loam that contains much chert. It is replaced below 24 inches by mottled brown, light-brown, and

yellow silty clay, which is tough and plastic but lower in chert content. The layer following is clay, which is tough and plastic when wet but very hard when dry. This is intensely mottled with lemon yellow, orange, brown, and gray, and it contains some soft brown concretions. Below 40 inches this layer becomes very tough and plastic, with yellow, gray, and dark-brown mottlings, and a few chert fragments.

The Maury soils have some surface resemblance to Dewey soils but are somewhat more plastic in the upper subsoil. In the virgin state there is a mellow 2- to 3-inch surface layer of rich-brown silt loam that contains a considerable quantity of organic matter. This is underlain for about 8 inches by a brown friable silt loam and then from about 12 to 25 inches by a heavy stiff yellowish-brown silty clay loam that breaks into irregularly shaped lumps. Below 25 inches and continuing to about 40 inches, the material is stiff heavy silty clay that grades to yellowish brown and contains brown rounded concretions. From 40 to 90 inches the brownish-yellow silty clay is slightly compacted and heavy and contains some concretions. The soil is weakly acid throughout but contains a comparatively high percentage of phosphate.

The Cookeville soils border and in many places intermingle with the Dewey soils. There is some relation between the two, but the Cookeville surface soil is grayer and its subsoil more streaked or mottled. The first 5 inches of surface soil is grayish-brown friable silt loam. Underneath this is yellowish-brown friable silt loam that changes to heavy brownish-yellow silt loam at about 11 inches. Brownish- to reddish-yellow silty clay loam containing some red streaks occurs below 20 inches. From 24 to 28 inches there is light yellowish-red to red silty clay loam with some compaction, and following is a 10-inch layer of mottled yellowish-red, gray, and yellow silty clay loam, compacted and hard, that contains some chert fragments. The material between 38 and 50 inches is mottled with red, yellow, and gray; below 50 and continuing to 66 inches, it is less mottled, but red and compacted in place. The very mottled material below this layer grades into a bed of chert fragments. Bedrock is usually at a depth of 72 to 96 inches.

Baxter soils are similar to the Cookeville in color but are more cherty on the surface and in the profile, have stronger slopes, and tend to be slightly shallower over bedrock in many places. The Baxter surface soil is grayish-brown friable silt loam the first 5 inches, and from 5 to 11 inches it is yellowish brown, with reddish-brown feathering of friable silt loam. Below this depth and continuing to about 20 inches is reddish-yellow heavy silt loam. From 20 to 24 inches the silty clay loam following is light yellowish red, and from 24 to 28 inches, yellowish red. Below 28 inches the silty clay loam becomes compacted, and it is mottled yellowish red, gray, and yellow to 38 inches. Brownish-red silty clay that is somewhat mottled extends from a depth of 38 to 66 inches. In places the Baxter profile is not so deep over bedrock as here indicated. Some chert fragments are usually on the surface and mixed through the soil.

Dickson soils are somewhat lighter gray in the surface layer than the Cookeville and are more yellowish and grayish in the subsoil. A siltpan is usually distinct at 22 to 26 inches. The soils ordinarily become mottled yellowish red, but the red is not so pronounced as in the Cookeville and it occurs at a lower depth.

The Bodine soils are somewhat similar to the Dickson in color but have more chert at the surface, are on steeper slopes, are shallower over bedrock, and contain no pronounced siltpan. Many of the areas are still in forest or in pasture, but some are cultivated. The crops planted suffer for lack of moisture in dry weather, however, and the soils are susceptible to rapid erosion.

In plowed fields the Sango soil is light-gray silt loam to about 3 inches. Yellowish-gray silty clay loam continues from 3 to about 15 inches without appreciable change, but it becomes mottled yellow, orange, and gray from 15 to 20 inches. From 20 to 33 inches the soil is an intensely mottled gray, yellow, and light-brown compacted and hard layer containing many brown iron concretions. At about 33 inches there is an abrupt change to mottled yellow, gray, and brown, the yellow being more pronounced and the layer being less compact than the one above. At 47 inches the material becomes heavier, is mottled yellowish gray and rust brown, and contains some chert fragments.

The Lawrence soil occupies low imperfectly drained bodies of land within Dickson areas. It has a light-gray surface soil; a mottled yellow, orange, and gray subsoil; and a compact hard layer at 18 to 22 inches. Water often stands on the soil after heavy rains, and the water table is usually near the surface until late in spring.

The Hollywood soil is the darkest, toughest, most plastic, and least acid soil in the county. It is derived mainly from weathered argillaceous limestone material, but in places some of the surface soil consists of colluvial and alluvial materials. This soil generally borders Limestone rockland, from which some of its material is derived. In forested areas the first 2 or 3 inches is dark-gray heavy silty clay. Below this thin layer and continuing to a depth of about 25 inches is tough plastic black clay that grades into steel-gray or pale-yellow mottled heavy clay. This material rests on bedrock at various depths.

SOILS OF COLLUVIAL SLOPES AND DEPRESSIONS

Soils of colluvial slopes and depressions occur at the base of eroded slopes; they consist of both local alluvium and colluvium. Five soil series, the Dellrose, Greendale, Abernathy, Ooltewah, and Guthrie, are represented in the group.

The Dellrose soils have developed on slopes where material has drifted down from soils of the Baxter, Dickson, and Bodine series. These soils are only medium acid and are well supplied with phosphate, which is apparently brought in by seepage water from adjoining limestone formations. The good supply of seepage water and phosphate makes them fairly productive, and erosion is not so severe as on many soils having comparable slopes. The profile is not uniformly developed and varies considerably from place to place. Variations in the depth of colluvial and alluvial material deposited over residual soil are from 6 inches to as much as 15 feet in only a short distance.

The Greendale soils are important farming soils in many places, because most crops do much better on them than on surrounding soils. Many farmers use them for garden crops, sorghum, and other similar crops, as the organic content and moisture supply are better than in

most other soils. These soils consist of colluvial materials accumulated at the base of slopes in areas of Cookeville, Baxter, and Dickson soils. They occupy positions similar to Abernathy silt loam, undulating phase, but differ in being lighter in color throughout the profile and in having somewhat more mottling in the subsoil. The 6- to 10-inch surface layer is light grayish-brown mellow silt loam. From this layer downward to about 30 inches is yellowish-brown firm silt loam. Below about 30 inches is mottled rust-brown, ocherous yellow, and gray friable silty clay loam. In some areas many chert fragments, up to 5 inches in diameter, are on the surface and throughout the profile. A cherty phase is mapped where chert fragments are present in quantities sufficient to interfere with tillage.

The Abernathy, Ooltewah, and Guthrie series occur in upland depressions. All are developed from similar limestone and cherty limestone materials. They are distinguished from each other mainly by differences in color resulting from differences in drainage. Drainage, least impaired in the Abernathy, becomes progressively more deficient in the Ooltewah and Guthrie.

The Abernathy soils have developed in depressions and near the heads of drainageways in the uplands, where they are associated with Dewey and Cumberland soils. They are well drained, usually through subterranean channels. Their suitability for use is similar to that of the Huntington soil. The dark reddish-brown or brown mellow silt loam surface soil is 12 to 16 inches thick. The heavy silt loam or silty clay loam subsoil is yellowish red or reddish brown to a depth of 24 to 36 inches, but below that depth the material tends to become gray mottled with yellow, rust brown, and light gray.

The Ooltewah soil is less well drained in the subsoil than is the Abernathy and is somewhat more subject to ponding in times of heavy rains. In suitability for use, the soils of the two series are not much different, but those of the Abernathy are suited to a little wider range of crops and are more reliable crop producers in wet years. Most of the Ooltewah soil is planted to corn, and though the yields are good the returns are usually somewhat lower than on the Abernathy soils. The Ooltewah surface layer is a 10- to 14-inch reddish-brown or brown mellow friable silt loam. The subsoil is grayish or brownish-gray silty clay loam splotched with yellow, brown, rust-brown, and some black spots. With depth, the grayish color increases and the material usually becomes heavier.

The Guthrie soil occurs in positions similar to those of the Ooltewah but is not so well drained. In even moderately wet seasons it is often under water, and this, together with its lack of available fertility, makes it unsuited to crop cultivation. Under proper management, however, it can produce very good pasture or hay crops. The first 1 or 2 inches of the surface soil is light-gray friable silt loam that generally contains only a small quantity of organic matter. Light-gray to almost white smooth and mellow silt loam continues from 2 to 10 inches. From 10 to 20 or 30 inches is mottled light-gray, yellow, or rust-brown silty clay loam. The subsoil of mottled rust-brown or yellow silty clay or heavy clay occurs at depths between 30 and 48 inches. At 48 to 60 inches the soil is underlain by limestone residuum. In a few places the soil profile may be only 24 to 36 inches thick over limestone bedrock, and in a few instances bedrock comes to the surface.

SOILS OF STREAM TERRACES

Soils of stream terraces comprise the Cumberland, Etowah, Humphreys, Wolftever, Capshaw, Taft, and Robertsville series. The first five of this group are well drained or at least adequately drained for the crops common to the area. The Taft soil is imperfectly drained, though drainage is sufficient for late corn and soybeans in all except unusually wet seasons. It produces pasture except during very dry seasons. The Robertsville soil is poorly drained but in most areas can be drained sufficiently for pasture.

The Cumberland soils have developed on old high to fairly high terraces. The reddish-brown mellow silt loam surface soil is 6 to 10 inches thick, and in uncleared areas considerable organic matter is incorporated. Beneath this layer and to a depth of 48 to 60 inches is firm but friable red clay loam or clay. This layer becomes lighter red or yellowish red with depth, and it finally grades into a mottled yellow, gray, and rust-brown clay loam. In places the underlying residual material is at a depth of 48 to 72 inches.

The Etowah soils are developed on younger terraces than the Cumberland, and their transported material has been derived largely from limestone. In some respects their profile resembles that of the Dewey. The surface soil is brown to grayish-brown mellow silt loam to a depth of 8 to 12 inches. The subsoil, a friable yellowish-red or yellowish-brown very fine sandy clay to silty clay, extends to a depth of about 40 inches. The material beneath the subsoil is variable, but in most places it is friable somewhat brown fine sandy clay splotched with gray and yellow.

The Humphreys soils occur in about the same positions as the Etowah but differ in several respects. They are derived from material originating largely in areas underlain by cherty instead of high-grade limestone. In forested areas Humphreys soils have a 4- to 5-inch surface soil of brown mellow silt loam. When cleared and cultivated, the surface layer soon loses its organic matter and becomes gray to plow depth. Below the surface soil is a 12- to 16-inch layer of light-yellowish or yellowish-brown mellow silt loam to silty clay loam. Beneath this layer and downward to about 24 inches, the material is yellowish-brown firm but friable silty clay loam. This is in turn underlain by mottled gray, orange, and yellow material, variable in character and tending to be poorly drained.

The Wolftever soil, like the Humphreys, is developed on moderately low terraces. It is rarely inundated and the floods are light. Its material is washed largely from high-grade limestone and shale and, to some extent, from cherty limestone. The soil is less brown than the Etowah, and though it resembles Humphreys soils in color, in surface soil, and in suitability for use, it differs in its compact subsoil at a depth of 24 to 34 inches and its lesser content of chert and gravel.

The Capshaw soil is developed on terraces in positions similar to those of the Etowah, Humphreys, and Wolftever. It differs from these soils, however, because it contains more sand, especially on the surface, since more of the material making it up has been washed from soils derived from sandstone and shale. The first 8 to 12 inches is grayish-brown to light-brown friable loam or fine sandy loam. Below 12 inches and down to about 30 to 34 inches is light yellowish-brown

heavy friable fine sandy clay loam. Grading down from about 32 inches the subsoil is light yellowish-brown to brownish-yellow sandy loam to clay loam in which there are varying quantities of water-worn sandstone fragments. Considerable water-worn sandstone may occur in places.

The Taft soil is derived to a large extent from material washed from soils underlain by cherty limestone. In forested areas the 5-inch surface layer is dark-brown to yellowish-brown silt loam that grades to a grayish-yellow silty clay loam. Below about 16 inches is mottled gray, rust-brown, and yellow silty clay loam to clay loam that contains some chert fragments in most places. Between 24 and 42 inches the material is gray mottled with rust brown and yellow, and it is compacted almost to a hardpan. Below this layer is mottled yellowish-gray and rust-brown clay containing some chert fragments.

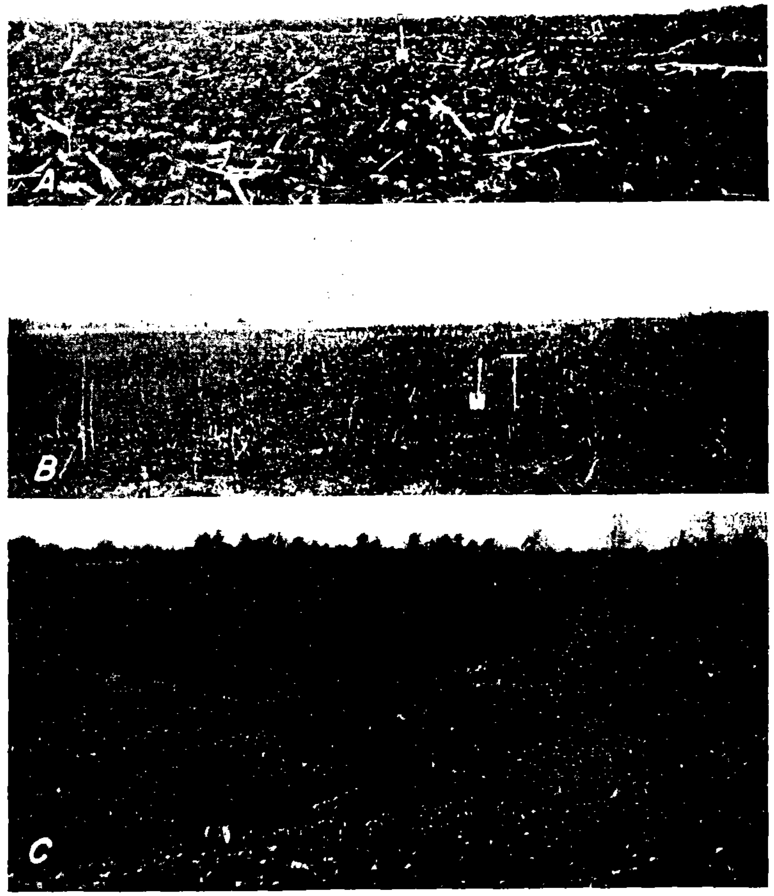
The Robertsville soil occurs on stream terraces in the slight depressions and low-lying areas that have poor external and internal drainage. The material from which it is derived has been washed from uplands underlain by high-grade and cherty limestone. From the surface downward the soil is mottled gray, with a compact layer beginning at a depth of about 20 inches. The compactness increases to a depth of about 26 inches, and below that depth the layer is very compact and hard. During moderately wet seasons the soil is often covered by water and consequently it is not suited to crops. Draining the soil for crop production would not be feasible in many areas but might be practicable for pasture.

SOILS OF FIRST BOTTOMS

Soils of first bottoms comprise the Huntington, Egam, Ennis, Lindside, Melvin, and Bruno series. These series are differentiated chiefly on the basis of differences in the character of their soil material, which is closely dependent on its source of origin and on drainage conditions. The soil material has been washed largely from soils underlain by high-grade and cherty limestone. The Huntington, Egam, and Bruno soils are derived largely from high-grade limestone material. The material making up the Ennis especially, and to some extent the Lindside and Melvin, is derived from cherty limestone.

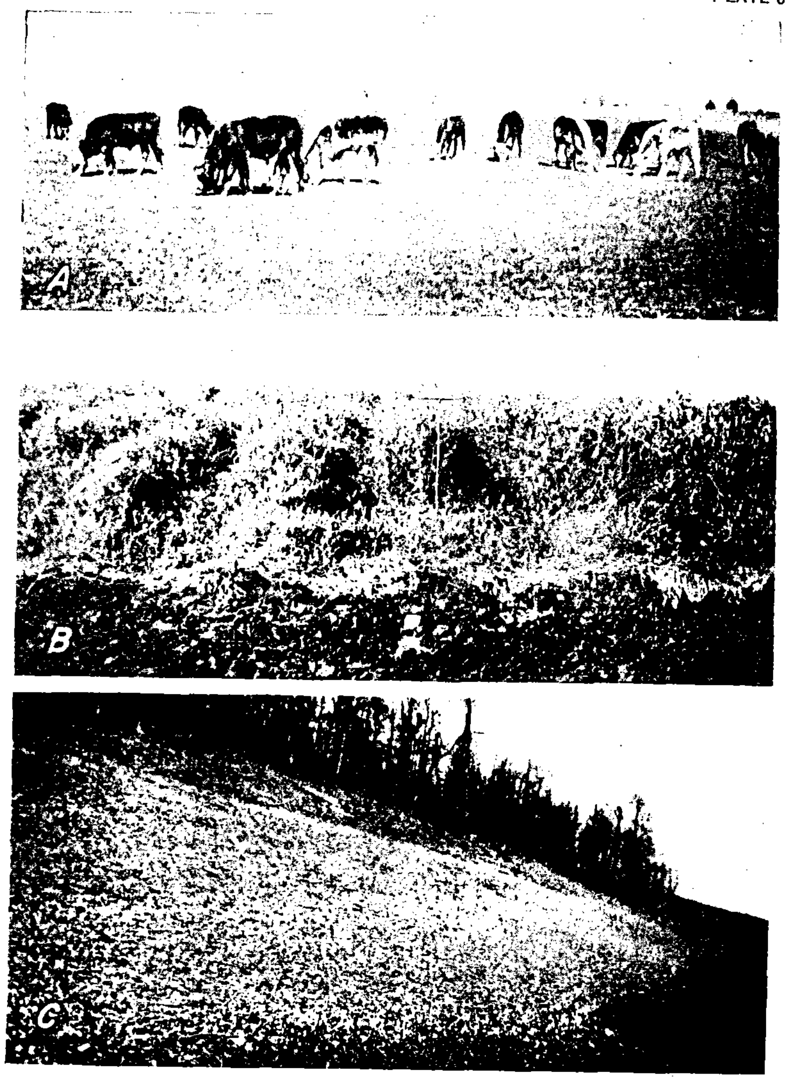
The Huntington soil is characterized by 18 to 24 inches of mellow brown silt loam underlain by moderately firm lighter brown friable heavy silt loam or silty clay loam that extends to a depth of 3 to 4 feet. The material following is variable, depending upon stream deposition. It is usually mottled but otherwise similar to the surface and subsoil. The Huntington soil is ordinarily planted to corn year after year without the use of fertilizer. Because the soil is well-drained and seldom subject to overflow crop failures are unusual.

The Egam soil is developed in close association with the Huntington, from which it differs chiefly in having a compact layer at a depth of about 2 feet. Like the Huntington, it is planted to corn year after year, but the yields are somewhat less and management is more difficult. The first 8 to 10 inches is brown mellow silt loam that grades into an 8- or 10-inch layer of lighter brown heavy silt loam. Below the second layer and downward to about 50 to 54 inches, the subsoil is compact slowly pervious dark grayish-brown to almost black clay



A, Landscape showing the very productive, easily worked, and easily conserved Dewey, Decatur, and Abernathy soils of the red lands.
B, Level Cumberland soil used for growing cotton.
C, Bluegrass pasture on Baxter cherty silt loam, eroded hilly phase.

Soil Survey of Limestone County, Alabama PLATE 6



A, Early spring grazing of a winter cover crop of rye, oats, and vetch on smooth Cookeville and Dewey soils.
B, Winter cover crop of vetch on Decatur silty clay loam, eroded undulating phase, ready to be turned under in preparation for corn.
C, Long rotations or permanent pasture are well suited to the strong slopes of Dellrose cherty silt loam, eroded hilly phase.

loam or silty clay loam. This is underlain by compact and relatively impervious grayish-brown clay loam that in most places is more or less splotched with gray. Though moisture moves slowly through this soil, it is fairly well to well drained.

The Ennis soils are similar to the Huntington, but they are grayer or paler brown throughout because they are derived from cherty limestone material. They are somewhat poorer than the Huntington in organic matter, lime, and probably other plant nutrients. They are also more imperfectly drained, being splotched at a depth of 24 to 30 inches in many places. Some imperfectly drained areas have been included that have a 10- to 12-inch surface layer of brown to yellowish-brown mellow silt loam underlain by brown mellow silt loam to light silty clay loam. The lower layer continues to a depth of 32 to 46 inches and in places shows some splotching in the lower part. The Ennis soils are rather consistently underlain by a gravelly substratum at a depth of 48 to 60 inches.

The Lindside soil is derived from much the same material as the Huntington and Egam and often occurs in close association with them. The material making it up, however, is somewhat more local in origin and in places may be more influenced by cherty limestone than the two associated series. This soil is about equal to the Egam in productivity but is somewhat less productive than the Huntington. In time of heavy rainfall it is more frequently subject to overflow than either and is less well drained, both on the surface and internally. About the same crops are planted, but these sometimes fail during rainy summers. The brown or yellowish-brown mellow silt loam surface layer extends to a depth of 10 to 16 inches. From 16 to 48 inches is firm to heavy clay or silty clay, light gray or gray mottled with pale yellow and rust brown, that is in places slightly compact and impervious. In places, some small black soft iron concretions occur. Below 48 inches the clay is mottled and there are some chert fragments and cobblestones.

The Melvin soil is developed from material washed largely from soils underlain by high-grade limestone and cherty limestone—material similar to that making up the Huntington and Lindside. It occupies narrow strips along smaller streams and low areas within larger tracts of Huntington and Lindside soils. Drainage is poor, both on the surface and internally. The soil is therefore not suited to crop production unless it is artificially drained. Some good pastures have been developed. The 6- to 12-inch surface layer is gray to grayish-brown or yellowish-brown silt loam, in places mottled with stronger brown. The 10- to 20-inch layer below is light-brown or gray silt loam to silty clay loam, which is mottled with yellow or rust brown, friable in some places, and heavy and somewhat plastic or slightly compact in others. It grades into steel-gray heavy clay or silty clay; at lower depths the material is variable in texture and color.

Bruno soil is brown to light-brown or light yellowish-brown fine sandy loam to a depth of 24 to 28 inches. Mottled gray, yellow, and brown sandy clay loam follows, and the material becomes finer and grayer as greater depth is reached. In a few small and widely scattered areas, the surface texture approaches a loamy fine sand.

849450—53——3

SOIL TYPES AND PHASES

In the following pages the soils of the county are described in detail and their agricultural relations discussed. Their acreage and proportionate extent are given in table 6, and their location and distribution are shown on the accompanying map.

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

Soil	Acres	Percent
Abernathy fine sandy loam	445	0.1
Abernathy silt loam:		
Level phase	14,376	4.0
Undulating phase	2,122	.6
Baxter cherty silt loam:		
Eroded hilly phase	9,130	2.5
Eroded rolling phase	12,816	3.5
Eroded steep phase	1,992	.5
Eroded undulating phase	5,846	1.6
Hilly phase	10,837	3.0
Rolling phase	2,047	.6
Steep phase	10,958	3.0
Undulating phase	1,445	.4
Baxter cherty silty clay loam:		
Severely eroded hilly phase	1,366	.4
Severely eroded rolling phase	3,642	1.0
Bodine cherty silt loam:		
Eroded hilly phase	801	.2
Hilly phase	589	.2
Bruno fine sandy loam	355	.1
Capshaw loam	285	.1
Cookeville silt loam:		
Eroded rolling phase	3,058	.8
Eroded undulating phase	30,560	8.4
Undulating phase	2,528	.7
Cookeville silty clay loam, severely eroded rolling phase	935	.3
Cumberland clay loam, eroded undulating phase	477	.1
Cumberland fine sandy loam, undulating phase	377	.1
Cumberland gravelly silty clay loam, eroded rolling phase	380	.1
Cumberland silt loam:		
Level phase	650	.2
Undulating phase	791	.2
Cumberland silty clay loam:		
Eroded rolling phase	1,147	.3
Eroded undulating phase	5,226	1.4
Severely eroded rolling phase	2,457	.7
Decatur silt loam:		
Level phase	7,542	2.1
Slightly eroded undulating phase	6,763	1.9
Decatur silty clay loam:		
Eroded rolling phase	1,312	.4
Eroded undulating phase	16,187	4.4
Severely eroded rolling phase	4,379	1.2
Dellrose cherty silt loam:		
Eroded hilly phase	2,365	.7
Hilly phase	350	.1
Dewey cherty silty clay loam:		
Eroded hilly phase	431	.1
Eroded rolling phase	937	.3
Severely eroded rolling phase	1,347	.4
Dewey-Decatur silty clay loams, severely eroded hilly phases	245	.1
Dewey silt loam:		
Level phase	800	.2
Slightly eroded undulating phase	1,453	.4
Dewey silty clay loam:		
Eroded hilly phase	139	(1)
Eroded rolling phase	1,639	0.5
Eroded undulating phase	16,082	4.4
Severely eroded rolling phase	2,344	.6
Dickson cherty silt loam:		
Eroded rolling phase	3,531	1.0
Eroded undulating phase	2,532	.7
Rolling phase	961	.3
Undulating phase	1,266	.3
Dickson cherty silty clay loam, severely eroded rolling phase	307	.1
Dickson silt loam:		
Eroded rolling phase	1,215	.3
Eroded undulating phase	23,736	6.5
Level phase	18,847	5.2
Undulating phase	13,477	3.7
Egam silty clay loam	548	.2
Ennis cherty silt loam	999	.3
Ennis silt loam	4,432	1.2
Shallow phase	524	.1
Etowah silt loam:		
Level phase	3,380	.9
Undulating phase	485	.1
Etowah silty clay loam, eroded undulating phase	805	.2
Greendale cherty silt loam, undulating phase	3,016	.8
Greendale silt loam:		
Level phase	676	.2
Undulating phase	11,161	3.1
Guthrie silt loam	19,531	5.4
Hollywood silty clay, level phase	649	.2
Humphreys cherty silt loam, undulating phase	1,486	.4
Humphreys silt loam, level phase	3,400	.9
Huntington silt loam	3,086	.8
Lawrence silt loam	10,169	2.8
Limestone rockland	674	.2
Lindside silt loam	5,084	1.4
Made land	159	(1)
Maury clay loam:		
Severely eroded hilly phase	156	(1)
Severely eroded rolling phase	1,195	.3
Maury silt loam:		
Eroded hilly phase	340	.1
Eroded rolling phase	831	.2
Eroded undulating phase	1,035	.3
Melvin silt loam	11,927	3.3
Mimosa cherty silt loam, hilly phase	469	.1
Mimosa cherty silty clay loam:		
Eroded hilly phase	1,158	.3
Eroded rolling phase	182	.1
Severely eroded hilly phase	310	.1
Ooltewah silt loam	3,229	.9
Robertsville silt loam	3,196	.9
Rough gullied land (Decatur, Dewey, and Cumberland soil materials)	364	.1
Sango silt loam	5,858	1.6
Taft silt loam	3,862	1.1
Wolftever silt loam	1,319	.4
Total	363,520	100.0

TABLE 6.—*Acreage and proportionate extent of the soils mapped in Limestone County, Ala.*—Continued

[1] Less than 0.1 percent.

Abernathy silt loam, level phase.—This soil occupies mainly basins or depressions in the southeastern, or red lands, part of the county. It has developed from material washed from surrounding soils of high-grade limestone. Though there is little surface runoff, the soil is well drained. Water may stand on some areas for a brief time after heavy rains, but it soon disappears, largely through subterranean passages in the limestone bedrock or by way of surface ditches. Few crops are lost because of inadequate drainage.

Being in depressions, this soil has retained its own productivity and received materials highly important to plant growth from surrounding areas. These have been washed from the Decatur, Dewey, Cumberland, and Etowah and, to a slight extent, the Cookeville soils, and consist of accumulations from organic matter and other solids deposited by surface water and from materials carried in solution by seepage waters. Although this soil is not susceptible to erosion, it is injured in places by deposited material washed from deeply gullied and otherwise severely eroded slopes.

The soil is variable and without distinct layers. In places some variation exists in the depth of the colluvial profile over residual material, and in others are bodies of fine sandy loam. In most places, however, is a 12- to 18-inch layer of dark reddish-brown to brown heavy silt loam underlain by a yellowish-brown to reddish-brown heavy silt loam. In many places at a depth of 24 to 36 inches is a very dark-colored layer, which was probably the surface soil before the overwash from surrounding land covered it. At a depth of 36 to 48 inches is splotched gray, yellow, and brown silty clay material.

Use and management.—The level phase of Abernathy silt loam usually is planted to the same crops as the surrounding land. Though it produces a rank weed or stalk growth, cotton does fairly well. Yields of 500 to 800 pounds an acre are obtained at times, but the cotton is ordinarily a little later in opening than it is on higher ground, and frost may at times prevent full development of bolls. If the areas could be separated from the surrounding Decatur or Dewey soils, most farmers would prefer planting the Abernathy soils to corn. The areas are so intermingled with other soils, however, that it is often difficult to put them to a different use from that of the main field. Corn yields of 40 to 60 bushels an acre are common on the deeper Abernathy, as this soil has particularly favorable moisture relations for corn and other crops that have a high moisture requirement late in summer and early in fall. Small grain and hay crops produce well, although they grow so rank at times that some lodging may result. Where the layer of inwash material is not too deep, good alfalfa and similar hay crops can be grown.

Being well drained and having favorable physical properties, this is a productive soil. It has no rigid requirements in regard to rotation and soil amendments, and little fertilizer is used for crops. The favorable physical properties, normal percolation of water, and good circulation and retention of moisture favor tillage; consequently, practically all the land is cultivated annually.

Abernathy silt loam, undulating phase.—Long bands of this phase are scattered at the base of upland slopes where material has been washed onto the terraces and bottoms from higher red limestone soils. Most areas are in the southern part of the county, but others are in nearly all parts where the red soils occur. The soil is constantly receiving fertile material not only from the surface wash but also from seepage waters that bring material from higher ground. Relief ranges from 2 to 4 percent, and surface drainage is good for practically all crops common to the area. The nitrogen content is so high in some places that stalk growth in some crops is excessive. Little erosion takes place, but the soil is sometimes injured by deposits washed from adjacent deeply eroded areas.

Owing to the short time since deposition of the soil material, no distinct layers have developed. In most places the surface material is brown to reddish-brown silt loam, 10 to 14 inches deep. Beneath this is reddish-brown to yellowish-brown heavy silt loam. In some places there is a dark layer at a depth of 24 to 36 inches, which may have been the surface soil before it was buried by material washed from higher slopes that were cleared and subjected to accelerated erosion. Silty clay material splotched with yellow, brown, and gray occurs at 26 to 40 inches.

Included with this phase are a few small areas having slopes of 2 to 5 percent, and in some places there are chert fragments and a little subsoil washed from eroded land.

Use and management.—Abernathy silt loam, undulating phase, is a desirable agricultural soil; its physical properties favor tillage and the movement of moisture and air. Good tilth, favorable slope, inherent fertility, and good drainage make it a productive soil. Almost all the crops common to the area are grown. Cotton yields 300 to 800 pounds of lint an acre. Though too much cottonweed develops in places, the crop generally matures better here than on the other Abernathy soils. Corn yields 35 to more than 55 bushels an acre. Small grain and hay of all kinds common to the area do well and are not so subject to lodging as they are on other Abernathy soils. Alfalfa may produce 3 to 4 tons an acre and annual hay 1 to 2½ tons. With good treatment pastures can be made to produce 100 to 150 or more cow-acre-days [8] of grazing.

This phase is usually farmed along with other soils, and about the same fertilizers are applied. Where it is farmed separately, fertilizers are not used so extensively. Other management practices are the same as for the Decatur and Dewey silt loams, though rotation of crops and erosion control are less important. The few small included areas having a slope range of 2 to 5 percent generally tend to be a little less productive of many crops. Cotton matures well on these, however, and the average yield is about as good as for the level phase of Abernathy silt loam.

Abernathy fine sandy loam.—Except for the larger quantity of fine sand in the profile, this soil is very much the same as the level phase of Abernathy silt loam. It occurs in the same positions, mostly in depressional areas within tracts of Cumberland fine sandy loam, undulating phase. Slopes range from 0 to 2 percent. Some of the

[8] Cow-acre-days, used to express the carrying capacity of pasture land, is the product of the number of animal units carried per acre multiplied by the number of days that the animals can be grazed without injury to pasture; for example, a soil that supports 1 animal unit per acre for 360 days rates 360; a soil supporting 1 animal unit on 2 acres for 180 days rates 90; and a soil supporting 1 animal unit on 4 acres for 100 days rates 25.

areas are being damaged by inwash of sand or, in places, by subsoil material washed from the severely eroded tracts of surrounding soil. Erosion is being checked in some degree, however, by the extensive control program carried on in the county.

Use and management.—Cotton, corn, hay, and pasture are among the crops planted on Abernathy fine sandy loam. Under similar management, the average yields are somewhat lower than on Abernathy silt loam, level phase. The fertilization and other management practices used for the two soils are almost the same. Practically the entire area of both soils has been cleared.

Baxter cherty silt loam, rolling phase.—The material from which this soil has formed is about the same as that parent to the Cookeville soils; that is, that coming from Fort Payne chert. This and other cherty phases are generally considered as younger soils, for they have not existed long enough to allow all the rock to break down and form soil. Areas occur mostly on 5- to 12-percent slopes in the broken and rolling parts of the county, the more extensive ones being in the northern part. Some areas occupy 4- to 5-percent slopes on the narrow ridge tops and extend down the adjacent slopes for some distance. This phase is associated with other Baxter soils and with those of the Dickson, Bodine, Maury, and Dellrose series. Small areas of cherty colluvial material are included. Both surface and internal drainage are good to excessive. Originally this soil was covered with a fairly heavy growth of red, Spanish, and post oaks; chestnut; hickory; dogwood; and other hardwoods.

The 4- to 5-inch surface layer is grayish-brown cherty silt loam mixed with numerous, usually angular, chert fragments that are up to 5 inches in diameter. A yellowish-brown silt loam mixed with chert fragments extends from a depth of 5 to 12 inches. Continuing from 12 inches to about 24 inches is brownish-yellow silty clay loam having a reddish cast, which is mixed with a somewhat lesser quantity of cherty fragments. From 24 to 36 inches the subsoil is yellowish-red silty clay loam streaked somewhat with yellow; it contains a small quantity of chert fragments. From 36 inches to about 46 inches is brownish-red mottled with gray and yellow silty clay loam that contains some chert fragments. Below 46 inches the chert bedrock is reached rather abruptly. In places the soil layer is not so thick, and bedrock may be at a depth of 26 to 30 inches.

Use and management.—Cotton, corn, annual hay, oats, wheat, and garden crops for home use are among the crops planted on Baxter cherty silt loam, rolling phase. Some pastures are developed, and the pasture acreage is increasing yearly. Cotton produces 200 to 500 pounds of lint an acre; corn, 15 to 40 bushels; wheat, 10 to 18 bushels; oats, 15 to 40 bushels; lespedeza, ½ to 1¼ tons of hay; soybeans, 1 to 2½ tons; and alfalfa, 1 to 2½ tons. Sweetpotatoes, potatoes, other vegetables, fruits, and pasture yield well.

Until recent years little attention was given to the growth of winter cover crops on this soil, but more vetch is now being grown each year. Farmers find that the cover crop conserves soil moisture and increases the organic and nitrogen content. Fertilizer costs are therefore reduced and the crop yield is increased considerably. It is important that the soil be plowed on the contour, especially if clean-tilled crops are to be planted, because the slope range is 5 to 12 percent in most

parts. The chertiness and porosity of this phase probably allows more leaching than in the Cookeville soils and therefore care in conserving fertility and moisture is more important.

Baxter cherty silt loam, eroded rolling phase.—This phase occurs rather widely in the more broken part of the gray lands section of the county, largely in the northwestern part, on 5- to 12-percent slopes. It differs from the rolling phase mainly in being more eroded. In only a few places is there enough chert present to interfere materially with tillage.

Baxter cherty silt loam, undulating phase.—The profile of this phase is much like that of the rolling phase but its various layers average somewhat thicker. In many places the chert is less abundant, and the total depth to bedrock is a little greater. It occurs in close association with the rolling phase and is derived from the same material, but it occupies the less sloping positions of 2 to 5 percent. Included with this soil are areas of Cookeville silt loam, undulating phase, and a few spots of Dickson cherty silt loam, undulating phase, too small to be mapped separately.

Use and management.—Because of its chertiness Baxter cherty silt loam, undulating phase, was not cleared when the county was first settled, but much of it has been cleared for 40 to 50 years. Only a small part of it remains in forest. Crops usually do well under good management, as moisture conditions tend to be good most of the time. Drainage is good, both externally and internally, and erosion is not severe if moderate care is exercised to prevent it. Practically the same crops are grown as on the rolling phase. Fertilization and other management practices differ but little on the two. There is only slight difference in yields, but it is natural to expect that the average over a long period of time will be greater on this soil if the two phases receive the same treatment.

Baxter cherty silt loam, eroded undulating phase.—This soil occurs in close association with other phases of the cherty Baxter and Dickson soils in rather widely scattered areas in the northwestern quarter of the county. Except for its eroded surface, the soil is much the same as the undulating phase. The slope range is 2 to 5 percent, but possibly more of this phase is on a slope of nearly 5 percent. The eroded condition is accounted for by the greater slope and the fact that the land has been cleared longer and, in many cases, handled in a more careless manner. Originally the soil was covered with a hardwood forest.

Both external and internal drainage are good, and when the soil is managed properly, moisture conditions are favorable for crop production. Much the same crops are planted as on Baxter cherty silt loam, rolling phase, and yields are only slightly lower. Fertilizer treatment and other management practices are practically the same for the two.

Baxter cherty silt loam, hilly phase.—This soil has weathered partly from high-grade limestone and partly from Fort Payne chert. Areas occur on some of the slopes in the cherty section, especially in the northern and northwestern parts of the county. The soil is associated with other phases of Baxter soils and with those of the Bodine and Dickson series. It differs from the rolling phase only in having

stronger slopes (12 to 30 percent) and in being a little shallower over bedrock.

This soil has not been affected by accelerated erosion, because nearly all of it is forested. If it were cleared, erosion would be rather rapid unless special care were exercised, since the slope is too great to permit clean tillage for a long period under average conditions. Should this phase be cleared, it would be best used in most places for permanent sod pasture, with possibly an occasional cultivated crop.

Baxter cherty silt loam, eroded hilly phase.—Stronger slopes (12 to 30 percent) and a shallower depth to bedrock are the chief differences between this and the closely associated eroded rolling phase. The areas are mainly in the more dissected northwestern part of the county. Though this soil has produced some fair crops in the past, it tends to erode more rapidly than the rolling phase. Considerable more erosion and a rapid decline in crop yields can be expected if the land is continued in tilled crops. Most areas that have been cleared are now being used for pasture (pl. 5, *C*). Hardwood constitutes most of the timber.

Baxter cherty silt loam, steep phase.—Included in this phase are some of the steepest areas in the county, the slope range being from 30 to more than 60 percent. Areas occur along the steeper slopes near the Elk River; Sugar, Shoal, and Ragsdale Creeks; and other small tributaries, chiefly in the northwestern part of the county. The soil is associated with other Baxter soils and with the Dickson and Dellrose series. It is derived from the same material as Baxter cherty silt loam, rolling phase, though its profile is less well developed. Depth to bedrock in general ranges from 12 to 60 inches, but there are some rock outcrops. Some areas resembling Bodine soil and others resembling Dellrose soil are included because of their small extent.

Use and management.—Virtually all of Baxter cherty silt loam, steep phase, is forested, in places with fairly good timber and in others with thin stands of low quality. If this soil were cleared of forest, the surface runoff would be rapid, severe erosion would be extremely difficult to prevent, numerous small gullies would form, and sheet erosion would spread rapidly. If best forest returns are to be realized, the need for considerable improvement in the present timber stand is apparent in many areas. The growth includes hickory; beech; walnut; maple; red, white, post, Spanish, and black oaks; sycamore; ash; elm; hornbeam; dogwood; redbud; and in smaller numbers, numerous other hardwood trees. There once were many chestnut trees, but they have been killed by disease. Many farm families depend on the forest covering this steep soil for firewood, and in the future, more families probably will obtain their fuel from these areas.

Baxter cherty silt loam, eroded steep phase.—Nearly all this soil is in the northwestern part of the county, where it occurs in association with other hilly and steep Baxter soils and with the Bodine and Dellrose series. A small acreage of eroded Dellrose soil is included. This phase has been cleared for a comparatively short time but narrow straight gullies have formed, and erosion cannot be controlled with any degree of success, even if the soil is used for sod pasture. Crops do well for the first few years after clearing, but tillage is difficult on the 30- to 60-percent slopes, and erosion is rapid under clean cultivation.

Sericea lespedeza for pasture or kudzu for temporary grazing may be suitable uses for this soil, but most areas will possibly revert to forest.

Baxter cherty silty clay loam, severely eroded hilly phase.—In its original state this soil was Baxter cherty silt loam, hilly phase, but it lost most of its surface soil through severe erosion when it was cleared and cultivated. It occurs in association with other steep and hilly phases of the Baxter series. Its profile is similar to the rolling phase of Baxter cherty silt loam, and its original forest growth was much the same. Slopes are from 12 to 30 percent and drainage is good. Surface runoff is rapid, especially during seasons of heavy rainfall.

All this soil has been planted to crops for several years, and erosion has been severe. Terracing will aid in checking erosion but in many places is not sufficient to control it. Perennial crops seem to be the best use for this soil.

Baxter cherty silty clay loam, severely eroded rolling phase.—Though somewhat shallower over bedrock, this phase differs but little from the severely eroded rolling phase of Cookeville silty clay loam. A few areas are on either side of Ragsdale Creek and in other rolling parts of the northern and northwestern sections of the county. The slope range is 5 to 12 percent. Considerable chert is on the surface and mixed with the soil mass. In most areas the fragments are not large, although in places they occur in sizes and quantities that would more or less interfere with tillage. These more cherty places are spotty in occurrence rather than continuous over an area large enough to map. Before good pasture sod can be established, liberal applications of lime, phosphate, and potash are needed. Kudzu or sericea lespedeza for temporary grazing or hay may sometimes be a good use for this soil.

Bodine cherty silt loam, hilly phase.—This soil occurs on the more sloping uncleared tracts in the northern and northwestern parts of the county in close association with the Baxter and Dickson soils. The chief difference between this phase and the hilly phase of Baxter cherty silt loam is in the color of the subsoil—the Baxter subsoil is reddish; this is yellowish brown. Both phases are rather shallow over chert and both have a relief of 12 to 30 percent. The timber cover is mainly red, white, and black oaks; hickory; blackgum; dogwood; sourwood; and, on the lower slopes, beech.

In forested areas the first 2 inches is dark grayish-brown mellow silt loam. The dark color is caused by stains from organic matter. From 2 to 8 inches is a light grayish-brown mellow silt loam containing chert fragments. Continuing from a depth of 8 inches to 30 inches is light yellowish-brown friable clay loam, faintly splotched with red, yellow, and gray. Many chert fragments are in this layer, and mottling is especially evident in the lower part. Below 30 inches is a bed of chert, in which occur spots or pockets of yellow, red, gray, and brown splotched clay loam. The entire profile is strongly or medium acid. Drainage is good to excessive, both externally and internally.

Where land is needed for pasture, areas may be cleared of nearly all the trees and seeded. Reasonably good pasture can be obtained, providing it is properly prepared and fertilized.

Bodine cherty silt loam, eroded hilly phase.—In this phase are areas formerly of the hilly phase that have been cleared and tilled until

moderately eroded. The slope range is from 12 to 30 percent, and most of the bodies are in the more broken northwestern part of the county. Crop yields are generally low and are rapidly declining. Quantities of chert and the strong slopes make harvesting of hay crops difficult, but pasture might do reasonably well under proper management practices (*14*). Erosion control is one of the main management problems. This far, the soil is only sheet eroded in most places, but if cropping is continued without special precautions for control, gullying will be severe. A good management practice is the incorporation of as much organic matter as possible in the soil to control erosion and to conserve moisture.

Bruno fine sandy loam.—This soil occupies narrow strips along the stream banks where fine sand has been dropped by floodwaters. In many places it forms a natural levee. Nearly all areas occur east of the Athens-Decatur Highway on the old Tennessee River bank and on the Elk River bank above Buck Island Bridge. The soil is formed of recent alluvium washed from upland soils underlain by high-grade limestone, shale, sandstone, and other rock. Usually there is little slope (0 to 2 percent), but some areas have a gradient of as much as 3 percent. Drainage is good throughout the profile. Huntington silt loam, Egam silty clay loam, Lindside silt loam, and Melvin silt loam are associated with this phase in the first bottoms.

Except for more fine sand in the profile, especially in the upper part, this soil does not differ greatly from Huntington silt loam. The surface 24 to 28 inches is brown to light yellowish-brown fine sandy loam. Below this is mottled gray, yellow, and brown sandy clay loam that grades with depth to fine-textured material.

Use and management.—Practically all of Bruno fine sandy loam has been cleared for many years. The principal crops are corn, pasture, or hay. Corn yields 20 to 40 bushels an acre; soybeans, 1½ to 2 tons; and lespedeza, ¾ to 1½ tons of hay. Cotton and vegetables are grown to a small extent, and pasture would no doubt do fairly well under proper management (*14*). Fertilizer is seldom used, and management practices are about the same as those for Huntington silt loam.

Capshaw loam.—This loam occupies 0- to 2-percent slopes on stream terraces in association with Etowah, Wolftever, and Humphreys soils, which are also on terraces, and the Huntington, Egam, and Lindside soils of the first bottoms. A large part of this soil is along the Elk River near the point where it enters the county. Areas lie above normal floodwaters but are subject to overflow during heavy floods. Drainage is good on the surface and throughout the profile. Lack of a tight compacted subsurface layer and its more sandy profile differentiate this soil from the Wolftever, and it is sandier and browner both in the surface and the subsoil than the Humphreys. The profile is better developed than that of first-bottom soils. The original cover was elm, willow oak, maple, hickory, hackberry, sycamore, ash, cedar, and many species of undergrowth, as dogwood and hornbeam.

In areas cultivated for a number of years the surface soil is grayish-brown granular and friable loam to a depth of about 7 inches. From this layer to a depth of 12 inches is mellow slightly heavier yellowish-brown loam that contains some small chert fragments, as do all the layers that follow. Between 12 and 20 inches, the subsoil is a friable

firm brownish-yellow fine sandy loam. The following layer of pale-yellow friable clay loam extends to a depth of 35 inches. The layer between 35 and 44 inches—a mottled gray, yellow, and brown silty clay loam—is a little more compacted than the overlying one but has about the same content of chert. Between 44 and 51 inches is highly mottled gray, rust-brown, and orange silty clay loam, in which some chert fragments are mixed. Below 51 inches is highly mottled gray and brown silty clay loam that remains very wet, even in moderately dry seasons. A few small chert fragments are present at this depth. Included with this soil are a few areas having a texture slightly finer than ordinary.

Nearly all the land has been cleared for many years. Management practices, including fertilization, are about the same as for Humphreys silt loam, level phase. The crops grown are approximately the same, and there is generally no great difference in yields.

Cookeville silt loam, undulating phase.—This is one of the important soils in the northern two-thirds of the county. It occupies level to gently rolling areas in nearly all sections north of the red lands. Slopes range from 2 to 5 percent and none of the areas have choppy relief. The soil is closely associated with the Dewey and Dickson, and it is intermediate between the two in respect to its position and color. It is derived in part from weathered material of high-grade limestone and in part from weathered material of Fort Payne chert. The reaction is medium to strongly acid. External and internal drainage are good. In uncleared areas the timber growth includes red, black, and white oaks; sweetgum; elm; dogwood, yellow-poplar, and other hardwoods.

In forested areas the first inch of the surface soil is dark grayish-brown silt loam that contains a fairly large quantity of organic matter from decaying leaves, stems, and roots. The surface soil beneath this thin deposit is grayish-brown slightly sticky silt loam to a depth of about 5 inches. When moderately moist, this layer is friable and mellow. Between 5 and 11 inches the soil is yellowish-brown silt loam, with slight reddish-brown feathering; from 11 to 20 inches is brownish-yellow heavy silt loam with a reddish hue. The layer between 20 and 24 inches is light yellowish-red silty clay loam streaked with red, containing soft rock fragments. A yellowish-red slightly compact silty clay loam with small chert fragments continues downward from below 24 inches to a depth of 28 inches. Mottled yellowish-red, gray, and yellow silty clay loam, compact and very hard when dry, and in places approaching hardpan, occurs between 28 and 38 inches. This contains a few small fragments of chert. From 38 inches downward to 66 inches or more is brownish-red compact silty clay loam, mottled with gray and yellow, that is more friable in the lower part. The material below 66 inches is mottled red and yellow slightly compact silty clay with many chert fragments.

Small areas of Dewey and Dickson soils are included with this phase in mapping. Small areas of cherty Baxter soils also are included; they are designated on the soil map by chert symbols.

Use and management.—There are few uncleared areas of Cookeville silt loam, undulating phase, and many of those cleared have long been in cultivation. Almost all the crops common to the area are planted on this soil; with good management, including fertilization,

it produces fair to good yields. Cotton produces 200 to 500 pounds of lint an acre; corn yields 15 to 35 bushels; wheat, 10 to 20 bushels; oats, 15 to 40 bushels; lespedeza, ¾ to 1½ tons; soybeans, 1 to 2 tons; and alfalfa, 1 to 3 tons of hay. Other crops produce fair to good yields.

The fertilization used is about the same as that for the phases of Dewey silt loam (*4, 5, 17, 19*). Winter cover crops are being used more and more, and the growing of these crops determines to some extent the quantity and kind of fertilizers used (*5, 7, 9*). In most areas, the use of proper crop rotations is a considerable aid in retaining soil fertility. In general, excellent response can be expected from this soil if good management is practiced.

Cookeville silt loam, eroded undulating phase.—Probably 50 to 75 percent of the original surface soil of this phase has been removed by erosion. Ordinary tillage practices have mixed subsoil material with the surface soil, and over approximately half the area the color of the soil has been altered to plow depth. Drainage is good, both externally and internally, and the moisture-holding capacity is good in areas where sufficient organic matter has been incorporated.

Areas occur in close association with the undulating phase and occupy very similar positions. Though both occupy 2- to 5-percent slopes, most of the undulating phase is on the milder slopes; whereas, this soil is predominantly on slopes of nearly 5 percent. There is more variation in the relief of this phase than there is in the undulating. The two were originally the same in profile characteristics, but owing to slightly greater average slope, longer cultivation period, and possibly more careless management in some places, this phase has lost much of its surface soil. Otherwise, the profiles of the two are still alike. Included with this soil are a few areas of uneroded soil too small to be shown on the soil map.

Use and management.—Nearly all of Cookeville silt loam, eroded undulating phase, has been cleared for the last 25 to 50 years and has been planted to field crops common to the area. The crops grown are the same as those on the undulating phase. Yields are slightly lower under ordinary tillage practices, but under good management, they can be practically the same. The moderate erosion the soil has undergone seems not to have reduced its productivity so greatly as it has that of many soils.

To restore and maintain the organic-matter content of this soil and to prevent erosion from becoming severe and reducing crop yields, the use of winter cover crops, proper crop rotations, and terracing are the principal management practices required. The soil is managed in a manner similar to that of the undulating phase, although it needs greater quantities of nitrogenous fertilizer and organic matter.

Cookeville silt loam, eroded rolling phase.—Except for its steeper slopes (5 to 12 percent), this phase differs little from the eroded undulating phase. Both are managed in much the same manner, but the eroded rolling phase is more subject to erosion because of its position on steeper slopes, and therefore its need for erosion control is more imperative. Areas occur in the rolling part of the gray lands section.

Use and management.—Cotton is the chief crop on the eroded rolling phase of Cookeville silt loam. Corn, hay, and soybeans for seed are grown by some farmers. Practically all the land has been cleared and has been tilled for 25 to 40 years. It responds readily to good management. Winter cover crops, as vetch, are proving their value (pl. 6, *A*) and are helpful in controlling erosion, in increasing the organic-matter content, in improving the physical condition of soil, in conserving moisture, and in lengthening the grazing season, as the vegetation is ready for pasturing several weeks before that of permanent pasture.

Cookeville silty clay loam, severely eroded rolling phase.—Through neglect and extended use, areas of Cookeville silt loam, rolling phase, have been reduced to this severely eroded soil. Areas occur in association with other phases of the Cookeville soil and with phases of the Dickson. These areas are rather small and constitute a part of the gray lands section of the county. Slopes range from 5 to 12 percent. Surface runoff is rapid, and as erosion continues, it becomes more rapid. Over most of this soil, erosion has removed at least 75 percent of the original surface layer and, in some places, part of the subsoil. Any tillage done is therefore largely in subsoil material. Short shallow gullies are common in many places.

The planting of close-growing crops and the use of strip cropping and terracing might easily have saved this soil from severe erosion. By the use of kudzu, lespedeza, sericea lespedeza, or similar crops, fairly good pasture might still be established. The sod should serve to hold erosion to a minimum, provided other generally approved management practices are employed.

Cumberland silt loam, undulating phase.—This smooth red soil occurs on well-drained fairly high to high terraces in the main valley of the Tennessee River and, to some extent, in the Elk River Valley and other smaller valleys. At least 80 percent is along a belt that extends about 1 mile back from the Tennessee River and a small area is near the junction of the Elk and the Tennessee Rivers. It is similar to the Decatur soils but differs in being more friable and in being derived from the material deposited by stream action. The material forming this soil has been washed largely from soils underlain by limestone and to a small extent by shale and sandstone. It was deposited many years ago when river beds probably were much higher and the stream flow much greater, for now the terraces are far above any overflow. Most of the slopes are less than 5 percent, the range being 2 to 5 percent. The natural vegetation was a heavy growth of red, black, and white oaks; hickory; yellow-poplar; and chestnut, with some cedar and pine intermixed. Undergrowth, in general, was scant.

The 5- to 8-inch surface soil of brown to reddish-brown friable silt loam contains a fair quantity of well-incorporated organic matter. From 8 to 15 inches the subsoil is reddish-brown friable silt loam that breaks in fragments and crushes to a crumb structure under pressure. The following 15 to 21 inches is yellowish-red heavy silt loam containing small brown concretions, sand and fine mica particles, and a few water-worn pieces of gravel. An occasional piece of gravel occurs on the surface or throughout the profile. The subsoil between 21 and 39 inches is red to slightly yellowish-red silty clay loam, firm to friable when moist. This breaks to nutlike fragments that may be crushed to crumblike or granular particles. In this layer there are purplish-red splotches, a few brown concretions, and some fine mica flakes and sand

particles. Bright-red slightly yellowish-tinged silty clay loam continues from 39 to 66 inches, and it contains some fine mica particles, a little sand, a few small concretions, and a few fine rock fragments. This material is friable and crushes easily, especially when well moistened.

As cultivation and weathering continue, the surface soil becomes lighter in color unless the organic content is maintained or increased. The tilth generally remains good until the original organic matter is gone. The absorption of moisture and its movement through the soil are good, but the more sloping areas are easily eroded unless care is taken to control runoff. Included with this phase, but designated on the map by gravel symbol, are several small areas of Cumberland gravelly silt loam, undulating phase.

Use and management.—Practically all of Cumberland silt loam, undulating phase, has been cleared for many years. Cotton, corn, hay, and small grains are grown. This soil is well adapted to cultivated crops because it is relatively fertile and has favorable physical properties and relief. Yields are good for almost all crops. Fertilizer requirements and management practices do not differ widely from those of Decatur and Dewey silt loam soils.

Cumberland silt loam, level phase.—The surface layer of this soil is generally 1 to 3 inches thicker than that of the closely associated undulating phase. It also differs in having a higher organic-matter content, a greater moisture-holding capacity, and a more level relief (0- to 2-percent slope). Except for these differences, it is much the same as the undulating phase. Small widely scattered areas occur a short distance north of the Tennessee River. Crops grow a little better on this phase than on the undulating phase because of its better moisture-holding capacity, and yields are generally 2 to 5 percent higher. The use and management of the two soils are practically the same, but the danger of erosion is negligible on this level soil.

Cumberland silty clay loam, eroded undulating phase.—Nearly all of this phase occupies high river terraces within 2 or 3 miles of the Tennessee and the Elk Rivers. It occurs in association with other phases of the Cumberland soil and with phases of the Etowah, Decatur, and Dewey soils. The boundary between bodies of this soil and those of Decatur silty clay loam, eroded undulating phase, are difficult to establish and in some places are arbitrarily fixed. The slopes range from 2 to 5 percent and are generally fairly long and regular. They vary a little more than those of Etowah soils. External and internal drainage are good, but loss of some of the surface silt loam through erosion has made moisture absorption fairly slow during heavy rain. Runoff is rapid.

The parent material of this eroded soil was evidently washed from uplands underlain largely by high-grade limestone. The material has lain in place for a long period, and a fairly definite profile has developed. Under forest conditions areas of this soil were likely the same as the undulating phase of Cumberland silt loam, but after clearing they were allowed to erode. Probably 50 to 75 percent of the original surface soil has been lost through accelerated erosion. Because of erosion the surface soil is thinner than that of Cumberland silt loam, undulating phase, and the intermixed subsoil material gives it a heavier consistence and a brighter red color. The profiles of the two are otherwise similar.

Use and management.—Owing to its good workability, high productivity, and proximity to transportation, the eroded undulating phase of Cumberland silty clay loam was one of the first soils cleared in the county. Much of it was undoubtedly cleared about 100 years ago, and since that time it has been in almost continuous cultivation. For a greater part of the time it has been planted to cotton or other clean-tilled crops. Fertilization and other management practices are much like those for the eroded undulating phase of Decatur silty clay loam; the crops grown and yields produced are closely similar.

Cumberland silty clay loam, eroded rolling phase.—Areas of this soil occur near the southern boundary of the county on slopes of 5 to 12 percent. Except for its steeper relief, it differs but little from the eroded undulating phase. The rather strong slopes allow rapid runoff during heavy rains, and consequently erosion is increased and the soil is prevented from absorbing as much moisture as crops need.

Use and management.—The crops grown and the fertilization practices used on the eroded rolling phase of Cumberland silty clay loam are about the same as those for Decatur silty clay loam, eroded undulating phase. Additions of organic matter, the use of close-growing crops, and the planting of winter cover crops are management practices needed.

Cumberland silty clay loam, severely eroded rolling phase.—This phase occurs in the southern part of the county and also near the bridge that spans the Elk River on the Athens-Florence Highway. It is mapped in close association with other Cumberland phases and is derived from the same material. It is similar to the severely eroded phases of Decatur and Dewey soils but is a little more susceptible to erosion than either of them and is more friable than the Decatur. In general, the areas are a little larger than those of the Decatur and Dewey. Small areas of Cumberland clay loam, eroded undulating phase, are included.

The management requirements for this phase are much the same as those for the severely eroded Decatur and Dewey soils, and the results to be expected under improved management are similar to those on the severely eroded Dewey soil under similar improved practices.

Cumberland fine sandy loam, undulating phase.—Except for more sand in the profile and greater susceptibility to erosion, this soil differs but little from Cumberland silt loam, undulating phase. The slope range is 2 to 5 percent. The larger areas are in the vicinity of Old Browns Ferry Landing and near Wall Street.

The soil is used and fertilized in about the same manner as the undulating phase of Cumberland silt loam and under similar management produces practically the same crop yields. Owing to its susceptibility to erosion, it is important that this soil be planted frequently to close-growing crops. Its friability permits its rapid breaking down by erosion.

Cumberland clay loam, eroded undulating phase.—By long cultivation and careless management, this soil has lost part of its original fine sandy loam surface layer. The subsoil has been turned up by tillage over at least half the area. The soil occurs mostly in the

southeastern part of the county in close association with Cumberland fine sandy loam, undulating phase, and to a large extent consists of tracts that were in all likelihood a part of that phase before erosion. Except for the higher percentages of clay and fine sand and the lower percentage of silt, the profile is much the same as that of the related undulating Cumberland fine sandy soil. A few areas having a grayer surface soil are included because most of them are not large enough to be mapped separately.

The slope range of this phase is from 2 to 5 percent, and drainage is good, both externally and internally. Because the porous surface soil is eroded, the subsoil tends to absorb heavy rainfall less rapidly, thus increasing runoff and more rapid erosion. In places where surface runoff is rapid and erosion rather severe, the water-holding capacity of the soil is reduced, and during extended drought corn, hay, and like crops suffer from lack of moisture.

Use and management.—Crops on Cumberland clay loam, eroded undulating phase, are about the same as those grown on Cumberland silt loam, undulating phase, but yields are slightly lower under the same fertilization and other management practices. Cotton always has been the main crop. The use of vetch and other winter cover crops during the past few years has improved yields considerably, reduced erosion, and tended to improve the workability of the soil, just as it has done on nearly all the red lands soils.

Cumberland gravelly silty clay loam, eroded rolling phase.—Differentiated in this phase is rolling Cumberland soil that contains a quantity of gravel—in some places enough to interfere with mowing, cultivating with hoes and other light implements, or similar field operations. This phase is eroded, and, as a result, the plow layer is a mixture of subsoil and surface soil and, in many places, is entirely subsoil material. The relief is rolling, generally on slopes of 5 to 12 percent, but in a few hilly places the gradient ranges to 30 percent.

Use and management.—All of Cumberland gravelly silty clay loam, eroded rolling phase, has been cleared and cultivated. Cotton is the chief crop; corn and hay are next in acreage. The yields are lower than those on the smoother Cumberland, Decatur, and Dewey soils. Chiefly because of its rolling surface and eroded condition, this soil is not well suited to intensive use. Rotations should be at least moderately long, and the parts most severely eroded and those more strongly sloping may be better used for permanent pasture or hay. Adequate fertilization, liming, and seeding are required to establish a good vegetation growth for grazing.

Decatur silt loam, level phase.—Nearly all this well-drained dark-red soil of the red lands is south of the east-west highway through Athens. The towns of Greenbrier, Belle Mina, and Mooresville are on some of the more extensive areas. This soil is derived from high-grade limestone of the Tuscumbia (St. Louis and Warsaw) formation (*1*), and the profile over bedrock is 12 to more than 20 feet thick. Dewey and Abernathy and the other Decatur phases are associated with this phase, but it occupies broad low ridges slightly higher than those on which occur some more typical areas of Dewey soils. It is one of the more extensive soils well suited to crops, and practically all of it has been cleared and cultivated for many years.

The surface is level to very gently undulating, the gradient rarely exceeding 2 percent. Moisture is not absorbed rapidly, and surface and internal drainage are good. During extended dry seasons the soil dries out and becomes very hard. Though this dryness and hardness is unfavorable for corn, lespedeza, soybeans, and other similar crops, it does not interfere materially with the growth of cotton.

In virgin or unplowed areas the first 5 inches is light-brown to reddish-brown friable silt loam that crushes to a granular mass. A considerable content of organic matter is well incorporated with the mineral soil material. From 5 to about 14 inches is a yellowish-red silt loam to silty clay loam of fragmentary or nutlike structure. Below 14 and downward to 30 inches is brownish-red firm silty clay loam of nutlike structure. Extending from 30 to 60 inches is brownish-red to red firm silty clay, fragmentary in structure, that grades to yellowish-red material at 40 inches. The yellowish-red layer is less firm or compact and it contains a few small chert fragments. In places it may extend downward for several feet, and in others it grades to mottled yellow-red and gray clay mixed with more chert fragments. The profile is slightly acid throughout.

Small slightly to moderately eroded patches, some of which have a silty clay loam surface soil, are included in some places, and a few small areas of Dewey and Abernathy soils are also within areas of this phase as mapped.

Use and management.—For the production of cotton, Decatur silt loam, level phase, is one of the most desirable soils. Yields of 500 to 600 pounds of lint an acre are not unusual. The land is somewhat less desirable for corn production during dry seasons, but yields of 30 to 45 bushels an acre are not exceptional in good seasons. Some good alfalfa, red clover, and other hay crops are grown. Yields of 4.4 tons of alfalfa and 2 to 2½ tons of red clover can be expected under proper management. Soybeans, cowpeas, and similar annual hay crops produce ¾ to 3 tons an acre, depending on the management. Wheat and oats are not extensively grown, but yields of 15 to 25 bushels of wheat and 30 to 50 bushels of oats may be obtained when proper fertilization is practiced.

Fertilizer recommendations vary somewhat with the conditions and depend to a large extent on whether or not a winter cover crop is grown (*4, 19, 20*). Some excellent results are reported from the use of vetch or like winter cover crops followed by corn (*5, 7, 9*). Some farmers practice a 3-year rotation. Vetch is planted in the cotton rows late in summer and is followed the next spring by corn. After the corn is harvested, oats or wheat may be planted and those crops followed by annual hay and then cotton. Other rotations are practiced by various farmers, but plowing under a winter cover crop of vetch is an increasingly prominent practice in the management system of most farmers in the area.

Decatur silt loam, slightly eroded undulating phase.—Areas of this phase are fairly large and are generally part of a smooth landscape in the southern and southwestern parts of the county. The slope (2 to 5 percent) is somewhat more than that of the associated level phase. The profiles and the variations in the two are similar except that the surface layer of this soil is a little less deep. Internal

drainage is good, runoff is relatively slow though somewhat more rapid than on the level phase, and natural fertility is high. The soil is not especially difficult to work and conserve, but erosion is somewhat hazardous on the more sloping parts.

Practically all this phase has been under cultivation for a long time. In management practices farmers make no special distinction between this and the level phase. Fertilizers used on the two are practically the same, but crop yields are a little lower on this soil. Because this phase is a little more subject to erosion, runoff control by use of contour plowing and close-growing crops is more essential.

Decatur silty clay loam, eroded undulating phase.—This well-drained dark-red soil of the red lands has developed over high-grade limestone, chiefly of the Tuscumbia (St. Louis and Warsaw) formation, in the southern part of the county. The surface is undulating to gently rolling, the gradient being from 2 to 5 percent. The fairly large separate areas are a part of a smooth landscape that includes Dewey and Abernathy soils and other phases of the Decatur series (pl. 4, *C*). All this phase has been eroded, and most of the acreage has lost 50 to 75 percent of the original surface layer. Included also are small severely eroded patches, generally the more sloping parts where the plow layer is almost entirely subsoil material.

When typically eroded, the 5- to 6-inch plow layer is reddish-brown silty clay loam, a mixture of the original surface soil and the subsoil. Below this is yellowish-red or brownish-red firm silty clay loam or silty clay that has a medium-nut structure. At a depth of about 20 inches the texture is silty clay. A little below this the color is lighter and the consistence a little less firm or compact. Small chert fragments occur below this depth but they are not abundant. Mottled yellowish-red and gray very firm clay mixed with chert is present in places at a depth of 50 inches. Bedrock limestone is 12 to 20 feet below the surface or, in some places, somewhat deeper. The entire profile is slightly acid, and surface and internal drainage are both good.

Use and management.—Practically all of Decatur silty clay loam, eroded undulating phase, has been cleared and cultivated for many years. It is one of the more desirable soils for crops and is particularly suited to cotton. Though productive and easily worked and conserved, its tilth is not so favorable as that of soils less firm or compact in place, and erosion is a hazard where a close-growing vegetative cover is lacking.

Cotton, the chief crop, commonly receives 350 to 500 pounds of complete fertilizer. Yields under this treatment range up to 500 pounds of lint an acre. The dry nature of this soil late in summer and early in fall favors its use for cotton but at the same time makes it less favorable for corn, lespedeza, soybeans, and most other later summer crops. The yields of these crops under common management, however, are fairly high.

Corn produces 25 to 35 bushels an acre when it is planted following a plowed-under cover crop of vetch. Where the soil has been built to a high state of productivity and the corn fertilized, yields of 40 to 45 bushels an acre can be expected. Wheat will produce 12 to 14 bushels an acre and oats, about 25 bushels, with a moderate application of a complete fertilizer. Where these crops are fertilized more

heavily and the areas have been under good management, the yields are about 50 percent higher. Wheat and oats are ordinarily harvested before the summer dry season begins. Neither crop is grown extensively.

Some alfalfa, cowpeas, lespedeza, and soybeans are grown for hay. Alfalfa is commonly grown under a high level of management that includes the consistent control of runoff, the use of rotations limiting the frequency of row crops, and the use of soil amendments, chiefly lime and phosphorus. Alfalfa yields about 4 tons an acre under such management.

Winter legumes as vetch (pl. 6, *B*), planted as cover crops and turned under the following spring, have given excellent results, and their use is becoming increasingly common, (*5*, *7*, *9*). Cover crops, along with contour cultivation and adequate fertilization, are important requirements for proper management. Results show that this is one of the most responsive soils of the county to adequate fertilization and legume cover crops.

Decatur silty clay loam, eroded rolling phase.—A stronger slope (5 to 12 percent) is the chief difference between this soil and the eroded undulating phase. In general, the surface soil is thinner and patches of subsoil are more frequently exposed by erosion. Internal drainage is moderate but runoff is excessive. The soil is distributed through the southern part of the county and is associated with the Dewey and Abernathy soils and with other Decatur phases.

Use and management.—All of Decatur silty clay loam, eroded rolling phase, has been cleared and cropped for many years, and its natural fertility has been depleted. Cropping and fertilization are about the same as for the eroded undulating phase, but yields are a little lower and management requirements are more exacting. Valuable to proper management are the consistent use of legume cover crops, contour tillage, adequate fertilization, and longer rotations in which row crops are used less frequently than is suitable for the smoother Decatur soils. Observations indicate that this is among the most responsive soils of the county to proper management.

Decatur silty clay loam, severely eroded rolling phase.—This severely eroded red soil differs from the eroded undulating phase of the same type chiefly in having a stronger slope and in being more eroded. It occurs in association with the Dewey and Abernathy and other Decatur soils in the southern part of the county. Most of it lies as long narrow strips that break from one smooth area down to another. The slope ranges from 5 to 12 percent, and practically all the surface soil has been lost through erosion. Accordingly, the tilth and permeability are much less favorable for cultivation and plant growth than that of the undulating phase. The plow layer is yellowish-red firm silty clay loam. Internal drainage is good, but surface runoff is great and exceptionally erosive on cultivated slopes that are not protected by a close-growing crop.

Use and management.—Chiefly because of its depleted fertility, unfavorable consistence, and strong slope, Decatur silty clay loam, severely eroded rolling phase, is not well suited to crops. Proper management usually requires the establishment of a vigorous growth of permanent sod on most areas. Good pastures probably can be established in most places if the land is limed and properly fertilized

and seeded. In places kudzu or sericea lespedeza is a well-suited crop that might be displaced in later years by better grasses and clovers for use as pasture.

Dellrose cherty silt loam, hilly phase.—Cherty material drifted down the slopes from the associated Dickson, Baxter, and Bodine soils and deposited on the moderately phosphatic limestone common to the outer part of the Central Basin is parent to this soil. This phase occupies strong slopes (12 to 30 percent) below the associated soils, and the drifted material varies considerably in thickness from place to place. There is no well-developed profile. One of the larger areas is near the northwestern corner of the county; other smaller areas are farther east near Shoal Creek and the Elk River. The forested areas are mainly in white, red, black, and post oaks; beech; hickory; yellow-poplar; maple; and dogwood.

The soil is slightly to medium acid. Drainage is good, both on the surface and internally. In many parts there seems to be a slow seepage of moisture from the underlying rocks, and even during dry seasons crops suffer little from lack of moisture. The gradual seepage apparently benefits the soil by adding to its fertility or supplying moisture for growing crops.

The 8-inch surface layer is grayish-brown to brown mellow silt loam containing numerous chert fragments up to 3 or 4 inches thick. Below this, to a depth of 16 inches, is brown heavy silt loam in which many fine chert fragments occur. When spaded, this breaks into nutlike fragments that crush readily to a granular mass. From 16 to 24 inches is yellowish-brown silty clay loam containing much chert of various sizes. When moist, this crushes readily to a crumblike or granular mass. At 24 inches is brownish-yellow slightly mottled silty clay loam, which is mixed with considerable coarse chert. At 32 inches this layer grades into mottled yellow, orange, and yellowish-gray silty clay loam, with which chert fragments of various sizes are intermixed. Mottled light-yellow, orange, yellowish-gray, and brown silty clay lies at a depth of about 48 inches. This material is residual from the underlying limestone, which usually ranges from 52 inches to 10 feet or more in depth, but is occasionally at a much shallower depth.

Use and management.—From 75 to 90 percent of Dellrose cherty silt loam, hilly phase, is cleared. Early settlers recognized it as a very fertile upland soil, and some of the more chert-free areas were cleared soon after settlement began. In spite of the long period that it has been cleared, farmers still consider it a productive soil. Crops planted include corn, wheat, cotton, and pasture. Corn yields 25 to 50 bushels an acre and wheat, 6 to 15. Cotton produces 200 to 400 pounds of lint an acre and pasture, 50 to 100 cow-acre-days of grazing.

Considering its steepness, this land is remarkably free from erosion. Nevertheless, it is subject to sheet erosion, and following prolonged row cropping, to gullying. Many farmers therefore allow this soil frequent rest periods. Careful management, including the use of interplanted green-manure crops, winter cover crops, and strip cropping, can do much to control erosion and maintain fertility. Pasture interspersed with an occasional tilled crop might prove to be a good rotation.

Dellrose cherty silt loam, eroded hilly phase.—Represented in this phase are areas of hilly Dellrose cherty silt loam that have been cleared and subsequently eroded to the extent that the plow layer is now a mixture of surface soil and subsoil. In general 50 to 75 percent of the surface soil has been lost, and in places the plow layer is entirely subsoil material. Slopes range from 12 to 30 percent. Surface runoff is moderately high, and internal drainage is slower than for the uneroded phase. The productivity is also somewhat lower, and erosion is more active. This is one of the less extensive soils, and all the areas are close to or south and west of Veto.

Long rotations or permanent pasture are suited to this soil (pl. 6, *C*), because it requires better protection from erosion than do many of the soils that are smoother or less eroded. With proper fertilization and control during the time the cover is being established, excellent pasture of bluegrass, white clover, and other desirable plants can be obtained.

Dewey silt loam, slightly eroded undulating phase.—This red lands soil has developed from high-grade limestone in association with the Decatur, Abernathy, and Cookeville series. Most areas are in the northern part of the red lands and in the eastern part of the county. The relief is predominantly undulating (2 to 5 percent), only a small part having a gradient of more than 5 percent. Runoff is not great, and internal drainage is moderate. The surface soil is lighter brown than that of the Decatur soils, and the subsoil is not so dark red and is usually more friable and permeable. Small quantities of chert are more common throughout the profile. The natural fertility is relatively high, and the capacity for holding moisture available to plants is high.

The surface 6 inches is brown to light-brown mellow silt loam, underlain by brown to light reddish-brown friable silt loam that grades to silty clay loam. Below 11 inches and continuing to a depth of about 27 inches is yellowish-red firm silty clay loam that crushes easily to fine, somewhat rounded pieces. Below this is a more compact yellowish-red silty clay loam or silty clay layer that breaks to larger more angular pieces. At a depth of about 42 inches, a few weak splotches or streaks of gray are evident. They are more prominent lower in the profile, and below 60 inches the material is red silty clay with mottlings or splotchings of gray and yellow. Bedrock limestone is at a depth of more than 12 feet in most instances.

Ordinarily there is a very small quantity of fine chert throughout the profile, the quantity increasing somewhat at a depth of 4 to 5 feet. Included with this soil are small patches of Abernathy soils and level phases of both the Dewey and Decatur soils. In a few places the profile grades to the color of the Cookeville series.

Use and management.—Practically all of the slightly eroded undulating phase of Dewey silt loam has been cleared and farmed for many years. It is one of the more desirable soils of the county for crops, as it is productive and easily worked and maintained. Cotton and corn are now the chief crops, with hay and small grains occupying a small acreage. Under common management, cotton yields approximate those on Decatur silt loam, level phase, but the yield of corn, small grain, and hay is likely a little larger.

Management requirements, crop yields, and the response of the soil to good management are approximately the same as those of Decatur silty clay loam, eroded undulating phase. Being less dry late in summer and being in general more permeable and less erosive, this soil probably has somewhat better moisture relations than the slightly eroded undulating Decatur soils for all crops except cotton. Its natural fertility is apparently slightly less than equal to that of those soils. This phase is suited to moderately short rotations, but inasmuch as erosion is somewhat hazardous, some care is required in handling runoff water.

Dewey silt loam, level phase.—This soil has developed from high-grade limestone in the red lands. In extremely few places does the gradient exceed 2 percent. Practically no erosion has taken place, and the surface layer therefore is a little thicker than that of the slightly eroded undulating phase from which it differs chiefly in having a more nearly level surface. This difference is of little or no significance agriculturally.

The top 6-inch layer is brown to light-brown mellow silt loam in which there is a fair quantity of organic matter. From 6 to 11 inches is brown to light reddish-brown friable silt loam or silty clay loam. Below 11 and continuing to 27 inches is yellowish-red firm silt loam or silty clay loam subsoil that crushes readily to small partly rounded particles. Below 27 inches the mass is more compact, and it breaks away to a layer in which the fragments are more angular, the pieces being coarser at greater depth. At 42 inches weak mottles or streaks of gray are evident. The gray increases with depth. Below 60 inches is red mottled with gray and yellow silty clay, sufficiently compact to be difficult to spade. Bedrock limestone is common below a depth of 12 feet.

A small quantity of chert and concretions occur throughout the profile. The chert is a little more evident below a depth of 4 or 5 feet. The entire profile is moderately acid. Surface drainage is slow, but internal drainage is adequate to make the soil suitable for all crops. Included with this phase are small areas of eroded Dewey soils and several small spots of the Decatur and Abernathy.

Use and management.—Crop yields are a little more variable on Dewey silt loam, level phase, than they are on the level phase of Decatur silt loam. The two are planted to about the same crops, but possibly more corn and small grains are grown on this phase and less cotton. The corn and small grain yield a little more on this phase than they do on the Decatur, but cotton yields do not differ greatly. Management requirements are about the same, because both soils are well suited to intensive use, responsive to fertilization, and not especially subject to damage by runoff, even though small losses and accumulations of soil material are evident in places on some of the very gentle slopes or in the slight depressions.

Dewey silty clay loam, eroded undulating phase.—From the slightly eroded undulating phase of Dewey silt loam this phase differs chiefly in having lost 50 to 75 percent of its surface soil by erosion. The 4- to 8-inch surface layer is friable reddish-brown silty clay loam. Underlying layers are similar to corresponding layers in the slightly eroded Decatur phases, and the parent material is high-grade limestone (pl. 7, *A*). The slope is 2 to 5 percent.

This soil is associated with other Dewey phases and with the Decatur and Abernathy soils. A few areas are associated with Baxter soils, and in these is a little more chert than average. Most of the acreage lies where the red lands part of the county joins the gray lands. Other areas are along Limestone Creek, near Hays Mill, near Elkmont, West Limestone School, and in the vicinity of Elk River Mills Bridge. Some areas are large, and in these are included small patches of other phases of the Dewey as well as of the Decatur and Cookeville soils.

Use and management.—Nearly all of Dewey silty clay loam, eroded undulating phase, has been cleared and cultivated for many years. It is a desirable soil for crop production. Cotton and corn are the most common crops, with small acreages of oats, wheat, alfalfa, soybeans, and lespedeza being grown. Legume winter cover crops are becoming increasingly common and are now recognized as important in maintaining the high productivity. Management is about the same as on the slightly eroded undulating Dewey and Decatur soils, but crop yields are lower and tilth and moisture relations are less favorable because of the eroded condition. Management requirements are more exacting because a luxuriant vegetative cover is more difficult to maintain, and runoff tends to be higher because of the slower percolation of water.

Dewey silty clay loam, eroded rolling phase.—This phase differs from the eroded undulating phase chiefly in having a stronger slope (5 to 12 percent). The surface soil is generally thinner, and small patches of exposed subsoil are common though not abundant. Chert fragments occur a little more frequently. Moderately strong slopes and moderately slow permeability cause a fairly high volume of runoff, and therefore the soil erodes quickly where the plow layer is loose and unprotected by vegetative cover. The thinner, less friable surface soil is not so fertile as that of the smoother, less eroded Dewey soils, and quantity of moisture available to plants is less. Bodies of this soil are widely distributed over the county, but the aggregate area is less than that of some of the other Dewey soils or that of the Decatur. Occurring in association with this phase are other Dewey soils and Decatur and Abernathy soils.

Use and management.—The eroded rolling phase of Dewey silty clay loam has been cleared and cropped for many years. Cotton and corn are the prevailing crops, with some small grains and hay. The fertilizer practices commonly used are similar to those for the smoother Dewey and Decatur soils, but crop yields are lower. The management requirements necessary to build and maintain a high level of production are more exacting. Close-growing crops—especially legume hay, pasture, and cover crops—and adequate fertilization are a part of good management. Contour tillage aids in restraining runoff, and terracing may be suitable for some sites.

Dewey silty clay loam, severely eroded rolling phase.—Erosion has removed practically all the surface soil from this phase and, in places, part of the subsoil. The plow layer, a yellowish-red firm silty clay or silty clay loam, is hard when dry, lower in organic matter and available plant nutrients than the original surface soil, and low in its capacity for holding water available to plants. Percola-

tion of moisture is slow, and runoff is high. The soil is very erosive in places where the plow layer is cultivated.

This phase differs from Dewey silt loam, eroded undulating phase, chiefly in being more severely eroded and in having a more sloping surface (5 to 12 percent). The aggregate acreage is not great, and the separate areas are small. Areas are widely distributed over the county in association with other Dewey soils, with the Cookeville series, and occasionally with Decatur and Dickson soils.

Use and management.—Crop yields are generally low on the severely eroded rolling phase of Dewey silty clay loam. The soil is difficult to maintain and is therefore poorly suited to crops requiring tillage. If properly fertilized, limed, and seeded, most areas probably can be made to produce much grazing of good quality. Long-time rotations are generally preferable to short rotations. Sericea lespedeza is suitable for quick establishment of soil-building and protective vegetation.

Dewey silty clay loam, eroded hilly phase.—This phase represents those hilly areas of Dewey silt loam that are moderately eroded. The slope range is 12 to 30 percent, and 50 to 75 percent of the surface soil has been lost by erosion. The plow layer is a mixture of surface soil and subsoil, generally a reddish-brown firm silty clay loam. Of common occurrence are patches where all the surface soil has been lost, and on these the plow layer may be yellowish-red compact silty clay. Some areas are cut by an occasional small gully. Runoff is high and percolation is moderately slow.

Use and management.—All the eroded hilly phase of Dewey silty clay loam has been cleared and cultivated, and much of it is used for crops. The yields are much lower than on the smoother Dewey soils. It is not well suited to crops requiring tillage because it is difficult to control runoff and carry on field operations. If properly fertilized and seeded, this land is capable of producing well when planted to pasture. Some areas, those less eroded and less hilly, are probably well suited to long rotations comprised chiefly of alfalfa or similar crops.

Dewey cherty silty clay loam, eroded rolling phase.—Except for its chertiness and notably shallower depth to bedrock, this phase resembles the noncherty Dewey soils in general characteristics. It is a red moderately cherty soil, developed over relatively high-grade cherty limestone. Runoff is moderate and the chert apparently retards sheet erosion to some extent. Internal drainage is retarded but a little more rapid than that of the noncherty Dewey soils. The aggregate area of this soil is not great, and the separate bodies are small, most of them occurring as narrow strips on sharp slopes of 5 to 12 percent in association with smoother Dewey, Decatur, and Baxter soils. Most of this phase is in the vicinity of West Limestone School and Elkmont.

The 6-inch surface layer is light reddish-brown cherty silt loam or cherty silty clay loam. The subsoil is yellowish-red firm cherty silty clay loam, grading at 40 inches to yellowish-red cherty silty clay, which is somewhat streaked and splotched with gray and yellow in the lower part. Bedrock cherty limestone is at a depth of 4 to 10 feet. The entire profile is moderately acid.

Use and management.—All the eroded rolling phase of Dewey cherty silty clay loam is cleared and most of it is cropped in about the same manner as the smooth and rolling noncherty Dewey soils. Chert interferes somewhat with tillage operations. Runoff is a decided hazard and requires careful management. Close-growing crops, especially those that afford a growing cover through the winter, should be on this soil as much of the time as is feasible, and field operations should be on the contour.

Dewey cherty silty clay loam, severely eroded rolling phase.—Narrow strips of this inextensive soil are associated with other Dewey phases and with Baxter, Cookeville, and Decatur soils on 5- to 12-percent slopes along the drainageways. Represented in this phase are areas of the cherty rolling Dewey soil that have been severely eroded. The plow layer and upper subsoil consist of yellowish-red firm to compact cherty silty clay loam or cherty silty clay, and the lower subsoil is yellowish-red moderately compact cherty silty clay, with streaks and splotches of gray and yellow in the lower part. Cherty high-grade limestone bedrock is at 3 to 8 feet. The slow percolation of moisture results in a high volume of runoff that is exceptionally erosive where the surface layer is loose or tilled.

Use and management.—All of Dewey cherty silty clay loam, severely eroded rolling phase, has been cleared and farmed for many years, but some of the areas now are idle or in permanent pasture. Chiefly because of its severely eroded sloping nature, this phase is poorly suited to a management system requiring tillage. Productivity is low, mainly because fertility is depleted and moisture conditions are unfavorable. Tilth is poor and erosion is an extremely serious hazard on cultivated areas. A permanent vegetative cover of sericea lespedeza, pasture, trees, or similar growth is well suited to this phase.

Dewey cherty silty clay loam, eroded hilly phase.—This phase differs from the eroded rolling phase chiefly in having a stronger slope (12 to 30 percent). Part of it is severely eroded, and the plow layer is yellowish-red cherty silty clay. Most of the individual areas are small. The soil occurs in association with Dewey, Decatur, and Cookeville soils.

Use and management.—All of the eroded hilly phase of Dewey cherty silty clay loam has been cleared and cultivated, but some is now idle or in permane t pasture. Crop yields are notably lower than on the smoother less oded Dewey soils, and chiefly because of the strong slope and erod condition, this phase is not well suited to crops requiring tillage. If properly limed, fertilized, and seeded, most areas are capable of furnishing much good grazing. The parts most severely eroded may be difficult to bring to a productive state, and therefore they may be best managed under a cover of sericea lespedeza until their tilth and productivity have been improved.

Dewey-Decatur silty clay loams, severely eroded hilly phases.—Included in this complex are severely eroded hilly areas of Dewey and Decatur soils. The gradient ranges from 12 to 30 percent, and in most places the plow layer consists entirely of subsoil material. The soil profile may have characteristics covering both series or may be predominantly Dewey or Decatur. The variation in characteristics is generally more evident in the complex than it is in areas

of either of the two series. Small to moderate gullies occur in places, but only a few are so large that they cannot be obliterated within a short period of time by practical means. The aggregate area of this complex is small, and the separate areas are associated chiefly with smoother Dewey and Decatur soils.

Use and management.—All of Dewey-Decatur silty clay loams, severely eroded hilly phases, have been cleared and cultivated, but some areas are now idle or used for pasture. Chiefly because of the eroded condition, moisture relations are unfavorable, tilth is poor, and the supply of available plant nutrients is much lower than in the less eroded Dewey and Decatur soils. Productivity is generally low, and the soil is difficult to work and conserve. Crops requiring tillage are not suited to this complex but with adequate liming, fertilization, proper seeding, and other practices of good management, many areas are capable of supporting fair to good pasture. The most exposed and eroded areas can be managed only by establishing sericea lespedeza, trees, or some other perennial cover.

Dickson silt loam, undulating phase.—This gray silt loam soil occurs on 2- to 5-percent slopes on broad smooth to gently sloping ridges. It is associated with other Dickson soils and with the Cookeville, Baxter, Sango, Lawrence, and Bodine soils. Much of this soil lies on either side of the highway leading north from Athens to Ardmore, but it occurs to a lesser extent in other parts of the northern half of the county. The soil has formed in place from weathered material of Fort Payne chert. It was not cleared so early as the red soils, and during the early history of the county was looked upon as being much inferior for cropping. Included with this soil in mapping are a few areas of Dickson silt loam, rolling phase, (5- to 12-percent slope), and a few bodies having a somewhat deeper surface soil.

In virgin forest the 14-inch surface layer is pale-yellow or grayish-yellow silt loam, mellow, crumblike in structure, and decidedly grayer when dry. Below 14 and continuing to 22 inches is light yellowish-brown silt loam to silty clay loam, friable in consistence but firm in place. This material shows a little more yellow when it is dry. The siltpan below, a mottled yellow, brown, gray, and orange silty clay loam that extends from 22 inches to a depth of 28 inches, breaks into fragments when it is spaded and crushed. Few roots penetrate this layer, and it is difficult to spade, especially when dry. The siltpan continues from 28 to 34 inches, fragmentary in structure and mottled with rust brown, pale yellow, gray, orange, and red. The material is extremely hard and is difficult to spade when dry. Between 34 and 45 inches is mottled reddish-brown, light-yellow, gray, and orange silty clay loam, fragmentary in structure and less compact than the material in the overlying layer. Mottled red, yellow, orange, and gray silty clay continues from 45 to 60 inches. This is tight, difficult to spade when dry, and very sticky when wet. The soil is strongly acid throughout the profile.

Although the movement of moisture through the siltpan layer is slow, this phase is well drained. The surface layer absorbs water rapidly. Surface runoff is free but not free enough to cause severe erosion if reasonable preventive measures are exercised. Originally, this soil was covered with hardwood timber, as sweetgum and blackgum; post and other oaks; hickory; sourwood; dogwood; and chestnut, with some shortleaf pine intermixed. The timber stand probably was thin, and not many of the trees grew to a large size. The underbrush was light or almost absent in all except lower places where more organic matter and moisture accumulated.

Use and management.—Cotton, corn, oats, soybeans, and lespedeza hay are grown on Dickson silt loam, undulating phase, as well as vegetables and fruit crops for home use. On this cold soil the crops start growing later in spring, but they make rapid growth where proper management is practiced. From 80 to 90 percent of the land has been cleared, but much of it has been farmed for only a relatively short time. Probably a large part was cleared soon after the First World War. Under proper management, the soil becomes more productive after it is tilled for a few years. Cotton yields 200 to 500 pounds of lint an acre; corn, 15 to 35 bushels; oats, 15 to 40 bushels; soybean hay, 1¼ to 2 tons; and lespedeza hay, ¾ to 1½ tons. Spring and summer vegetables and fruits do fairly well, but the fall crops suffer to some extent from lack of moisture. Except for cotton, most of the crops grown are consumed on the farm.

The fertilizers used differ little from those used on phases of Dewey and Decatur silt loams. At first it was thought that winter cover crops were not well suited to this soil, but their acreage is increasing every year and some good results are obtained, especially when the crops are planted in time to benefit from the rains early in fall and when liberal applications of lime, phosphate, and potash are used. Terracing, contour plowing, and supplying all the organic matter possible have been unusually helpful in conserving needed moisture.

Dickson silt loam, eroded undulating phase.—This soil occupies positions similar to those of the undulating phase, is in about the same localities, is associated with the same soils, and has the same range in slope (2 to 5 percent). In fact, practically the only difference is its moderately eroded condition, which has resulted from a longer period of cultivation or more careless management. The gray silt loam surface soil is somewhat thinner than that of the undulating phase, and in some areas the slopes are a little more irregular.

Practically all this phase is cleared, and about the same crops are grown as in the undulating phase. Fertilizer applications are practically the same for both soils. Among the management requirements are contour plowing and practices that will increase the content of organic matter.

Dickson silt loam, level phase.—Although occurring in positions much like those of the undulating phase, this phase is nearly level. Slopes are 0 to 2 percent. The two phases occur in close association, occupy areas in about the same localities, and in many places grade into each other. This soil is less eroded and has a deeper surface layer of gray silt loam, but both are derived from the same material. The profiles are the same except for the deeper surface layer. The trees on this soil are the same as those on the undulating phase, although the growth is slightly heavier and the trees a little bit larger. Included with this soil are some small areas in which the surface layers are unusually thick.

About 90 percent of this phase is cleared. In use and management, little difference is made between this phase and the undulating phase,

though more care is needed in controlling erosion on the undulating soil. Cotton yields are slightly lower on this soil, but corn and hay do nearly as well. No difference is made in the fertilization of the two soils.

Dickson silt loam, eroded rolling phase.—This phase is distributed over nearly all parts of the gray lands section of the county, especially on the slopes that lead down to streams from the broad ridge tops occupied by the undulating phase. The soil occurs in association with other phases of Dickson silt loam, and differs from the eroded undulating phase in having stronger slopes of 5 to 12 percent. These steeper slopes cause more rapid runoff of heavy rainfall, more severe erosion, and a greater loss of needed moisture. Included with this soil are small areas of the inextensive severely eroded rolling phase of Dickson silt loam.

Good management practices apparently would include the use of strip cropping, the frequent planting of close-growing crops, and the use of winter cover crops as often as possible. A good response generally can be expected from the soil under these practices.

Dickson cherty silt loam, undulating phase.—Except for only a moderate siltpan and many chert fragments up to 5 inches in diameter on the surface and in nearly all parts, the profile of this soil is similar to that of Dickson silt loam, undulating phase. It occurs in the same general area as that phase, is associated with the same soils, and is derived from much the same materials, but generally occupies less extensive areas. It is mapped on 2- to 5-percent slopes near some of the more broken tracts in the county. Chert fragments are usually present in quantities sufficient to interfere somewhat with tillage. Drainage is good, though the moderate siltpan somewhat retards internal movement of moisture. In most places water is absorbed rather rapidly, and surface runoff is too slow to cause severe erosion. The original forest cover was the same as the present one, except that there were more chestnut, red and black oak, and hickory trees and a thicker growth of underbrush.

Use and management.—More than 80 percent of Dickson cherty silt loam, undulating phase, is in cleared land, some parts having been cleared for 30 to 40 years. Crops grow well. The yields obtained are about the same as or better than those for the undulating phase of Dickson silt loam, and fertilization and other management practices are much alike. Tillage for this phase is more difficult and expensive. Low-growing hay plants, as lespedeza, are difficult to harvest because of the large chert fragments, but in a few areas the larger fragments could be removed profitably. Terracing may be less necessary on this soil than on some of the others in the county.

Dickson cherty silt loam, eroded undulating phase.—As a result of long cultivation, poor soil management, or both, this phase is moderately eroded. Except for this difference, the soil profile, the 2- to 5-percent slope, and drainage are similar to those of the associated undulating phase.

The crops planted on this eroded soil are not different from those on the undulating phase, but yields are usually somewhat lower. Fertilizers used on the two soils do not differ, but more organic matter and closer attention to erosion control are needed on this phase. Practically all this soil has been cleared for many years. As erosion advances, more rocks appear on the surface and tillage becomes more difficult and expensive.

Dickson cherty silt loam, rolling phase.—The main features differentiating this soil from Dickson silt loam, undulating phase, are stronger slopes of 5 to 12 percent, many chert fragments on the surface and in the profile, a shallower profile over bedrock, and a less distinct hardpan. About the same crops are grown as on Dickson silt loam, undulating phase, but the yields are generally a little lower although the soil receives the same fertilization and other management. Only a small part of the land is cleared. It is easily eroded when cleared and special care is required to control erosion.

Dickson cherty silt loam, eroded rolling phase.—Stronger slopes (5 to 12 percent), chert of the surface and in the profile, moderate erosion, a shallower depth to bedrock, and the absence of a distinct siltpan are characteristics differentiating this soil from the undulating phase of Dickson silt loam. The bodies of this phase occur in areas that are between the streams and the broad ridges occupied by the undulating phase. The chert fragments on and in the soil aid in checking erosion and absorbing moisture during heavy quick showers.

Use and management.—Though the chert in some places interferes with tillage, crops on the eroded rolling phase of Dickson cherty silt loam yield about the same as on the associated undulating phase, if management is similar. Some fairly high crop yields have been noted in areas where management has been good over a period of years. The most common crops are cotton, corn, and soybeans grown for seed. Hay crops grow fairly well, but owing to the many chert fragments they are difficult to harvest. Cotton yields 200 to 300 pounds of lint an acre and corn, 15 to 35 bushels, under average management.

Dickson cherty silty clay loam, severely eroded rolling phase.—Small areas of this phase are scattered on 5- to 12-percent slopes over the rolling areas in the northwestern part of the county. The soil is derived from weathered material from Fort Payne chert and is associated with other Dickson phases and with phases of the Baxter series. Drainage is good to excessive. Before it was cleared of forest, this was Dickson cherty silt loam, rolling phase; after clearing and subsequent cultivation over a period of years under poor practices of management, it was reduced to its present severely eroded condition. Bedrock outcrops occur here and there. It has been farmed for many years, but nearly all of it is now idle. With heavy machinery, many areas can be cultivated. As erosion becomes more severe, more chert will be left on the surface and the soil will become shallower over bedrock.

Egam silty clay loam.—This brown moderately well-drained soil is on first bottoms along the Tennessee and the Elk Rivers and along Sugar Creek. In general it is along streams where a large part of the material is washed from uplands underlain by high-grade limestone and possibly shale. It is associated with Huntington, Lindside, and Melvin soils, and a few small areas of Huntington and Lindside silt loams too small to be shown separately on the soil map are included. The soil is nearly level (0- to 2-percent slopes). External drainage is good but internal drainage is slightly slow. Some areas are flooded

during wet seasons, but they generally dry in time for planting and growing corn.

To a depth of about 5 inches the surface soil is brown to yellowish-brown mellow silt loam that differs but little from the surface soil of Huntington silt loam. From 5 to 12 inches the material is darker and the texture finer. After a gradual transition this is replaced by silty clay loam, which is more sticky when wet and more compact when dry. Dark grayish-brown compact silty clay loam of fragmentary structure continues from 15 to 36 inches. The dark color and compactness of this layer are the principal features distinguishing it from the Huntington soils. Below 36 inches is very dark-brown slightly mottled silty clay loam, sticky when wet. Reaction is slightly to medium acid throughout the profile.

Use and management.—Nearly all of Egam silty clay loam is cleared, and it is planted year after year, mostly to corn. A few farmers grow hay, cotton, and pasture. Corn yields 25 to 40 bushels an acre; cotton, 200 to 475 pounds of lint; and lespedeza and soybeans, 1 to 1½ tons and 1¾ to 2½ tons of hay, respectively. Pasture affords 50 to 95 cow-acre-days of grazing.

Little special management is given this soil. Good results are obtained from fairly deep breaking of the ground and from special efforts to eradicate Johnson grass, the principal undesirable plant. A few farmers obtain good results by planting soybeans, cowpeas, or like green-manure crops with the corn during its tillage period. Generally, little fertilizer is applied for corn, but where green-manure crops are turned under, good returns can be obtained from the use of 200 to 300 pounds of superphosphate an acre. For cotton, 200 to 400 pounds of 6–8–4 fertilizer an acre is generally applied under the seed at planting time.

Ennis silt loam.—This soil is found on first bottoms along local streams in the northern part of the county. The slopes are almost everywhere less than 1 percent (pl. 7, *B*), the range being 0 to 2 percent. Except for an occasional overflow, the soil has good external drainage. Internal drainage is fair to good. The material from which the soil is formed is derived largely from uplands underlain by Fort Payne chert and, to some extent, from uplands underlain by high-grade limestone. It is associated with Etowah, Humphreys, and Taft soils, which lie on terraces, and with Huntington, Lindside, and Melvin, all of which are first-bottom soils. In forested areas the cover includes sweetgum, blackgum, elm, Spanish and willow oaks, yellow-poplar, hackberry, cedar, sycamore, and a dense growth of underbrush. A little more than half of the soil is cleared and in cultivation.

To a depth of about 8 inches this soil is brown to yellowish-brown friable silt loam. This material is slightly compact in forested areas and contains many tree, grass, and weed roots. When crushed, it forms a mass of granules and larger fragments and many contain an occasional rounded piece of gravel or chert. From 8 to 24 inches the soil is yellowish-brown friable silt loam that breaks into irregular fragments. The upper part of this layer is slightly compact. Mottled grayish-brown, yellow, and gray mellow heavy silt loam continues from 24 to 32 inches. Between 32 and 50 inches is mottled gray or very light-gray, brown, and yellow silty clay loam. This material is very easily spaded, contains some rounded pieces of gravel, and is extremely wet during wet seasons. Below 50 inches is a fairly large quantity of gravel. A layer of gravel is almost always present at some depth, perhaps at 4 to 10 feet. The soil is strongly acid throughout.

Use and management.—Corn is the principal crop grown. Pasture and hay crops are also important, and a few small areas are used for cotton. Corn yields 15 to 40 bushels an acre; oats, 15 to 45 bushels; cotton, 200 to 400 pounds of lint; soybean hay, 1¼ to 2¼ tons; lespedeza, ¾ to 1¼ tons; and cowpeas, ½ to 1 ton. Pasture provides 60 to 95 cow-acre-days of grazing.

Little fertilizer is used on this soil for any crop except cotton. Under common practice, cotton receives 300 to 400 pounds of 6–8–4 an acre at the time of planting. In areas where pasture is to be established, farmers are beginning to use lime and phosphorus in larger quantities than usual. Two of the principal management requirements for this soil are better drainage and improved protection from flooding. The growing and turning under of cover crops will increase the organic-matter content and aid much in improving productivity. Owing to its low position near streams, the soil usually cannot be plowed and planted until fairly late in spring.

Ennis silt loam, shallow phase.—Areas of this soil occur on 0- to 2-percent slopes on the broad, fairly low, nearly flat bottoms along the larger creeks flowing from the gray lands. The material from which it is formed is the same as that giving rise to the normal phase. The upper 24 to 36 inches of these two soils are nearly everywhere much the same. In places, however, this phase has chert fragments on the surface and in the profile, and below 24 to 36 inches it becomes very gravelly. In contrast, Ennis silt loam contains only a few pieces of gravel and a few chert fragments at depths of less than 40 to 46 inches. The large quantity of gravel relatively near the surface promotes the leaching of plant nutrients from this soil, and crops suffer from lack of moisture during dry seasons. Though this is used for about the same crops as the normal phase, the yields are generally lower under similar management.

Ennis cherty silt loam.—This soil generally occurs fairly close to small streams that have currents swift enough to move chert fragments and other materials. Areas are in some of the first bottoms of the county, where the parent material has been derived from uplands underlain by Fort Payne chert. The widely scattered relatively small areas are in the northern part of the county, and in the northwestern part where the surface is more broken. Slopes are 0 to 2 percent, but most areas are on slopes of less than 1 percent. Except during occasional floods, the soil is well drained. Floodwaters usually come quickly and cover the soil for only a brief period. The original trees included water oak, beech, sweetgum, sycamore, mulberry, and willow, with common alder bushes.

In forested areas this soil is brown to grayish-brown cherty silt loam to a depth of about 4 inches. In this layer are chert fragments up to 3 inches in diameter. From 4 inches to a depth of 18 inches is light-brown cherty silt loam, the chert fragments being somewhat smaller than those in the overlying layer. Between 18 and 30 inches is yellowish-brown gritty silt loam, slightly mottled, especially in the lower part, that also contains chert fragments. From 30 inches to a depth

of 40 inches and more, the material is mottled yellowish and gray gritty to cherty silty clay loam. More chert fragments are in this layer than in the one overlying, but the quantity varies from place to place. This soil is strongly to medium acid in all parts of the profile.

Use and management.—From 50 to 80 percent of Ennis cherty silt loam has been cleared, some for a long time, but most of it for only a comparatively short period. The land is used chiefly for corn, but some areas are planted at times to hay and sorghum. Corn yields 10 to 30 bushels; soybean hay, 3/4 to 2 tons; and lespedeza, 1/2 to 1 ton of hay an acre. Some areas are used for pasture (pl. 7, *C*), which afford 15 to 70 cow-acre-days of grazing. Lespedeza hay is difficult to harvest in places where chert occurs in quantities. The crops receive comparatively light applications of fertilizer.

The chief problems in managing this land are the removal of the larger chert fragments and the protection of the soil from floods that sometimes leave heavy chert deposits and carry away some of the better silty material.

Etowah silt loam, undulating phase.—In general the Etowah soil is on terraces lower than those on which Cumberland soils lie but is well drained. It occurs with other Etowah soils on moderately high terraces along the Tennessee and the Elk Rivers and especially near Limestone and Beaver Dam Creeks. Other smaller areas are along smaller streams. Slopes are from 2 to about 5 percent and surface and internal drainage are good. Moisture is absorbed readily and retained well. Erosion does not usually constitute a serious problem, though some sheet erosion occurs on the slightly steeper slopes. This soil is associated with the Cumberland, Wolftever, and Taft soils, and, to a large extent the material making it up has washed from the Decatur, Dewey, Cookeville, and related soils. In places a few small areas of Etowah silt loam and Cumberland, Taft, and Abernathy soils have been included because they were not large enough to map separately.

From 2 to 10 inches the soil is brown to grayish-brown mellow silt loam in which are some organic stains. Extending from 10 to 23 inches is friable silty clay loam subsoil, usually yellowish red or yellowish brown, but reddish brown in many places, especially in those of the more elevated areas. Below 23 and continuing to 32 inches, the subsoil is yellowish-red or yellowish-brown firm silty clay loam. At 32 inches and extending down to 41 inches, the color is reddish yellow, and the texture is silty clay loam. The gradation is gradual to an underlying layer of light reddish-yellow or brownish-yellow firm silty clay loam or silty clay that continues from 41 to 52 inches. A few small concretions and some feathering of gray are apparent in some places. Below 52 inches this layer is mottled dark brown, grayish yellow, and rust brown, and some compactness and dark concretions are evident in many places.

Use and management.—Almost all of Etowah silt loam, undulating phase, has been cleared and cultivated for many years. It is relatively fertile, good in physical properties, and favorable in relief. Its management is not so exacting as that of many soils. With proper liming, fertilization, crop rotations, and tillage practices, good yields can be expected, as the soil is unusually responsive to management. Under good management cotton yields 300 to 800 pounds of lint an

A, Excavation in Dewey silty clay loam, eroded undulating phase; the 10- to 16-foot soil mantle is underlain by level-bedded high-grade limestone.
B, Ennis silt loam on high bottoms along the larger creeks.
C, Fertilizing and seeding permanent pasture on a partly cleared area of Ennis and Etowah soils.

A, Landscape of nearly level to undulating Etowah soils planted to vetch.
B, Permanent pasture on Lindside silt loam.
C, Breaking Taft silt loam preparatory to fertilizing and seeding for permanent pasture.

acre; corn, 35 to 60 bushels or more; wheat, 15 to 25 bushels; and oats, 35 to 70. Alfalfa yields up to 4½ tons an acre, annual hay 1 to 3 tons, and lespedeza hay up to 2 tons. Vetch does well as cover crop or for seed production on this and other Etowah soils (pl. 8, *A*).

Considerable variation occurs in the kinds and quantities of fertilizer used under crops planted on this phase. Recommendations are about the same as for Decatur silt loam (*4*, *5*, *19*, *20*).

Etowah silt loam, level phase.—This soil occupies level to very gently undulating areas on 0- to 2-percent slopes along the river and larger creek bottoms. It usually lies slightly above flood stage, but occasionally some of it may become flooded. Except for the more level lay of the land, slightly deeper surface layer, and almost complete absence of erosion, it differs but little from the undulating silt loam. Some areas of Etowah loam, level phase, have been included. It is very similar to Dewey soils of the uplands.

Use and management.—Nearly all of the level phase of Etowah silt loam has been cleared for many years and continued in crops. This and the undulating phase are usually planted to the same crops, though there may be a little less cotton grown on this phase and somewhat more corn. Crop yields are practically the same on both soils, and practically no difference is made in the kinds and quantities of fertilizer used. Management practices are also much the same, though somewhat greater care is necessary to prevent erosion on the undulating silt loam.

Etowah silty clay loam, eroded undulating phase.—Most of the material making up this soil has been washed from the red soils of the uplands, including the Decatur, Dewey, and Cookeville series. It occurs in association with other Etowah soils on the river and creek terraces, most of it being above the flood plains of the streams but parts being covered by exceptionally high floods. This soil differs from Etowah silt loam, undulating phase, in that a considerable part of its surface layer has been removed by erosion. A few areas with slopes of more than 5 percent have been included, but nearly everywhere the slopes are 2 to 5 percent. Drainage is good throughout, and moisture conditions are favorable for crop production. Reaction is medium to strongly acid.

The crops planted are about the same as those on the undulating silt loam, but yields are generally slightly lower. The use of winter cover crops and terracing are being recognized as important in management. Practically all this soil was cleared and cultivated soon after the county was settled.

Greendale silt loam, undulating phase.—This soil consists of local alluvial or colluvial material accumulated at the base of slopes of the Baxter and Dickson series. The material originated from weathered Fort Payne chert and similar rock and has washed chiefly from the surface layers of Baxter and Dickson soils, since they were cleared and put into farm use. Material is being brought down from the soils on the slopes above, both in suspension and in solution, and deposited on this and other phases of Greendale silt loam.

Small bodies of this soil are in nearly all parts of the northern two-thirds of the county. In practically all areas the slope gradient is below 5 percent, and it is usually not more than 2 or 3 percent. Some

areas with slopes of less than 2 percent have been included. Through most of the year drainage is good both on the surface and through the subsoil. During wet seasons, however, water may stand high in the subsoil of some areas.

The profile of this phase is somewhat variable from place to place, but in an open field where the land has been cleared for possibly 30 or 40 years, one like the following may occur.

The surface 6 inches is grayish-brown or light yellowish-brown mellow silt loam that crushes readily to a crumblike mass. It contains a few chert fragments in places. A good moisture supply is usually at this depth, even in dry seasons. The layer extending from 6 to 10 inches is mellow gray to yellowish-gray silt loam, only slightly darker and firmer than the one above, that spades out into large fragments readily crushed to a crumblike or granular mass.

The first layer of subsoil, a mellow yellowish-brown silt loam, abruptly replaces the one above at 10 inches and continues to a depth of 20 inches. When spaded this material breaks into large fragments that crush readily to a granular mass. Many pores are present through which dark material has drifted down from the layer above. The following layer, extending from 20 to 29 inches, is firm but friable brownish-yellow silt loam that falls into a medium crumblike mass when crushed.

The gradation to the layer of pale-olive silt loam is rather abrupt. This rather easily crushed material continues from 29 to 37 inches, and is then replaced abruptly at 37 inches by mottled gray, pale-yellow, rust-brown, and reddish-brown silty clay that continues to 52 inches. This clay is hard when dry but sticky when wet, and it contains many chert fragments. Downward from 52 inches the clay is mottled with reddish brown, pale yellow, and gray, and it is compacted and slightly more gritty than the layer above. Many chert fragments occur and spading is difficult.

Reaction is medium to strongly acid throughout, and in some places there may be more than the usual quantity of chert in all layers.

Use and management.—Nearly all of Greendale silt loam, undulating phase, has been cleared, and much of the land has been used for crops many years. Crops planted include cotton, corn, hay, small grain, sorghum, vegetables, and pasture. Cotton yields 400 to 600 pounds of lint an acre; corn, 25 to 40 bushels; oats, 25 to 40 bushels; lespedeza hay, 1 to 1½ tons; soybean hay, 1¾ to 2½ tons; and alfalfa hay, 2½ to 3½ tons. Sweetpotatoes produce 120 to 180 bushels and potatoes, 128 to 150 bushels an acre. The carrying capacity of pastures ranges from 60 to 110 cow-acre-days of grazing.

Where this land is not farmed with surrounding areas, less nitrogen is applied, and in some instances no fertilizer is used. Terracing is usually not needed, and drainage is adequate.

Greendale silt loam, level phase.—In nearly all respects this soil is much like the undulating phase. It does have less slope, a little higher percentage of organic matter, and moisture conditions slightly more favorable to most farm crops. To a large extent, the areas occur in association with Dickson soils. The soil is well drained, though sometimes water stands on the surface for a short period after heavy rains. The slopes are from 0 to 2 percent but in nearly all cases are less than 1 percent. Erosion is not a problem, but the soil is injured in some places by deposition of materials washed from the adjacent soils. The crops grown and the management practices are about the same as those for the undulating phase, but yields are slightly higher. Corn is the most commonly grown crop.

Greendale cherty silt loam, undulating phase.—Usually much of the material parent to this soil has been washed or rolled down from surrounding slopes of cherty Dickson and Baxter soils, though in some places it is from the Bodine and Dellrose. It occurs in colluvial positions at the base of slopes, much as do other Greendale soils. Slopes are from 2 to 5 percent but are usually about 3 percent. The areas, ordinarily small, are widely distributed over the central and northern parts of the county, especially in the more rolling sections where chert is more prevalent. Reaction is strongly acid.

Except for the chert on the surface and in the profile, there is little difference between this soil and Greendale silt loam, undulating phase. The two are planted to much the same crops, and fertilization and other management practices do not differ greatly. This phase produces a somewhat lower yield of most crops, largely because of its chertiness. Tillage is more difficult, and crops suffer somewhat more from lack of moisture, especially in dry seasons, than they do on the silt loam.

Guthrie silt loam.—Areas of this soil occur in depressions over nearly all parts of the uplands. Usually they are saucer-shaped, with little surface outlet for water; some, however, are at the heads of watercourses, where surface drainage is slow. Farther down such drainageways, where the soil material becomes more strictly alluvial, the Melvin soil occurs. The Guthrie soil is formed of residual and colluvial materials from both high-grade and cherty limestone. In the southern part of the county, it is closely associated with phases of Abernathy and Ooltewah silt loams. It occupies positions similar to these but is more poorly drained. In other parts of the county it is associated chiefly with the Dickson and Sango soils. Surface and internal drainage are poor, as the soil receives considerable seepage water from surrounding areas. Many of the areas are covered with water during heavy rains, and the water table is usually near the surface in all areas during winter and spring.

The following profile of a forested area in the red lands is characteristic of the soil in all parts of the county. The surface inch is dark-gray silt loam, stained with organic matter from leaves and stems. From 1 to 6 inches is mellow light-gray silt loam mottled with yellowish streaks. Below 6 and continuing to 14 inches is very light-gray mellow floury silt loam that crushes to fine indistinct granules when moist. Below 14 inches is heavy clay loam to clay, mottled gray, brownish yellow, and yellowish brown. This layer is sticky when wet and becomes hard on drying. The soil is strongly acid throughout.

Use and management.—Only a small part of Guthrie silt loam is cleared. The timber stands, which are usually thin, include white, willow, and water oaks; sweetgum; winged elm; blackgum; and other hardwoods. Corn, sorghum, hay, and soybeans are the crops grown. Fertilizer is seldom used, and crop yields are generally low, even if the land is fertilized. Poor drainage and low fertility discourage use of

this soil for crops. If properly limed, fertilized, drained, and managed, good pastures can be developed as has been shown by work at the State Farm on the southeast edge of Athens.

Hollywood silty clay, level phase.—This soil, known as "black waxy land," occurs on 0- to 2-percent slopes west of the Elk River, near Shoals Creek, and along Sugar Creek. Most of the acreage is in the northern part of the county, but a few small areas occur elsewhere. The soil is a combination of local alluvial, colluvial, and residual material closely associated with areas of Limestone rockland. It is derived from the same limestone that outcrops in the rockland and in many places includes materials washed from it. The soil undoubtedly contains a fairly good quantity of phosphate, but it is not known just how readily available the phosphate is. Reaction is weakly acid to neutral in most parts.

Areas of this phase are relatively level in most places, and they extend benchlike from the base of slopes. Surface and internal drainage are slow. Cedars occur on a few areas and on the associated Limestone rockland. Included with this phase are small areas of somewhat poorly drained soils.

In a cultivated field the surface 7 inches is dark grayish-brown silty clay loam, very sticky when wet, that contains an occasional chert or lime rock fragment. From 7 to 20 inches it is very dark-gray to black clay, tough and sticky when wet but hard when dry. This layer contains some chert and limestone fragments. It grades rather sharply to the light-gray to gray clay layer below, which is mottled with yellow and brown and extends from 20 to 26 inches. This becomes very sticky and plastic when wet but is hard when dry. It contains many small rock fragments that show a brown color when cut. Below 26 inches the material is mottled gray, yellow, and rust-brown clay. This is also tough and plastic when wet, and it becomes hard and dense on drying. A few small rock fragments are present.

Use and management.—Nearly all of Hollywood silty clay, level phase, has been cleared for many years, but some has been abandoned for crop use and is now idle or in pasture. Corn, cotton, soybeans, oats, and pasture crops are grown. Corn produces 25 to 50 bushels an acre; oats, 20 to 45 bushels; and soybeans, 1 to 2½ tons of hay. Pastures do well in spring but tend to thin out during dry seasons. Because cotton matures slowly on this soil, it is often injured by frost. During rainy spells, tillage is difficult, and in extreme cases, it may be impossible to harvest the crop.

Fall plowing and the use of suitable winter cover crops would be beneficial, but neither has been practiced to any great extent. Because of its slow drainage, the soil usually cannot be plowed in winter or early in spring. Corn sometimes shows a tendency to become diseased on this soil, but in some instances a more liberal use of potash fertilizer has partly overcome this. In practice, corn usually receives little fertilizer; although the usual quantities are applied under cotton. There is some difficulty with small grain and hay crops because of lodging.

Humphreys silt loam, level phase.—This soil occurs in second-bottom positions along some of the larger streams that flow through areas of Dickson, Baxter, and Bodine soils. In relation to the streams and the adjacent first-bottom soils, it has positions similar to the Etowah. Areas are usually on slopes of less than 2 percent just above normal overflow and are flooded only by the higher waters. Surface and internal drainage are both good, but some areas are flooded for a short time.

The soil is associated with the Huntington, Wolftever, Greendale, and Lindside soils. Some of the larger and more representative areas are in the Elk River and Sugar Creek Valleys; smaller ones occur along Piney and Limestone Creeks. This phase resembles Wolftever soil in a great many respects, the chief difference being the much more compacted layer in the Wolftever subsoil. This soil is more yellow and less reddish brown in the subsoil than is the Etowah. The original cover included elm, willow oak, yellow-poplar, sweetgum, hackberry, sycamore, hickory, and cedar, and a dense and varied growth of underbrush.

In a field cleared and cultivated for many years, the first layer is grayish-brown weakly granular and friable silt loam that extends to a depth of 6 inches. The organic content is low in most places. From 6 to 11 inches is yellowish-brown mellow silt loam that blends rather gradually to the layers above and below. Worm and root holes are common. The subsoil, below 11 inches and continuing to 26 inches, is yellowish-brown heavy silt loam to silty clay loam, somewhat fragmentary in structure. It is not difficult to spade when medium moist. A few pores and some small brown concretions are present. Light yellowish-brown heavy silt loam to silty clay loam extends from 26 to 38 inches. It is a little more packed than layers above and breaks to fragments of various sizes and shapes if spaded when moderately moist. The fragments are easily crushed, and the material becomes grayer on drying. The material extending from 38 to 72 inches is gray or grayish-olive slightly compacted silty clay loam. Some platiness is in this layer. At about 72 inches is a variable mixture of sand, silt, clay, and gravel, which in most places grades downward to sand and gravel that is usually high in moisture content, even during dry periods.

Use and management.—Nearly all of Humphreys silt loam, level phase, is cleared and has been cleared for the past 25 to 75 years. Corn, cotton, oats, and annual hay are the crops most frequently planted. Cotton yields 250 to 600 pounds of lint an acre; corn and oats, 20 to 40 bushels; soybean hay, 1½ to 2¾ tons; and lespedeza hay, ¾ to 1½ tons. There are also some exceptionally good yields of soybean and lespedeza seed.

Management is much the same as for the level phase of Etowah silt loam, and the fertilizer used on the two are about the same in quality and quantity (*4*, *5*, *19*, *20*). Until recently very little attention was given to the planting of cover crops, but farmers are rapidly coming to the belief that vetch and similar winter cover crops are beneficial to this soil.

Humphreys cherty silt loam, undulating phase.—Except for its chertiness, greater average slope (2 to 5 percent), and less profile development, there is little difference between this soil and Humphreys silt loam, level phase. It occupies low and medium to large stream terraces in the northern and especially the northwestern part of the

county. It has formed from old cherty silty alluvium similar to that parent to the cherty Greendale soils.

This soil is somewhat less productive than Humphreys silt loam because it contains so much chert. Like Greendale cherty silt loam, it is more difficult to cultivate and crops are more readily harmed by lack of moisture in dry seasons. As to use, management, and suitability, this phase is similar to the undulating phase of Greendale cherty silt loam.

Huntington silt loam.—This is a highly productive soil of the flood plains on slopes of about 2 percent. It consists of young alluvium washed chiefly from the red upland soils formed from limestone. It receives fresh sediment when streams overflow periodically and this tends to maintain its high fertility. Except for occasional floodings, drainage is good throughout. During winter the soil remains wet much of the time; in summer no difficulty is encountered from too much moisture, except when the season is wet, and then there may be infrequent flooding. The material has not been in place long enough for the development of distinct soil layers and consequently there is not much difference between the surface and subsoil.

To a depth of about 11 inches the soil is brown to yellowish-brown mellow silt loam, containing in many places a good quantity of organic matter. Dark-brown to faintly yellowish-brown heavy silt loam extends from 11 to 19 inches. This also contains fairly good quantities of organic matter in most places. Below 19 and continuing to 32 inches is faintly yellowish-brown heavy silt loam to silty clay loam. This layer is just a little lighter in color than the layers above, and it becomes a little harder on drying. From 32 to 43 inches the material is a little more compact, a little more grayish or slightly yellowish, and faintly mottled. It grades to deeper materials that differ extremely in general character from place to place.

Use and management.—Nearly all of Huntington silt loam has been cleared. Corn is planted every year in many places, and yields of 40 to 75 bushels an acre are common with little or no fertilizer. Some hay crops, as soybeans, cowpeas, and lespedeza, are grown. Soybeans and cowpeas produce 2 to 3 tons and lespedeza 1¼ to 2 tons of hay an acre. A few fields of cotton are planted, but the crop is so late in maturing that many bolls fail to open.

Little fertilizer is used because the soil is relatively high in fertility, and under proper management the fertility is not difficult to maintain. Lime is generally not needed, and good yields of corn can be produced without the use of fertilizer. Nonetheless, high fertilization will increase yields considerably. The increase in yield per unit of fertilizer applied may possibly be greater on this soil than most others of the uplands.

Lawrence silt loam.—Areas of this soil occur in somewhat depressed positions, chiefly in the gray lands section of the county, but to some extent in the red lands. Fort Payne chert is the predominant parent rock. Even the areas in the red lands lie in poorly drained gentle depressions where the parent and underlying rock appears to be Fort Payne chert rather than the high-grade St. Louis limestone of the associated red soils. Most of the material is residuum in place, but areas of the soil have a thin surface of local alluvium. This soil is closely associated with the Guthrie and Sango soils and is between the two in regard to productivity and drainage.

Internal drainage is slow. The native forest was chiefly post, red, black, white, and Spanish oaks; blackgum; sweetgum; and maple. This cover was very likely less luxuriant than that on adjoining soils having better moisture relations.

The surface 2 to 3 inches is gray to very light-gray silt loam splotched with dark gray. This is friable and easily spaded when moist. The following layer is heavy silt loam, very mottled with yellow, orange, and gray, in which there are some fine chert fragments. At 16 to 22 inches is silty clay loam, very mottled with gray, yellow, and rust brown, that also contains some chert fragments. This layer is usually saturated during wet periods and becomes puttylike. It is underlain by a siltpan of mottled gray, rust-brown, and yellow silty clay loam, very hard and compact and difficult to spade, even when moist. Gray becomes more predominant with depth. Below 42 inches is gray, yellow and rust-brown mottled cherty silty clay loam, which is saturated much of the time. The chert fragments are up to 3 inches in diameter. The soil is strongly acid.

Use and management.—Lawrence silt loam is best suited to corn, pasture, sorghum, or soybeans. An estimated one-third to one-half of the land is cleared, but much of the clearing has been done fairly recently. Where cleared, the soil is planted to corn, hay, soybeans, cotton, and pasture. Corn yields 13 to 18 bushels an acre; soybean hay, ¼ to ½ ton; and cotton, 100 to 250 pounds of lint. Pasture produces 10 to 60 cow-acre-days of grazing.

The soil is fertilized in much the same manner as the phases of Dickson silt loam. The chief management problems are proper drainage and addition of organic matter. Winter cover crops are frequently drowned out, and therefore soybeans seem to offer better promise as a green-manure crop, since they can be grown fairly well during a drier part of the year and can be planted in the corn without injury to that crop (*3*).

Limestone rockland.—Bedrock, chiefly high-grade limestone, is exposed so completely that little vegetation is growing over most of the surface. In a few small areas the limestone is cherty. The larger part of this separation is along the Elk River and its tributaries, but smaller areas occur southwest of Wall Street and in other parts of the county. Near the Elk River the outcrop is of the Chickamauga limestone formation. About 1½ miles west of the southeastern corner of the county the formation is of Tuscumbia limestone (*1*). The areas of soil intervening between the outcrops and boulders are generally of the Mimosa, Maury, or associated series. The slope range is 12 to 60 percent, and usually more than 25 percent.

Except in small patches where some soil accumulation has taken place, there is only a scrubby growth of brush. The chief timber is red cedar, but there are some black locust, redbud, hickory, buckeye, winged elm, and other hardwood trees. This land type cannot be tilled; it affords little pasture and is not especially productive of forest. Redcedar and black locust grow to a size suitable for fence posts, and the few small deeper pockets of soil material produce good bluegrass and clover pasture. The outcrop areas are possible sources of limestone for construction.

Lindside silt loam.—Areas occur on the flood plains of the Tennessee and the Elk Rivers and along some of the larger creeks. The soil is associated with Huntington, Egam, and Melvin soils, and with the Etowah, Wolftever, and Humphreys, which lies on adjacent stream terraces. The surface is nearly level, the slope being not in excess of 2 percent. Internal drain is slow, and most areas are subject to flooding. Excessive moisture restricts field operations and crop suitability, but the soil is productive of many of the important crops. It is slightly acid to medium acid.

The 7-inch surface layer is grayish-brown mellow silt loam that crushes to medium to fine granules. Following is grayish-brown mellow silt loam with fine gray lenses. This continues to a depth of 14 inches. From 14 inches downward to 21 is brown, dark-brown, and gray mottled silty clay loam, sticky when wet. Below 21 inches is mellow silt loam or silty clay loam, very mottled with light yellow, dark brown, gray, and brown. This is grayer at lower depths, may contain a variable quantity of grit and small gravel, and is wet most of the time.

Use and management.—Most of Lindside silt loam is cleared, and in spite of imperfect drainage it is productive of corn and lespedeza, redtop, white clover, and other pasture plants (pl. 8, *B*). Corn is the crop usually planted, but some hay is grown and occasionally cotton. Corn yields 25 to 40 bushels; soybean hay, 1¼ to 2½ tons; lespedeza hay, ¾ to 1¼ tons; and cotton, 200 to 500 pounds of lint an acre.

Little fertilizer is used except under cotton. For that crop, 200 to 400 pounds of 6–8–4 fertilizer is applied at the time of planting. Proper drainage, eradication of noxious weeds, and the addition of organic matter are essential to the best use of this soil.

Made land.—This separation represents an area of 159 acres in a bend of the Elk River about 5 miles southwest of Elkmont. This area consists mostly of nearly level first-bottom soils that have been greatly mutilated by the construction of fish ponds. A great part of the soil material is that of Huntington silt loam, which is underlain by gravelly and sandy material at a depth of 4 to 6 feet.

Maury silt loam, eroded undulating phase.—This soil is similar to Dewey soils, differing mainly in that it has formed from phosphatic limestone. The areas still need lime and phosphate for legume crops. In most parts the soil occupies slopes of 2 to about 5 percent. The aggregate area is small and mostly in the vicinity of Veto. Drainage is good both on the surface and internally, and mositure relations are generally favorable for plants.

The 4-inch surface layer is grayish-brown mellow silt loam. To a depth of 15 inches below this is brown mellow silt loam, somewhat sticky when wet. The subsoil is yellowish-brown friable silt loam from 15 to 40 inches. It contains some fine lenses of sand and a few rock fragments and is moderately compact below 28 inches. The layer extending from 40 to 54 inches is yellowish-brown silty clay loam more friable than the layer above. In this are a few rock fragments and thin sandy lenses. The layer below is slightly mottled brown, yellow, and gray silty clay loam that extends to a depth of 66 inches and contains small pockets and lenses of fine sand. From 66 to 100 inches the material is mottled brown, gray, and light-gray silty clay that is sticky while wet. Some areas are more nearly a silty clay loam, and chert is common in a few places. Bedrock is at a depth of 5 to 12 feet.

Use and management.—Nearly all of the eroded undulating phase of Maury silt loam was cleared during the early days of the county, and, except for the rest periods usually given the upland soils, it has been farmed ever since. Almost all crops common to the general area are grown. Cotton yields 200 to 600 pounds of lint an acre; corn, 25 to 45 bushels; wheat, 10 to 18 bushels; oats, 30 to 50 bushels; soybeans and cowpeas, 1 to 1½ tons; and lespedeza, 1 to 1½ tons of hay. The fertilizers used are usually about the same as those applied on Decatur soils, though some farmers feel that they get little benefit from the use of phosphate on this soil.

This productive soil is suited to crops requiring tillage. It erodes readily when not protected by a close-growing cover, and therefore intertilled crops should not be grown in succession. Moderately long rotations consisting chiefly of legume hay crops, as red clover and alfalfa, and fall-sown small grains should be used. Cultivation should be along the contour. Terracing is practical under some conditions.

Maury silt loam, eroded rolling phase.—A greater slope (5 to 12 percent) is the chief difference between this soil and the eroded undulating phase with which it is associated. Other differentiating characteristics are the generally thinner surface soil and shallower depth to bedrock. This phase is also a little heavier in the surface layer and gullies are a little more common in some parts. The slope is fairly regular, and drainage is good both on the surface and internally. Though this phase is more subject to erosion, the management usually practiced on the two soils differs little. Both are planted to cotton, corn, hay, and pasture crops, but yields are a little less on this phase. Both soils need organic matter and a system of management that will better control erosion. All this phase has been cleared and cultivated for 40 to 100 years.

Maury silt loam, eroded hilly phase.—The small total acreage of this soil occurs in association with other Maury and Mimosa soils in the vicinity of Veto. It differs from Maury silt loam, eroded undulating phase, chiefly in having a slope of 12 to 30 percent. In general, its depth to bedrock is much less. Surface runoff is fairly rapid. Most areas have been cleared and are to some extent eroded. Chiefly because of its strong slope, this soil is not well suited to cultivation. Much of it does not support good pasture under ordinary management, but if properly fertilized and seeded, it produces good pasture of bluegrass and white clover or lespedeza.

Maury clay loam, severely eroded rolling phase.—The small aggregate area of this soil is in the northern part of the county, chiefly southwest of Veto, south of Easter Ferry Bridge, and north of Maplewood School. It is associated with other phases of the Maury and Mimosa soils. From Maury silt loam, eroded undulating phase, it differs chiefly in having a slope range of 5 to 12 percent, in having lost most of its original surface soil as a result of erosion, and in having a notably less depth to bedrock. The plow layer is yellowish-brown silt loam or silty clay loam subsoil material. Though severely eroded, gullying is less noticeable on this phase than it is on some other severely eroded soils.

Use and management.—Maury clay loam, severely eroded rolling phase, is not well suited to crops requiring tillage unless they are grown

under careful management including the use of long rotations in which close-growing crops predominate. It is well suited to pasture, however, and where pasture plants are well established, it furnishes grazing of good quality. Chiefly because of its eroded condition, the cost of establishing good pasture may become expensive.

Maury clay loam, severely eroded hilly phase.—This soil occurs in close association with the eroded hilly phase of Maury silt loam and differs mainly in having lost almost all of its original surface soil by erosion. The slope range is 12 to 30 percent. The surface 20 to 25 inches is yellowish-brown firm but friable silt loam or silty clay loam. Below this is lighter colored more friable silt loam. Bedrock phosphatic limestone is at a depth of 25 to 50 inches. Drainage is good throughout, and surface runoff is rapid.

Use and management.—All the areas of Maury clay loam, severely eroded hilly phase, have been cleared and planted to crops for many years, and management much of the time has been careless. The eroded condition and strong slope are the main factors making this soil unsuitable for crops requiring tillage. Pasture is generally lespedeza that lasts only a short time in spring and summer. It probably would be difficult to establish good grass pastures at a reasonable cost. Sericea lespedeza is possibly one of the best uses. Redcedar and other hardwood trees do well, and where pasture is not urgently needed, the land might be most feasibly used for such forest.

Melvin silt loam.—This poorly drained soil is on less than 2-percent slopes in the first bottoms. It is very similar to Guthrie silt loam. Some material is washed from land underlain by Fort Payne chert. The difference in material causes variations in the reaction and productivity. In areas where the material is washed from high-grade limestone, the soil may be medium acid; where the material is largely from chert, it may be strongly acid. The soil is associated with the Huntington, Egam, Lindside, and Ennis soils. In some of the bottoms where it occupies old stream channels, the Huntington and Lindside soils are on the adjoining higher strips. Where these strips are too small to be shown separately on a map, they have been included.

This is an extensive soil, but little of it has been cleared. The natural forest includes hickory, sweetgum, beech, wild cherry, persimmon, water and chestnut oaks, sycamore, and hornbeam (ironwood). Some areas are too wet for many of these trees since the land is under water through the wet season and the water table is very near the surface for long periods.

Where the soil has not been plowed the 4-inch surface layer is grayish- or yellowish-brown silt loam with a small quantity of leafmold on top. From 4 to 9 inches is mottled gray, brown, and yellow silt loam to silty clay loam that breaks easily to small fragments. Below 9 inches is an abrupt transition to light-gray mottled with yellow and rust brown firm silt loam. From 24 to 36 inches is very mottled gray, yellow, and rust-brown silty clay. Below 36 inches is a medium to strongly acid gravelly cementlike layer that is difficult to penetrate.

Use and management.—When properly drained, some areas of Melvin silt loam may be used for pasture, sorghum, soybeans, lespedeza, or corn. The cost of drainage and the possibility of losing crops from drowning makes the production of tilled crops hazardous in most places. Pastures, on the other hand, may be only temporarily damaged by floods, and less complete artificial drainage is required to bring them close to maximum productivity. Corn may produce 5 to 25 bushels an acre; lespedeza hay, ½ to 1 ton; soybean hay, ¾ to 1½ tons; and pasture, 40 to 130 cow-acre-days of grazing, depending on degree of drainage. The use of lime, phosphate, and potash is often very beneficial in developing pastures.

Mimosa cherty silty clay loam, eroded rolling phase.—The material making up this soil is residual from high-grade limestone of the Maysville geologic formation. Indications are that this rock is usually fairly high in phosphate, though preliminary tests indicate some variation in the content from place to place. The soil occupies low ridges in valleys where the high-grade limestone outcrops (*1*) and is confined to the northern part of the county, chiefly in the valleys of larger streams. The soils are medium acid throughout but less acid in the lower parts.

Nearly all the land is cleared and has been farmed for several years. The total area is not large, most of it being near the Tennessee line, on both sides of the Elk River. The range in slope is 5 to 12 percent. The original cover included hickory, white and post oaks, red cedar, and a few hackberry trees. The timber stand was thin and in some places consisted almost wholly of red cedar and hickory.

In cleared fields to a depth of 5 inches the soil is light-brown or chocolate-brown mellow silty clay loam containing many chert fragments up to 5 inches thick. Dark yellowish-brown mellow silty clay loam, also containing many chert fragments, extends from 5 to 12 inches. This grades to yellowish-brown cherty silty clay loam that continues to a depth of 18 inches. Below 18 inches is mottled light-brown, yellow, and gray tough silty clay. Somewhat less chert is in this layer; the lower part is less yellow and exceptionally plastic. Bedrock is at a depth of 30 to 60 inches.

Use and management.—Cotton, corn, and pasture are among the crops planted on Mimosa cherty silty clay loam, eroded rolling phase. Cotton yields 200 to 400 pounds of lint an acre, and corn, 15 to 40 bushels. Pastures produce 20 to 60 cow-acre-days of grazing. The fertilizer treatment is much the same as that common to Dewey silt loam soils, but some farmers believe that yields from the use of phosphate are not so good as on other soils.

This soil is suited to crops requiring tillage, but chiefly because of its rolling surface and very slowly permeable subsoil, careful management is required to maintain productivity. Long rotations should be used, and tillage should be with the contour. The addition of organic matter is just as important to the productivity of this soil as it is to the other soils commonly cropped. Hay crops are impractical on many areas because of chert. To improve tillage, mowing, reaping, and certain other field operations, the larger chert fragments would have to be removed. On most areas this would be a large task. Where the fertility is well maintained and white clover and bluegrass are well established, permanent pasture of good quality can be expected.

Mimosa cherty silty clay loam, eroded hilly phase.—A stronger slope (12 to 30 percent) is the chief difference between this soil and

the eroded rolling phase. It is associated with the other Mimosa soils and its aggregate area is small. Included are a few areas of Colbert silty clay loam, eroded phase, which is tough plastic clay, shallow in depth to limestone bedrock.

Use and management.—Practically all of the eroded hilly phase of Mimosa cherty silty clay loam has been cleared and farmed for some time, but owing to its steep slope and slowly permeable subsoil, erosion is too active to permit continued tillage. Because of erodibility and the large quantity of chert, it is not advisable to grow hay crops. Checking erosion, removal of larger chert fragments, and restoration of organic matter are all needed, even if the land is to be put in pasture.

Mimosa cherty silty clay loam, severely eroded hilly phase.—Almost all the surface soil has been eroded from this phase. This loss and the stronger slopes (12 to 30 percent) are the main differences between this and the eroded rolling phase. The 4- to 5-inch surface layer is dark yellowish-brown mellow silty clay loam containing many chert fragments. Below this is light-brown, yellow, and gray mottled tough silty clay. Where erosion has been especially severe, this material is at the surface. Bedrock limestone is at 18 to 50 inches. Runoff is very high, and internal drainage is slow.

Use and management.—The forest cover was the same as for the other Mimosa soils, but nearly all of the severely eroded hilly phase of Mimosa cherty silty clay loam has been cleared and farmed for a time. Practically all of it is now idle or in native pasture. Generally the pasture sod is poor, with some bluegrass on the less eroded spots. This soil is not suited to tillage, but if badly needed for pasture, some areas might be fertilized and seeded and eventually fair to good grazing could be expected. Under average conditions most of the land is best used for forest.

Mimosa cherty silt loam, hilly phase.—This inextensive phase represents uneroded forested areas of the Mimosa soils on slopes of 12 to 30 percent. Nearly all of it is along the northern border of the county, in the vicinity of Veto and westward. It is associated with other Mimosa soils but is somewhat more cherty. The chertiness probably accounts for its not being cleared. Practically all of it is under hardwood forest. Except for the higher content of organic matter in the surface layer and the shallower depth to bedrock, the profile is similar to that of Mimosa cherty silty clay loam, eroded rolling phase. This hilly phase is not suited to crops requiring tillage but should produce fair to good permanent pasture if it is properly seeded.

Ooltewah silt loam.—Areas of this soil occupy circular depressions similar to those of the Abernathy soils. The slope is very gentle to nearly level (0 to 2 percent). Surface and internal drainage are both slow. Ponding follows heavy summer rains and is occasionally a hazard to crops. The soil occurs in association with Decatur, Dewey, and Cumberland soils mostly in the red lands section, but a few areas have been mapped in association with Maury soils. The material making it up is derived mostly from soils underlain by fairly high-grade limestone. Reaction is strongly to medium acid throughout; in some places it becomes more acid with depth. The original forest cover included oaks, gums, hackberry, sycamore, and similar hardwoods.

In cleared areas the 10- to 14-inch surface layer is reddish-brown or brown mellow silt loam. The organic content is moderately high. Below this is light-gray or gray silty clay loam or silty clay mottled with yellow and brown. This is easily spaded when moist, but it becomes sticky when wet. Below 24 inches the material grades to more compact mottled silty clay, and at 36 inches it becomes decidedly gray very sticky clay. The depth to bedrock is usually several feet.

A few small areas of this soil in the vicinity of Veto have a silty clay texture throughout the profile. These consist, at least in part, of Mimosa soil material. Certain other areas are being injured by an overwash of subsoil material that comes from the surrounding higher lying soils when they are under cultivation.

Use and management.—Practically all of Ooltewah silt loam is cleared. Corn is the crop most often planted, but cotton and hay are not uncommon. Winter grain crops tend to be killed out by heaving during winter and early in spring, and they commonly lodge before they are ready for harvest. Corn yields 25 to 45 bushels an acre; cotton, 250 to 500 pounds of lint; soybean hay, 1¾ to 2¾ tons; and lespedeza hay, ¾ to 1½ tons. Pastures do well also, producing 130 to 150 cow-acre-days of grazing, and even more where they are well fertilized.

Little fertilizer is used except when the land is planted to cotton. Under cotton some farmers use 200 to 300 pounds of 6–8–4 fertilizer an acre. Some use a reduced quantity of nitrogen with fairly good results because the soil is high in organic content. The soil is fertile, easily worked and conserved, and suitable for intensive use. Impaired internal drainage and susceptibility to temporary flooding limit the kinds of crops that can be grown. The moisture condition and high fertility favor permanent pasture.

Robertsville silt loam.—The nearly level areas of this soil occur on less than 2-percent slopes on stream terraces where nearly all the material has been washed from soil underlain by high-grade limestone. Drainage is poor both on the surface and internally. During rainy seasons many areas are covered with water, and for long periods in winter and spring the water table is near the surface. Drainage outlets are difficult to obtain in many parts. This soil is associated with the Cumberland, Etowah, Taft, and Ennis soils and, to some extent, with the Wolftever and Humphreys.

The surface 12 inches is gray silt loam mottled with yellow and rust brown. Some chert fragments are present. From 12 to 20 inches is mottled gray, yellow, and brown silty clay loam containing some chert fragments, though fewer than the layer above. Below 20 inches is very mottled brown, yellow, and gray silty clay, which contains some gritty material and grades at about 26 inches to gray lightly mottled with yellow and brown silty clay in which there is some gritty material and chert. This very hard and cementlike layer is difficult to dig, and the thickness varies considerably. The soil is strongly acid in all parts. A few areas have a 6- to 12-inch surface soil of fine sandy loam instead of silt loam.

Use and management.—The forest on Robertsville silt loam includes sweetgum, maple, wild cherry, post oak, and other hardwoods. A small part of the soil is cleared. Where it is cleared and adequately drained, fair crops of corn, sorghum, hay, and soybeans can

be produced in all but the wetter years. Considering the high cost of drainage, sufficient drainage should be installed to assure rapid removal of surface water and then permanent pasture established. Some exceptionally good grazing has been obtained on areas where drainage is adequate and the soil has been properly prepared, fertilized, and seeded.

Rough gullied land (Decatur, Dewey, and Cumberland soil materials).—This land type represents areas of soil so mutilated by erosion that reclamation for crops or pasture is difficult. Most of it is in areas of the red soils, only a small acreage being with the Dickson, Baxter, and associated soils of the gray lands. Deep gullies, in some places cutting to bedrock, are common. The slope range is 5 to 60 percent. Runoff is high and extremely erosive on any area loosened by plowing or like cultivation.

The areas of the land type are generally inextensive and occupy small rather steep spots widely scattered over the county. Possibly there are more areas in the southern part and along the slopes of the Elk River than elsewhere. Generally areas are found on the steeper slopes of fields otherwise fairly gentle in relief. They have been cultivated in the same manner as the surrounding land and owing to the steepness of slopes have eroded severely. Included are a few small areas of very severely eroded Baxter and Dickson soils.

Some farmers have found it advantageous to plant this land type to kudzu, sericea lespedeza, black locust, or some other rapidly growing plant that will check erosion as quickly and cheaply as possible. When a heavy growth has been established, erosion will be almost completely checked, regardless of its severity.

Sango silt loam.—Broad flat areas within the gray lands section are occupied by this extensive soil. Most of the acreage is in a belt extending southwest from Ardmore toward Carey and west of Athens. It is closely associated with the Dickson soils and is derived largely from Fort Payne chert, weathered in place. There is considerable resemblance between this soil and Dickson silt loam, level phase, but this soil has slower internal drainage and a siltpan a little closer to the surface. Both in drainage and depth to the siltpan, it represents a gradation from Dickson silt loam, level phase, to Lawrence silt loam. After several years of cultivation the surface layer appears more dead and bleached than does that of the Dickson. It grades gradually into the Dickson soil on the better drained side and into the Lawrence or Guthrie on the more poorly drained side. Because of the nearly level to gently sloping relief (less than 2 percent), runoff is slow and internal drainage is impeded by the layer of siltpan and the lack of fall sufficient to carry away the water.

In forested conditions the land is covered with a thin growth of post, red, and white oaks; hickory; sweetgum; blackgum; other hardwood trees; and brush. The trees are usually not large. An estimated 60 to 75 percent of the soil has been cleared, most of it within the past 25 to 40 years.

The surface 3 inches in unplowed areas is light-gray silt loam with some chert fragments and brown concretions. This layer is friable, and it breaks to a crumblike structure. The gradation to the next layer is gradual. Below 3 and continuing to 15 inches is yellowish-gray friable silty clay loam, slightly sticky when wet. At a depth of about 15 inches this grades with moderate abruptness to mottled yellow, orange, and gray moderately brittle silty clay, that contains some cherty fragments and concretions. The siltpan, consisting of very mottled gray, yellow, and light-brown compact brittle silt loam or silty clay loam, lies at a depth of about 20 inches. It contains many brown or reddish-brown concretions. The compactness or hardness diminishes below a depth of about 33 inches, and the gray is less predominant over the yellow. Below 47 inches is mottled yellow, gray, and rust-brown cherty silty clay. The soil is strongly acid throughout.

Use and management.—Drainage on Sango silt loam is usually sufficient for planting and cultivating crops late in spring, as corn, grain sorghum, sorghum, or soybeans. The soil is exceptionally wet in wet seasons. Corn, soybeans, cotton, hay, and pasture are the crops most frequently planted. Corn yields 8 to 22 bushels an acre; cotton, 100 to 300 pounds of lint; soybean hay, ½ to 1½ tons; lespedeza hay, ¼ to ¾ ton; and pasture, 20 to 70 cow-acre-days of grazing.

The soil is very deficient in lime, phosphate, and potash, and it is fertilized like the surrounding Dickson soils. To continue production of fair crops, it is important that winter cover crops be planted just as often as possible, even though some of these will fail because of lack of good drainage. Owing to the strongly acid condition, liberal lime applications will aid in the growth of legume crops. Proper drainage and increased fertility are among the chief objectives in good management.

Taft silt loam.—This soil occupies moderately low terraces near larger streams, as Swan, Piney, and Limestone Creeks. It is associated with Etowah, Wolftever, Humphreys, Ennis, and Robertsville soils. The material making it up has been washed from soils underlain chiefly by limestone and cherty limestone. The relief is nearly level to very gently undulating, the gradient being less than 2 percent. Surface and internal drainage are both slow. The soil is strongly acid to very strongly acid.

In plowed areas the first 5 inches is light brownish-gray silt loam that spades out as fragments readily crushed to medium granules. There are some small chert fragments. The layer from 5 to 17 inches is pale-yellow or grayish-yellow silt loam to silty clay loam containing some chert fragments. Below this the material is mottled gray, rust-brown, and yellow firm or moderately compact silty clay loam to clay loam in which there are some chert fragments and a few soft concretions. The material breaks into fragments. The change to the layer below is rather gradual. Below 26 inches and continuing to 42 inches is gray mottled with rust-brown and yellow silty clay loam or silty clay, a little grayer and less yellow than the layer above. This layer is brittle and somewhat laminated, and it breaks to fragments showing signs of cementation that suggest a semihardpan. From 42 to 52 inches is very mottled yellowish-gray and rust-brown clay. Pockets of heavier material are common, and there are often a few chert fragments.

Use and management.—The original forest cover of Taft silt loam included hickory; sweetgum; red, post, and water oaks; and loblolly pine. From 60 to 80 percent of the soil is now cleared and planted to

crops each year. Much of it has been cleared fairly recently. Erosion is not a management problem, but proper drainage and incorporation of organic matter are of major importance. Crops grown include principally corn, oats, hay, and pasture. Pasture is one of the best uses. When seeded early and properly fertilized (pl. 8, *C*), good winter cover crops of vetch are obtained by some farmers. Corn produces 5 to 20 bushels an acre; oats, 5 to 25 bushels; soybean hay, ½ to 1¼ tons; and lespedeza hay, ¼ to ¾ ton. Pasture yields 20 to 70 cow-acre-days of grazing.

Wolftever silt loam.—This soil is associated with and similar to Huntington soils. Though its position is a little higher than that of the first bottoms, most areas are inundated occasionally by the highest floods. Surface drainage is good; internal drainage is moderately slow. The material making up the soil has been washed from soils underlain chiefly by Fort Payne chert and high-grade limestone. Some material from other rock, as sandstone, is intermixed. A few small areas of silty clay loam have been included because of their small extent.

In cultivated fields the first 7 inches is light yellowish-brown mellow silt loam having a crumb structure. A few chert fragments occur in places. The layer extending from 7 to 16 inches is yellowish-brown firm silt loam. At 16 inches this grades to pale-brown or light yellowish-brown silty clay loam, fragmentary in structure, that contains many dark concretions and a few small chert fragments. From 28 to 38 inches, the subsoil is pale brown or light yellowish-brown streaked with gray very tight or compact silty clay loam. It is very hard when dry, and the compactness of this layer is the chief characteristic distinguishing this soil from the Humphreys. The mottled yellowish-brown, gray, and dark-brown tight or compact silty clay loam following becomes grayer with depth.

Use and management.—Practically all of Wolftever silt loam has been cleared for many years. The present use, yields, and management requirements are similar to those of Humphreys silt loam, level phase. The Wolftever soil has somewhat impaired internal drainage, and it is more droughty because of its compact subsoil.

SOIL ASSOCIATIONS

Two, three, or more soils are likely to occur in geographic association with one another. Usually a different set of soils is associated in one part of the county, as in the red lands, than in another. Study of the detailed soil map (cover page 3) makes it possible to recognize the different soil associations. For example, by observing the location of the soils in the county as indicated on the detailed soil map, it becomes obvious that the Dickson, Cookeville, and Baxter soils, with some others less important, are generally located near one another, and thus form a soil association. By placing these and other geographically associated soils in groups, it is possible to prepare a generalized map showing the areas dominated by each association. Such a map is an inset on the detailed soil map.

The soils of each association generally manifest a characteristic pattern of distribution that can be determined by study of the detailed map. For example, the distribution of the soils in the Dickson-Cookeville-Baxter association can be determined in this manner. Moreover, if maps are made to show the distribution of specified soil characteristics in an association, as slope, drainage, or suitability for use, the map delineating each characteristic will tend to show a pattern rather distinctive of a particular association. To illustrate, the majority of farms in any one soil association will usually have similar problems of soil use and management. The problems will of course not be exactly the same on all farms. Farm boundaries may be such that one farm will contain more of one soil than its neighbor, and less of another. Nevertheless, nearly all farms in one association area will have certain soil problems in common. The soil problems of farmers in that area are apt to be different from those of farmers in another association.

In this county, 11 soil associations are named after the principal soil series in them. They are as follows: (1) Melvin-Robertsville-Taft, (2) Cumberland-Etowah-Decatur, (3) Decatur-Abernathy, (4) Decatur-Dewey-Cookeville, (5) Dickson-Cookeville-Baxter, (6) Dickson-Sango-Lawrence, (7) Ennis-Taft-Melvin, (8) Huntington-Wolftever-Humphreys-Lindside, (9) Maury-Mimosa, (10) Baxter-Dickson-Bodine, and (11) Cookeville-Baxter.

MELVIN-ROBERTSVILLE-TAFT ASSOCIATION

The Melvin-Robertsville-Taft association consists predominantly of poorly and imperfectly drained soils on low stream terraces and bottom lands. These nearly level to very gently sloping areas lie as narrow bands or strips along the larger creeks, and much of the acreage is subject to overflow. The association occurs in the southeastern part of the county and is adjacent to extensive areas of the Decatur-Abernathy association. Practically all of it is included in farms that partly consist of Decatur, Abernathy, and associated soils.

A large part, especially of the Melvin and Robertsville soils, is under hardwood forest. The cleared part, including practically all of the Taft and less extensive parts of the Melvin and Robertsville soils, is used chiefly for annual legume hay and pasture, with some corn and cotton on the Taft.

The suitability of this association is restricted by its poor drainage. Being limited chiefly to pasture and annual hay, it can be used to best advantage as parts of the farms on which there is sufficient acreage of soils well suited to row crops and the other more exacting crops requiring tillage. The productivity and suitability of many areas can be greatly increased by artificial drainage where feasible.

CUMBERLAND-ETOWAH-DECATUR ASSOCIATION

The Cumberland-Etowah-Decatur association occupies moderately broad, undulating to rolling, well-drained areas adjacent to Wheeler Reservoir. The soils are predominantly reddish and fertile with firm but moderately permeable subsoils that are deep to bedrock. That part of the acreage on the stronger slopes has been eroded to a notable degree, much of it having lost all of its surface soil. Gentle depressions or sinks occupied by Abernathy soils are widely distributed throughout the areas. Small areas of imperfectly and poorly drained soils of the Melvin-Robertsville-Taft series are along the larger drains and creeks.

849450—53——6

Practically all this association has been cleared of its original forest, and in some sections practically all of it is used for either crops—chiefly cotton, corn, and hay—or pasture. In the area in the southeastern corner of the county, south of Wall Street, there is a notable acreage that has been abandoned chiefly because of its depleted fertility and eroded condition.

In general, the management level is not so high as on some other associations, as depletion of fertility and erosion appear to be more active. Many of the farms in this association are operated under absentee ownership. A great part of the acreage is capable of responding well to good management, the chief requirements of which are increased fertility, improved tilth, and the use of more close-growing crops in rotation, as winter legumes, cover crops, small grains, and hay crops. Under proper management a great part of the acreage is capable of producing high yields of a wide variety of crops, including cotton, corn, small grains, and the more desirable grasses and legumes for hay and pasture.

DECATUR-ABERNATHY ASSOCIATION

A relatively large area of the southeastern part of the county is occupied by the Decatur-Abernathy association. It is one of the most desirable sections for farming, as a great part of the acreage is productive and fairly easily worked and conserved. A large part of it consists of nearly level to gently undulating red well-drained fertile soils. The nearly level parts include a considerable acreage of slight depressions occupied by the Abernathy soils.

Practically all of this association is cleared and used rather intensively for crops, chief of which is cotton. Corn and hay crops are common but of notably less importance. A great part of the cotton is produced on the Decatur soils, whereas most of the corn is grown on the Abernathy soils. Winter legumes, chiefly vetch, are widely used. Some alfalfa is grown and there is a small acreage of oats and wheat, some of which is generally followed by lespedeza. A great part of the land is held in fairly large units by absentee owners. Although cotton farming predominates, beef and dairy farming are of some importance and are increasing.

This association is suited to a wide variety of crops and where well managed is capable of intensive use. High yields of cotton, corn, small grains, and more desirable grasses and legumes for hay and pasture can be expected, where good management is practiced.

DECATUR-DEWEY-COOKEVILLE ASSOCIATION

The Decatur-Dewey-Cookeville association lies as an irregular belt across the county from east to west in the vicinity of and a little south of Athens. Other areas are farther north, the largest of which is in the vicinity of Elkmont. This association consists of an intricate pattern of Decatur, Dewey, and Cookeville soils, with Dickson, Abernathy, Greendale, and Guthrie soils intermixed. The surface is predominately undulating to gently rolling and much of the acreage is at least moderately fertile and well drained.

With the exception of some of the poorly drained acreage, practically all of this association has been cleared and is now used for a wide variety of crops or pasture. Cotton is the main crop, but corn, hay, small grains, and pasture are important. More of the farms are owner operated than in the Decatur-Abernathy and Cumberland-Etowah-Decatur association. In general, the farms are smaller, tractors are less common, and horses and mules are more common and accordingly lighter farming equipment is used. From 5 to 8 percent of the land is idle.

The somewhat more irregular surface than that of the Decatur-Abernathy association causes management requirements to be a little more exact and apparently has favored the development of smaller farms. The natural fertility of some of the soils is a little lower, but a very great part of the acreage is capable of responding well to good management, especially to adequate fertilization.

DICKSON-COOKEVILLE-BAXTER ASSOCIATION

The Dickson-Cookeville-Baxter association occurs in several broad bodies in the central part of the county, with more irregular areas distributed in the northwestern corner. The areas are predominantly undulating, although some have a rolling relief or else are nearly level along the drains and gentle sinks in the uplands. Most of the nearly level areas consist of poorly drained soils chiefly of the Guthrie and Melvin series. The greater part of the landscape is occupied by the undulating Dickson and Cookeville soils, the Dickson usually predominating. Drainage conditions on this major part of the landscape are generally adequate for most of the crops commonly grown, although internal drainage of the Dickson soils is notably restricted by the hardpan. Natural fertility of the Dickson soils is moderately low and that of the Cookeville is moderately high, being somewhat less, however, than that of the Decatur and Dewey soils. The general lay of the land of this association is somewhat more irregular or broken than is that of the Decatur-Abernathy and the Decatur-Dewey-Cookeville associations. Small areas, especially on the stronger slopes, have some stone, chiefly chert.

A great part of the acreage is cleared and about 5 percent is idle land. A subsistence type of agriculture predominates, with corn, cotton, small grains, and hay the chief crops. Some farmers, in addition to their cotton crops, sell a few hogs and beef cattle.

Although this association is well suited to general farming common to the county, the low fertility and hardpan conditions of the extensive Dickson soils cause the general productivity of the association to be lower and the range of suitability to crops somewhat more restricted. If a high level of productivity is maintained, relatively heavy fertilization and a high level of management are required.

DICKSON-SANGO-LAWRENCE ASSOCIATION

The Dickson-Sango-Lawrence association lies almost entirely in one very large body extending across the central part of the county from northeast to southwest. It has a nearly level to very gently undulating surface and a great part is occupied by grayish imperfectly drained soils that have a siltpan. The soils, in general, are low in fertility.

About 70 to 80 percent of this association is cleared and used mostly for crops and pasture. Cotton, corn, small grains, and hay are the chief crops. The uncleared acreage is largely on the poorly drained

Guthrie and Melvin soils, with small areas on the Sango and Lawrence soils. From 6 to 8 percent is idle land. A subsistance type of agriculture predominates in which a great many of the farms are small owner-operated ones.

The general low fertility and impaired internal drainage limits the productivity and range of suitability of most of the soils of this association. A diversified type of agriculture producing small grains, hay, and pasture crops, together with some row crops, is suited. Substantial fertilization and organic matter and lime are required to maintain a fairly high level of production, and, unless the fertility is high, the more desirable legumes and grasses for hay and pasture cannot be expected to yield well.

ENNIS-TAFT-MELVIN ASSOCIATION

The Ennis-Taft-Melvin association occupies first bottoms and low terraces along the larger creeks, the headwaters of which are in areas underlain by cherty limestone. The relief is nearly level to gently sloping and internal drainage ranges from very poor to good. All of this association is in the eastern and southeastern parts of the county and lies as long narrow strips along the larger creeks that cross areas of the more extensive associations of red well-drained fertile soils. Probably over half of the aggregate area is subject to periodic overflow, and nearly all the rest is occasionally subject to inundation. Ennis, Taft, and Melvin soils predominate, with small acreages of Etowah, Humphreys, Lindside, and Robertsville intermixed. The fertility of the soils ranges from low to moderately high and some of the areas, especially in the more northern parts, are gravelly, some being so gravelly as to prohibit tillage practically.

From 40 to 50 percent of the acreage—mostly the well-drained soils—is used for row crops, chiefly corn and cotton. Some acreage is used for hay. About 20 percent is in forest that can be used for pasture, about 15 percent is idle land, and the rest is in native forest. The suitability of this association is restricted by internal drainage conditions and overflow hazard, and all the areas are parts of farms that include a notable acreage of more fertile well-drained soils with a wide crop adaptation. In combination with these latter soils, those of the Ennis-Taft-Melvin association can be used to good advantage for certain row crops, hay, and permanent pasture.

Management requirements for the better drained areas are not exact, that is, they are easily worked and not difficult to conserve, and their fertility is not particularly difficult to maintain at a fairly high level. The poorly drained soils of this association, however, require artificial drainage, and many require heavy fertilization if they are to be maintained in a high productive state. Artificial drainage of many areas, however, may not be feasible.

HUNTINGTON-WOLFTEVER-HUMPHREYS-LINDSIDE ASSOCIATION

The Huntington-Wolftever-Humphreys-Lindside association occupies nearly level to undulating relief in the valleys of the larger streams in the northwestern part of the county. The principal areas are along the Elk River and Sugar and Shoal Creeks. A large part of the Wolftever and Huntington soils are along the Elk River, most of the Humphreys is along Sugar Creek, and the Lindside areas are distributed throughout all the valleys in which this association lies. All the soils consist of alluvium deposited by streams carrying material derived from high-grade limestone, cherty limestone, and shale. Internal drainage in most places is good. There is very little acreage of poorly drained soils and only a moderate area of imperfectly drained soils, these being of the Lindside series. Much of the acreage is subject to overflow and practically all of it is subject to occasional inundation.

A large part of this association is cleared and used for corn, hay, pasture, and some cotton. In general, these soils are well suited to intensive use, as they are not subject to erosion and are relatively fertile. Most of the acreage is part of farms including more hilly land, although there are a few farms consisting almost entirely of soils within this association.

MAURY-MIMOSA ASSOCIATION

The Maury-Mimosa association occupies three rather small irregular areas in the north-central part of the county, bordering the Elk River. They consist chiefly of upland soils developed over phosphatic and moderately phosphatic limestone. The areas are undulating to hilly and the depth to bedrock in most places is shallow. The natural fertility is moderately high, but active erosion has greatly lowered the productivity (see pl. 9, *B*). Rock outcrops, stony spots, and cherty areas are common.

A large part of the Maury soils has been cleared and farmed, but the forest cover has been removed from only about half of the Mimosa soils. Corn, cotton, and hay are the chief crops and there is some acreage in pasture. At the present time there is a trend among the farmers to use these areas for livestock farming, to which they are suited.

In general, management is not on a very high level, as erosion is active in a great many places and crop yields are low. Much of the acreage is particularly well suited to pasture and hay crops, since the Maury soils, especially, have a high content of phosphorus.

BAXTER-DICKSON-BORINE ASSOCIATION

The Baxter-Dickson-Bodine association, with its rolling to steep relief, has more hills than any association in the county. It occupies a large part of the northwestern quarter of the county, and the areas are broken and intermingled with several other associations. Most of the soils are developed over cherty limestone, although strips of alluvial soils extend throughout the areas along the drains and creeks. A large part of the association is cherty and the general level of fertility is low to medium. Internal drainage is moderate or adequate for crops, but owing to the strong slope external drainage is excessive. In places crops suffer from lack of moisture during dry seasons.

Approximately 25 percent of this association is under forest, which is mostly on the stronger slopes of the Baxter and Bodine soils. About 20 percent is unimproved pasture consisting of fair grazing vegetation, chiefly broomsedge, lespedeza, and other native grasses. Approximately 10 percent is idle land and the remaining acreage is cultivated, with corn, cotton, and hay being the chief crops. Average yields are low as the general level of fertility is low and

fertilization is not at a high rate. Some livestock, chiefly hogs and cattle, are raised by most farmers.

The general low fertility and hilly relief make this association poorly suited to a farming system in which row crops predominate, especially cash crops. Systems of farming in which the needs of the farm family are met and in which relatively long rotations consisting of close-growing crops predominate are better suited. Systematic rotations are not commonly practiced, but on some of the acreage row crops are grown for 2 or 3 years, followed by a period of 2 to 5 years of pasture. If a relatively high level of productivity is to be maintained, the row crop acreage needs to be restricted, adequate fertilization practiced, and legume hay and pasture crops emphasized.

COOKEVILLE-BAXTER ASSOCIATION

The Cookeville-Baxter association consists of relatively small areas of undulating moderately reddish soils, which are moderately fertile. The relief in general is smooth, with small moderately and strongly sloping areas along the drains. A large part of the acreage is well drained.

Soils of this association are desirable for crops. Most of the acreage is cleared and used for crops, chiefly cotton, corn, and hay, with fruits and vegetables grown for home use. Crop yields in general are fair to good. Some of the farms are owner-operated but the larger ones are operated by tenants.

Management requirements are not particularly exacting except on the limited acreage of the stronger slopes. All the soils respond well to proper fertilization, and legume grass hay and pasture crops under good management are of good quality.

USE, MANAGEMENT, AND PRODUCTIVITY OF THE SOILS

The use, management, and relative productivity of the soils of Limestone County are discussed in this section. The soils are grouped in 5 classes according to their similarity of general suitability for crops, pasture, or forest and in 19 groups on the basis of their general suitability for different uses and their management requirements. Better management practices are discussed for the soils of each group. The expected crop yields for each of the soils under two levels of management are given in table 7.

LAND CLASSIFICATION

The soils are grouped in five classes on the basis of their relative physical suitability for agricultural use under present conditions. Productivity, workability, and conservability are the factors considered in this classification. The classes, in the order of their decreasing desirability for agricultural use, are First-, Second-, Third-, Fourth-, and Fifth-class soils. Though the soils of no one class are ideal for existing agriculture, the First-class soils more nearly approach that ideal than do those designated as Second class, and the soils of each succeeding class are farther from the ideal than are those of the ones preceding. An ideal soil is exceptionally productive of a large number of important crops, easily worked, and conserved with minimum effort. All the soils of the county fall short of the ideal, but they differ widely in the degree of shortcoming and may fall short for different reasons. For example, a soil may be highly productive and easy to conserve but extremely difficult to till. The productivity of the soils is expressed in terms of yields in table 7. This table also shows the workability and conservability of the soils and their land class.

Under present conditions of agriculture in this county, the soils only moderately well suited to crops requiring tillage and to pasture are better soils for farming than are those poorly suited to crops but well suited to pasture. This assumption was made because soils well suited to crops are more limiting to agriculture on a greater number of farms than are those well suited to pasture. If livestock should become more important in the agriculture of the area, this assumption might become invalid.

The soils are divided in two groups. In one group, the productivity, workability, and conservability of the soils are sufficiently good to permit considering them at least fairly well suited to both crops and pasture. In the other group, one or more of the factors of productivity, workability, and conservability is sufficiently poor to make the soils poorly suited to crops requiring tillage.

The first group is subdivided into three subgroups, the limits between them being chosen to approximate the concept of fair and good cropland, respectively. These three subgroups, in decreasing order of suitability for agriculture, are First-, Second-, and Third-class soils. The second group, consisting of soils poorly suited to the production of crops that require tillage, is subdivided into two subgroups. The Fourth class comprises soils at least fairly well suited to the production of permanent pasture, and the Fifth class, soils poorly suited to permanent pasture and probably best suited to forest.

Information obtained from the experience of farmers, soil surveyors, extension and experiment station workers, and others who work with the soil was used in placing the soils in the five physical land classes. Comparisons were made among the soils, considering productivity, workability, and conservability. For example, a farmer knows that some soils on his farm are better suited physically to agriculture than are others. By comparisons within farms and among farms, the soils were placed in the approximate order of their physical suitability for agriculture. Descriptions of the land classes follow.

FIRST-CLASS SOILS

First-class soils are very good for agriculture—they are good to excellent for crops requiring tillage and for permanent pasture. All are relatively well supplied with plant nutrients when compared with other soils of the county, but even the most fertile is responsive to amendments for some crops. 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. Their physical properties favor normal movement of air and moisture, and roots penetrate them easily.

None of these soils is characterized by any prominent adverse condition. They are almost free of stones, and the relief is favorable

for soil conservation and tillage. None is severely eroded or highly susceptible to erosion. The productivity is high for many crops, and the problem of conserving soil fertility and soil material is relatively simple under common farming practices. All are well suited physically to most of the exacting and intensive crops commonly grown in the locality.

The First-class soils have an aggregate area of 33,609 acres, or 9.2 percent of the county.

SECOND-CLASS SOILS

Second-class soils are good for agriculture as it is practiced in the county. They are fair to good for the production of crops requiring tillage and fair to excellent for permanent pasture. These soils are at least moderately productive of most of the crops commonly grown in the county. Their physical properties are at least moderately favorable for tillage, maintenance of good tilth, and normal circulation and retention of moisture. None occupies slopes greater than 12 to 15 percent, is severely eroded, or is sufficiently stony to interfere seriously with tillage operations.

Each soil is moderately deficient in one or more characteristics that contribute to productivity, workability, or conservability, but none is so seriously deficient in any characteristics that it is poorly suited physically to use for crops requiring tillage. The deficiencies vary widely among the soils. Some are fertile but sloping and moderately eroded; others are almost level and uneroded but relatively low in content of plant nutrients. Management requirements range widely among the soils because of the many different kinds of soils included in the class. The soils of this class are relatively similar in their suitability for agriculture, but the benefits of their suitability depend on management practices, which may vary greatly from soil to soil.

The Second-class soils have an aggregate area of 187,785 acres, or 51.7 percent of the county.

THIRD-CLASS SOILS

In the Third class are soils considered fair for the agriculture practiced in the county. They are poor to fair for crops that require tillage and fair to very good for permanent pasture. Each soil is characterized by workability, conservability, or productivity, one of which, or a combination of which, is sufficiently poor to definitely limit suitability of the soil for crops requiring tillage. No condition is so limiting, however, that the soil can be considered poorly suited to tilled crops. The soils are better suited to crops requiring tillage than are those of the Fourth class, but they are less well suited to such crops than Second-class soils.

One or more unfavorable conditions limit suitability of the soils for tilled crops. Among these are low content of plant nutrients; low content of organic matter; low water-holding capacity; undesirable texture, structure, or consistence; strong slope; stoniness; or inadequate natural drainage. Management requirements range widely because of the diversity of characteristics among the soils of this group.

The Third-class soils have an aggregate area of 48,383 acres, or 13.3 percent of the county.

FOURTH-CLASS SOILS

Fourth-class soils are poorly suited to crops that require tillage and are poor to very good for permanent pasture. Mainly because of the limited number of uses to which they are well suited, they are the poor agricultural soils of the county. Nonetheless, some of them may be most important on farms where soils well suited to permanent pasture are in great demand. On farms where acreages of soils better suited to crops are too small to satisfy the needs of the farm unit, a considerable acreage of Fourth-class soils is used for crops. In this county, the intensity of management practiced on the areas of Fourth-class soils used for crops is generally inadequate for good soil conservation. Management requirements vary widely among the Fourth-class soils, as they do for soils of the Third class. The variation is evident both in use for crops requiring tillage and in use for pasture.

Each soil of this group is so difficult to work or conserve, or both, that the management necessary to its successful use for crops requiring tillage is not usually feasible. On some farms, however, soils well suited to crops requiring tillage may be so limited that it is good farm practice to employ the intense soil management necessary to produce successfully tilled crops on Fourth-class soils.

The Fourth-class soils have an aggregate area of 77,613 acres, or 21.4 percent of the county.

FIFTH-CLASS SOILS

Fifth-class soils are very poorly suited to the agriculture of the county. For crops requiring tillage, they are very poor and for permanent pasture, poor to very poor. Under present conditions they are apparently best suited to forest or similar use. Conditions in the locality or on a particular farm unit may require the use of some of the soils of this class for pasture or crops, in spite of the fact that they are poorly suited to such use. Some farmers who have applied special systems of management have successfully used a few soils, as Dickson cherty silty clay loam, severely eroded rolling phase, for crops.

Each soil of this class is so difficult to work or conserve or so low in productivity that it is generally not feasible to apply the intensity of management necessary to assure its successful use for tilled crops. All are sufficiently low in content of plant nutrients or to such an extent deficient in favorable moisture relations, or both, that common pasture plants produce little feed.

The Fifth-class soils have an aggregate area of 16,130 acres, or 4.4 percent of the county.

SOIL USE AND MANAGEMENT

The use and management of the soils of the county are discussed according to management groups, soils of relatively similar management requirements being placed in one group. The management of each soil in each group is considered in respect to the following two broad uses: (1) Crops that require tillage and (2) permanent pasture. Among the management practices considered are those that aid in maintaining an adequate and uniform supply of moisture for plant growth and those that adjust other soil conditions so as to allow plants to make efficient use of moisture.

Because management requirements vary among crops grown on the same soil, the discussions are in terms of crop rotations well suited to the soils. The management requirements for each crop are dependent, therefore, not only on the characteristics of the soil and of the crop, but also on the management already practiced for other crops in the rotation.

Little experimental data are available on which to base recommendations for the use or management of many soils of the county. The best use and management of a soil on a particular farm involves consideration of many factors besides the soils on that farm. General recommendations for use and management of a soil will not always fit the needs of a given farm, and consequently this discussion is limited primarily to a consideration of the deficiencies of the soils and possible ways of correcting them.

The management practices suggested are those considered good under conditions prevailing on many farms in the county and are to be used in defining management in columns C of the table on expected yields. The practices given represent one or more particular kinds of management considered to be good, but many different combinations of management practices, applied in various intensities, can be used in most instances to attain the same objective of production.

The proper choice of management depends upon the farm as an operating unit. For example, the nitrogen content of a soil can be maintained by use of legumes, manure, commercial fertilizer, or combinations of the three. The best method for maintaining nitrogen therefore depends on the farms as a business, as well as on soil conditions and the preference of the individual farmer.

SOILS GROUPED ACCORDING TO SIMILAR MANAGEMENT REQUIREMENTS

Each soil of the county probably has some individuality in regard to its management, but certain groups of soils have many similar management requirements. On the basis of this similarity they are grouped in this section for convenience in discussion and reference. Under each group are given the uses to which the soils are suited and the practices generally required for good soil management.

The practices making for good management do not depend entirely on the soil and the crop but also on the other soils and crops on the farm and on other circumstances peculiar to the farm. Use and management practices given for each of the groups are believed to be generally suited to the soils of the group, but on some farms their use may not be wholly applicable.

GROUP 1

The three soils of group 1 are the level and undulating phases of Abernathy silt loam and Huntington silt loam. They are highly productive, easily worked, excellent in moisture relations, and not appreciably subject to accelerated erosion. They have a limited range of crops to which they are suited, but they will endure continuous intensive cropping better than other soils of the county. These soils are nearly level to undulating and occur on first bottoms, along the bases of slopes, and in upland depressions. They receive depositions of alluvial material periodically and are relatively high in content of organic matter and plant nutrients because these constituents are deposited on the surface either by floods or by inwash from the higher surrounding areas.

In physical condition the soils are very good for the maintenance of good tilth and for the normal retention and movement of water in the upper parts of the profile. External drainage is slow on Abernathy silt loam, level phase, and Huntington silt loam, and some areas are subject to inundation in spring and during periods of high rainfall. External drainage is relatively rapid on Abernathy silt loam, undulating phase, and this soil is not usually flooded. Internal drainage is fairly rapid in all these soils. The flooded soils are not so well suited to perennial and winter-annual crops as those of the well-drained uplands.

Soils of this group are exceptionally well suited to corn, and they produce good yields of alfalfa, red clover, lespedeza, and similar hay crops. The hay tends to become rank, however, and it may be a little difficult to cure in wet seasons. These soils are excellent for pasture, and they often occur close to permanent streams that can be used as a source of water for animals. They are not so well suited to small grains because the grain tends to lodge and become diseased.

Abernathy silt loam, undulating phase, is the first of the group to become suitable for tillage in spring, and it has the widest range of suitability. A few areas of Abernathy silt loam, level phase, would be benefited if drainage were established to remove excess surface water more quickly after heavy rains. Some areas of Huntington silt loam could be greatly improved by dikes or other means of controlling the floodwaters.

The soils can be used for intertilled crops each year. They will maintain a high level of productivity for considerable time without amendments, but precautions taken to maintain the content of plant nutrients and organic matter are generally rewarded by increased production. Corn followed in fall by crimson clover, hairy vetch, or a similar cover crop, is one crop system favorable for these soils. The cover crop is plowed under as a green manure in spring. Another good system is corn interplanted with crotalaria as a manure crop. Production can be maintained at a relatively high level without amendments under either of these systems of cropping; light or moderate applications of potassium and phosphorus to the cover crop are usually reflected in an appreciably increased yield of corn.

A cropping system also considered good for these soils is corn followed by 1 or 2 years of lespedeza or red clover and grass hay. In this, however, some spots produce hay so rank that it may bed down and be somewhat difficult to harvest and cure. Moderate to light applications of potassium and phosphorus at the time the hay is seeded improve yields of both the hay and the corn. Alfalfa can be grown in place of the suggested clover or lespedeza. Moderate applications of lime at time of seeding improve alfalfa on most areas of the Abernathy soils. Areas subject to floodwaters that stand long on the surface are not well suited to alfalfa.

Late-planted vegetables do well on soils of this group. When they are properly managed in other respects, vegetable crops produce well if they are followed each year by a leguminous winter cover crop that

is turned under in spring. Experience in other areas indicates that vegetable crops respond well to heavy applications of commercial fertilizer.

No special practices of tillage or cropping are necessary to control too rapid runoff. On the Huntington soil there is some danger of scouring during floods, and where the surrounding soil is poorly managed, excessive erosion brings down deposits of less productive subsoil material that cover the Abernathy. To help prevent scouring on the Huntington, spring rather than fall plowing is advisable.

Permanent pastures are good to excellent without special management practices. In most instances phosphorus is the principal plant nutrient that limits productivity. Pastures should be grazed or clipped closely periodically to encourage the growth of leguminous pasture plants at the expense of the grasses. On these soils, heavy grazing is generally less harmful to pastures than undergrazing. Pastures hold up well, even in dry seasons.

GROUP 2

In group 2 are the undulating and level phases of Etowah and Cumberland silt loams, the level and slightly eroded undulating phases of Dewey and Decatur silt loams, and the undulating phase of Cumberland fine sandy loam. These are relatively fertile, nearly level or undulating, medium-textured, uneroded to moderately eroded soils of the uplands and terraces. Though relatively fertile, they are less well supplied with plant nutrients than the soils of group 1. All are medium to strongly acid. They are not subject to rapid loss of plant nutrients by leaching and are only moderately affected by accelerated erosion. Physical conditions for normal retention and movement of water are good. The soils are well aerated, and they have surface layers in which good tilth is relatively easy to obtain and maintain.

The soils are well suited to most crops commonly grown in the county. Provided other management requirements are met, they can be conserved in a rotation that includes a clean-cultivated crop once in 2 or 3 years. A suitable rotation is cotton or corn, 1 year; small grain seeded to a leguminous hay crop, 1 year; and hay or pasture, 1 or more years. Alfalfa or red clover can be grown for hay with good results, but red clover is the better hay crop if a short rotation is desired. If hay is wanted for 3 or 4 years, alfalfa would probably be better. Other intertilled crops can be substituted for cotton or corn. The rotation can be shortened safely to allow growing an intertilled crop every other year, provided a winter legume green-manure crop is grown in the intervening years.

Phosphorus is probably the nutrient most frequently limiting plant growth, but maintenance of nitrogen content requires constant attention. In the rotations suggested, leguminous crops can be depended on for maintenance of most of the nitrogen, but if need for nitrogen becomes apparent, it is advisable to plow under a leguminous crop at some point in the rotation. Such practice is especially desirable on the more eroded phases of the group. If corn is grown every year on the most level phases, crotalaria can be used in the corn as a volunteer-reseeding crop. It is beneficial in maintaining nitrogen and organic content.

Good results are obtained when most of the fertilizer is applied to the legume at seeding. For red clover, the equivalent of 1 ton of ground limestone, 300 pounds of 20-percent superphosphate, and 25 pounds of potash an acre is satisfactory in most places, and for alfalfa, 2 tons of ground limestone, 500 pounds of 20-percent superphosphate, and 25 to 50 pounds of potash an acre. The quantity needed of each will vary with the past management of the soil. Although potash is necessary in some areas, it can be left out of the fertilizer mixture if manure is used. Boron is the limiting element in some areas, but a light application of borax will correct the deficiency if the soil has not been overlimed. Insufficiency of boron is generally apparent on land in alfalfa.

Vegetables do well on these soils, but they require heavy applications of phosphorus, potash, and nitrogen. Barnyard manure is highly beneficial for these and most other crops and is especially useful on the small eroded spots in some fields. It can be used to replace part of the potash and nitrogen in fertilizer mixtures.

The soils can be tilled through a relatively wide range of moisture conditions without destruction of good tilth. Tillage is best on the contour, where feasible, and the soils should not be left bare of vegetation for extended periods. Terracing and other engineering methods of controlling runoff are generally not necessary if other management requirements are met.

Soils of this group produce good pasture, but they usually require lime and phosphorus. Heavy applications at long intervals are more desirable on soils of this group than are light applications at short intervals. If the soil has not been limed or fertilized for a long time, it is especially important that the initial application be heavy. The lime and phosphorus promote the growth of legumes that fix nitrogen. Except in fall, relatively close grazing should be practiced because it favors the nitrogen-fixing legumes at the expense of grass; periodic clipping of uneaten herbage has a similar effect. Too close grazing of legumes early in fall, however, increases danger of winterkilling. Droppings should be scattered to provide uniform distribution of their potash and nitrogen content and to prevent cattle from leaving the herbage uneaten around them.

GROUP 3

In management group 3 are the eroded relatively fertile undulating silty clay loam soils of the uplands and terraces. These are the eroded undulating phases of Dewey, Decatur, Cumberland, and Etowah silty clay loam; the eroded undulating phase of Cumberland clay loam; and the eroded undulating and undulating phases of Cookeville silt loam. At least 25 percent of the easily tilled surface layer has been removed over a large part of these soils, but in some places a fairly easily tilled surface soil still remains. Being less well supplied with plant nutrients than are the soils of groups 1 or 2, these are only moderately fertile soils. All are medium to strongly acid. Loss of plant nutrients by leaching is rapid, although the soils are only moderately subject to accelerated erosion and a little more subject to sheet erosion. Physical conditions for normal retention and movement of moisture are fair, and aeration and drainage are good in each of these soils.

Soils of this group are fairly well suited to nearly all the crops ordinarily grown in the county. A rotation that includes a clean-tilled crop once in 3 or 4 years is adequate to conserve them if other management requirements are met. A suitable rotation includes cotton, 1 year; small grain seeded to a leguminous hay crop, 1 year; and hay or pasture, 2 years or more. Alfalfa, red clover, lespedeza, or sericea lespedeza can be used for hay with good results. When a short rotation is desired, lespedeza or red clover is better, but alfalfa or sericea lespedeza is preferable when hay is wanted for 3 or 4 years. Corn, peanuts, soybeans, or other intertilled crops might be substituted for cotton. Where a winter legume is grown as a green-manure crop, the rotation can be shortened a little.

Phosphorus and nitrogen are the nutrients most generally limiting, but some additional potassium is also needed. In the rotations suggested, the leguminous crops can be depended on for maintenance of a large part of the nitrogen, especially after the nitrogen content of the soil has been built up to a fairly high level. Turning under a few leguminous crops is an aid in building the nitrogen and organic content to the desired level.

A large part of the fertilizer should be applied at the time of seeding legumes. A suggested mixture for legumes is 1 ton of ground limestone, 300 pounds of 20-percent superphosphate, and 25 to 30 pounds of potash an acre. For alfalfa, 3 tons of ground limestone, 500 pounds of 20-percent superphosphate, and 30 to 50 pounds of potash are suitable. The quantity of each fertilizer will naturally vary with the past management of the soil. On certain areas it is not necessary to apply potash, and where manure is used liberally, potash can be omitted from the fertilizer mixture entirely. Boron is limiting to plant growth in some areas; its lack is apparent on land in alfalfa. The deficiency can be corrected by a light application of borox, unless the soil has received an excess of lime.

Vegetables do fairly well but require heavy applications of phosphorus, nitrogen, and potash. Manure, both in the form of manure crops and barnyard litter, is very beneficial to most crops, especially on the eroded spots. Barnyard manure can replace part of the potash and nitrogen in fertilizer mixtures.

As soils of this group become more eroded, the range of moisture conditions favorable for tillage is increasingly limited. For that reason, an effort should be made to keep a vegetative cover on the ground as much as possible, and contour tillage is desirable where feasible. If other management requirements are met, terracing or other engineering methods to control runoff are usually not necessary.

These soils can be made to produce good pasture, but lime, potash, and phosphorus are generally required. After a good sod is established, it is not so necessary to apply potash. Results are better if heavy applications of fertilizer are made at long intervals rather than lighter applications at short intervals. It is especially important that the first application be heavy if the soil has not been limed or fertilized for a long time.

The liming and fertilization just described are intended to aid the growth of legumes, which will in turn fix nitrogen in the soil. Close grazing and clipping of ungrazed spots aid in promoting growth of legumes at the expense of the grass. The scattering of droppings helps to assure a uniform distribution of potash and nitrogen and prevents the cattle from leaving the herbage uneaten around the droppings. Clipping weeds just before their seed matures aids in keeping a purer stand of more desirable pasture plants.

GROUP 4

The soils of group 4 differ from those of group 3 principally in having steeper slopes. Gradients generally range between 5 and 12 percent. The eroded rolling phases of Dewey, Decatur, and Cumberland silty clay loams; of Cumberland gravelly silty clay loam; and of Cookeville silt loam comprise this group. The soils are moderately eroded but relatively fertile and have good moisture relations. Good tilth is relatively easy to obtain and maintain, but slightly more attention to tillage is necessary than is required on the soils of group 3. Runoff is moderately rapid, and the principal difference in management requirements between these soils and those of group 3 are in methods for runoff control.

Rotations similar to those suggested for group 3 are well suited to these soils, provided other management requirements are met. A 4- or 5-year rotation including cotton or corn, small grain, clover and grass, and grass and clover for hay or rotated pasture is suitable. The longer rotation suggested for the soils of group 2 is also satisfactory. In this, cotton or corn is followed by small grain, and then alfalfa is grown for 2 to 4 years. Intertilled crops other than cotton or corn can be used.

The fertilization and liming practices suggested for the soils of group 3 are suitable, although generally these soils are slightly more eroded than those of group 3 and the application of manure to eroded spots is highly beneficial. Because of their greater susceptibility to erosion, tillage should be on the contour and a vegetative cover should be present. The soils should not be left entirely bare during winter, especially if the ground is freshly plowed. Terracing should be considered for the longer slopes if intertilled crops are used frequently. Runoff can generally be controlled without terraces on short slopes and where intertilled crops are grown less frequently. Strip cropping is practicable and desirable on some long and relatively uniform slopes. Good management of permanent pasture requires practices essentially similar to those for the soils of group 3, but the grazing provided by soils of group 4 can be expected to be somewhat less, owing to the heavier runoff and slightly greater erosion.

GROUP 5

Soils of group 5 contain somewhat more phosphatic materials than those of group 3, but in many other respects they are similar. The soils in this group are the eroded undulating and eroded rolling phases of Maury silt loam. Their susceptibility to accelerated erosion is greater than that of soils in any of the groups previously described, but otherwise they have a physical condition favorable to the maintenance of good tilth and to good absorption and retention of moisture. The relief is undulating to rolling (2 to about 12 percent). Soluble fertilizer materials are retained well. Erosion control is one of the chief problems on these soils.

Some farmers report no response from the use of phosphate on these soils, indicating that there is enough phosphate in them in many places.

Nitrogen and potash are the elements limiting good plant growth, and apparently the soils need additions of organic matter. Management practices should be those favorable to the maintenance or increase of nitrogen, potash, and organic matter. Practices that regulate the runoff of rainfall are included.

The crop rotations chosen provide a leguminous crop at moderately short intervals. The time between intertilled crops should be slightly longer than the minimum considered good for the soils of group 3. Rotations similar to those suggested for group 4 are well suited, provided other management requirements are met. A suitable 4-year rotation is cotton or corn; small grain, clover and grass; and clover for hay or rotated pasture. As many pasture crops as feasible should be included because bluegrass and clovers grow as well, if not better, on these soils than on most soils of the county.

Generally these soils are slightly more eroded than the soils of group 3, and the application of manure or other organic matter to eroded spots is highly desirable. Tillage is best on the contour, and the soils are left bare of vegetation as little of the time as practicable. They should not be left entirely bare through winter, especially if the ground is freshly plowed. Terracing is considered best for the longer slopes if intertilled crops are to be used frequently. Runoff can generally be controlled without terraces when intertilled crops are grown less frequently and on short slopes. On long and relatively uniform slopes, strip cropping is practicable in many places.

Good management practices for permanent pasture are essentially similar to those for soils of group 3. Provided equally good management practices are used, grazing should be equal to or better than that on soils of group 3. Some burley tobacco has been grown in the rotations used on these soils and good yields obtained. Tobacco should be grown only at wide intervals.

GROUP 6

The soils of group 6—the undulating, level, and eroded undulating phases of Dickson silt loam—are relatively uneroded, moderately low in fertility, medium textured, and, except for the siltpan, well drained. They occupy nearly level or undulating uplands and differ from the soils of group 4 principally in having less slope and in being derived from cherty instead of high-grade limestone. Slopes range from 0 to 5 percent.

Nitrogen, phosphorus, or potash may be limiting to good plant growth. The soils present a moderate but not serious problem in the control of runoff. These soils are generally less susceptible to erosion than others of similar slopes that have developed from limestone material. Nonetheless, their erodibility is sufficient to justify close attention to runoff control.

Good management practices are concerned with the maintenance or increase of the content of nitrogen, phosphorus, potash, and organic matter and the regulation of the rate of runoff. Crops and rotations are chosen so as to provide a leguminous crop at moderately short intervals. The time between intertilled crops should be slightly longer than the minimum considered good for the soils of group 5. A rotation of cotton or corn, small grain, and lespedeza and grass for 2 years is satisfactory. In making substitutions in this rotation, sericea lespedeza, red clover, or a mixture of red clover and grass can be used. The red clover requires heavier fertilization and liming than the lespedeza. Vegetables do only fairly well, but potatoes can be substituted for cotton or corn in the rotation. In general, leguminous sod-forming crops are used 2 or 3 years in the rotation.

Fertilization of the rotations suggested is similar to that described for the soils of group 3. If the rotation used is longer, slightly heavier applications of lime and phosphorus are advisable for the leguminous crop or light applications for another crop in the rotation.

Vegetables generally respond well to heavy applications of nitrogen, phosphorus, and potash. These applications, supplemented by lime and by additional phosphorus for the leguminous crop, will generally have sufficient residual effect to supply the needs of other crops in a 4- or 5-year rotation. Manure produces favorable results in most commonly grown crops.

Tillage of these soils can be performed throughout a relatively wide range of moisture conditions. It should be done on the contour as often as good farm management will permit. Terracing is generally not necessary, but if intertilled crops are grown frequently in the rotation, it can be used effectively on the longer slopes of some of these soils to aid in the control of runoff. Strip cropping is desirable in some places.

An effort should be made to keep soils of this group in some kind of cover as continuously as possible, and winter legumes should be grown in the rotation if the soil would otherwise be bare in winter. The winter legume can be turned under as a green-manure crop in spring, and therefore it is useful not only as a cover to control runoff but also in maintaining or increasing the nitrogen and organic-matter content of the soil.

Good pasture management is similar to that suggested for the soils of group 3. The additional problem of controlling runoff will be largely solved if practices are followed that aid in the establishment and maintenance of a good pasture sward. Contour furrowing aids in the conservation of water for plant growth.

GROUP 7

The soils of group 7 are differentiated from those of group 3 mainly by their intermediate instead of high level of fertility. These soils are the undulating and eroded undulating phases of Baxter and Dickson cherty silt loams. They are undulating or gently sloping medium-textured soils of the uplands, having physical conditions favorable to the maintenance of good tilth and good absorption of water. Moisture movement is impeded slightly by the siltpan in the Dickson, but otherwise the soils are well but not excessively drained. Though the soils have slopes similar to those of group 3, they are generally less susceptible to accelerated erosion and the water-control problem is more a matter of conservation of moisture than of controlling erosion.

In content of organic matter and most plant nutrients, soils of this group are lower than those of groups 2 or 3, nitrogen, phosphorus, and potash all being relatively limited for plant growth. Through leaching, soluble fertilizer materials are lost somewhat more rapidly than they are from the soils of group 2 or 3. Moderate quantities of phosphorus and potash, applied at relatively short intervals, are included in

fertilization. It is advisable to fertilize the small grain and lespedeza or the small grain and clover with moderate to light applications of potash and, in addition, supply some potash to the cotton or corn crop. Phosphorus and lime are probably best applied just before the leguminous crop.

So far as the operating limitation of the individual farms will permit, crops and rotations should be planned to increase fertility. The rotation should include leguminous crops frequently, and as much of the vegetation as feasible should be returned to the soil directly, or indirectly, as manure. The quantity returned will vary, of course, depending on the requirements of practical farm management.

A 2-year rotation of cotton or corn followed by small grain and lespedeza is satisfactory. A longer rotation of cotton or corn, small grain, and red clover and grasses would also be satisfactory, but a considerably heavier application of fertilizer and lime would be required for the red clover than for the lespedeza used in the shorter rotation first suggested. Alfalfa has not proved a highly desirable crop.

In a 3- or 4-year rotation the requirements of most of the crops included will be satisfied by applying the equivalent of 300 pounds of 20-percent superphosphate and 1½ to 3 tons of ground limestone per acre just before the legume is planted. Probably 100 pounds of potash an acre, divided between the hay crop and corn or cotton crop, is adequate. A quantity less than that may be sufficient in many places; the requirement will vary with the past management of the soils. Light applications of soluble fertilizer at frequent intervals are more desirable than heavy applications at long intervals.

These soils can be tilled over a moderate range of moisture conditions, and special practices of tillage are generally not necessary for the control of runoff. Cultivation on the contour is advised where feasible, and the soil should not be left bare during winter. Terracing and strip cropping are usually unnecessary if other desirable management practices are employed.

Pastures are generally poor unless they are well managed. Moderate quantities of lime should be applied at relatively short intervals after an initial heavy application has been made. Phosphorus should be supplied in relatively large quantities. An application of potash may aid in the establishment of a good pasture; once established the plants are usually able to derive sufficient potash from the scattered droppings. Pastures are harmed more by very close grazing than those on soils of groups 2 or 3, but undergrazing is equally harmful. Uneaten herbage should be clipped, and droppings should be scattered.

GROUP 8

Soils of group 8—the eroded hilly and hilly phases of Dellrose cherty silt loam—differ from those of group 7 in occupying steeper slopes (12 to 30 percent) and in having a higher content of phosphatic materials. They are well drained and receive a good supply of seepage water that tends to prevent their becoming droughty in dry seasons. The seepage water probably brings in the added phosphate from adjoining formations. The soils are cherty in most places, and, in a few spots, very cherty. Erosion is less severe than that normally expected on soils of similar slopes.

Because these soils are rather high in plant nutrients and not so readily eroded as some soils on similar slopes, they can be used more

safely for clean-tilled crops. A rotation permitting the use of a clean-tilled crop every 3 or 4 years is considered fairly satisfactory. Reasonably well suited is a rotation similar to that suggested for soils of group 3, but wider intervals between clean-tilled crops is desirable. Corn is grown more frequently than cotton. Because of the steepness and chertiness, it is more desirable to plant soils of this group in pasture rather than hay. Determination of this point will depend on the relative desirability of the two crops in the method of farming being used.

Potassium and nitrogen are the nutrients that generally limit productivity of these soils, but some phosphate may be needed on certain areas. When the nitrogen content has been built up in the soils, the leguminous crops in the rotation can be depended on to maintain it fairly well. The turning under of a few leguminous crops would aid in building the nitrogen and organic content to a relatively high level. In favorable positions, the phosphorus content is maintained by seepage water coming in from adjoining formations high in that nutrient. Fertilizer should be added at about the time and in approximately the same quantities as suggested for group 3, but the quantity of phosphate can be reduced somewhat, especially on areas where its addition produces little response.

GROUP 9

The soils of group 9 are well-drained or moderately well-drained soils of first bottoms, low terraces, and depressions. These seven soils are the level phase of Humphreys silt loam, Capshaw loam, Wolftever silt loam, the undulating and level phases of Greendale silt loam, and Abernathy and Bruno fine sandy loams. They are not subject to appreciable accelerated erosion, except by scouring during floods, but the Greendale, Abernathy, and Bruno receive depositions periodically and may at times receive heavy deposits of materials that are lower in fertility. All have physical conditions highly desirable for the maintenance of good tilth.

The management problems presented by the soils of group 9 differ from those of group 1, principally because of the greater difficulty in maintaining the content of plant nutrients at a high level. In comparison with that group, all are moderately low in nitrogen, phosphorus, and potash, and all except the Bruno are relatively low in lime.

Most of these soils are at least moderately well suited physically to vegetables, corn, and hay crops. They are generally not so well suited to perennials or winter annuals as they are to corn or hay, but small grains are moderately productive under good management. Management practices for first consideration are those that aid in maintaining organic matter and plant nutrients at levels adequate for good production. Intertilled crops, as corn, vegetables, and, to some extent, cotton, can be grown successfully year after year on most of these soils if the necessary management requirements are met. Crimson clover, hairy vetch, or a similar winter-legume cover crop should usually be grown after each intertilled crop to aid in the maintenance of organic matter and nitrogen.

The soils are acid and, for good results in a cropping system such as that mentioned, moderate applications of lime should be made at relatively short intervals. In other areas, vegetable crops have given

good results when a heavy application of a complete fertilizer carrying a relatively high proportion of nitrogen and potash was used. Most of the nitrogen and organic matter necessary can be obtained from the cover crop if it is turned under in spring as a green manure. It is desirable to apply lime under the cover crop and phosphorus and potash under the vegetable crop, and then depend on the residual effects of each for the crop to follow. Application of manure is especially beneficial. Where manure is used, the quantity of nitrogen and potash can be reduced in the commercial fertilizer applied.

A frequently used rotation of common field crops, and one apparently well suited, is corn followed by small grain and lespedeza. The grain is harvested in spring and the lespedeza the following fall. In this rotation, lespedeza can be replaced by red clover and timothy or orchard grass. A moderate application of lime under the seeding of small grain and lespedeza benefits all the crops in the rotation, and moderate quantities of potassium and phosphorus, applied once in the rotation, should prove beneficial. Manure is highly beneficial and can be used to replace part of the potash in commercial fertilizer. Frequent moderate applications of fertilizer are more desirable than heavy ones at long intervals. Liming may not be so necessary on Bruno fine sandy loam. Alfalfa can be used in a longer rotation on the well-drained soils of this group, but it requires heavier applications of lime and potassium than do the other hay crops suggested. Sericea lespedeza is another hay crop that offers some promise in a long rotation.

Pastures on these soils are ordinarily covered by relatively undesirable plants unless they have been adequately fertilized. Moderate applications of lime and phosphorus every 3 or 4 years are desirable. Scattered droppings supply adequate quantities of potassium, but if a deficiency develops, it becomes necessary to supply the potassium from commercial sources for best results. Very close grazing is more harmful on these soils than on those of group 1, but undergrazing should be avoided. Clipping pastures aids in controlling pasture weeds and encourages the growth of white clover.

No special practices of tillage or cropping are necessary for the control of runoff, but the soils of the first bottoms may scour during floods. If an early cover crop is not grown, the soils should be plowed in spring instead of fall. Most of these soils can be tilled throughout a relatively wide range of moisture conditions, but special precautions should be taken to prevent puddling or clodding.

GROUP 10

The soils of group 10—Egam silty clay loam and Hollywood silty clay, level phase—are slightly heavier in texture than those of group 1, and are correspondingly more difficult to keep in good condition. All are relatively high in plant nutrients and not subject to appreciable accelerated erosion, but they have restricted internal drainage. Though they are fair for the common field crops, their physical suitability is not so good as that of soils in group 1. They are better suited to corn and hay than they are to most other crops commonly grown in the area. They are relatively poorly suited to vegetable crops and alfalfa.

The rotations of commonly grown field crops suggested for soils of group 1 are well suited to this one. Lime is usually not needed for the common crops, but it may benefit clover in some areas. A slight or moderate response to phosphorus applications can be expected from most crops. Potash is limiting in some areas, especially in the Hollywood soil.

No special practices are necessary to control runoff, but because of the danger of scouring, areas subject to flooding are not to be plowed in fall unless an early winter cover crop is planted. To prevent destruction of good tilth, the soils should not be tilled when too wet or dry. Greater care is necessary to increase and maintain a high organic-matter content on these soils than is needed for group 1. Permanent pasture is well suited and good management practices are similar to those described for group 1.

GROUP 11

In group 11 are Ooltewah, Lindside, and Ennis silt loams. The management problems differ from those of soils in group 1 chiefly in drainage and in the greater difficulty with which plant nutrients are maintained at a high level. Surface drainage is slow because the land is very level and low, and internal drainage is somewhat retarded because of low position. Except in dry seasons, imperfect drainage necessitates late plowing and planting in spring. All the soils are fairly high in plant nutrients, and they are not subject to appreciable accelerated erosion.

The soils are better suited to corn and hay than to most crops commonly grown in the county. They are relatively poorly suited to cotton, vegetables, and alfalfa, but, like soils of group 1, are excellent for pasture. In many instances they are near permanent streams or in such a low position that water for livestock can be obtained at relatively low cost from shallow wells. Winter crops, as small grain and vetch, are uncertain because they winterkill or are harmed by excessive moisture on the ground.

Crop rotations considered good are (1) corn for 1 year, followed by an annual hay crop or (2) corn grown each year, with an interplanting of crotalaria or another manure crop. Soybeans tend to maintain or even increase the organic content if they are interplanted with corn and plowed under as a manure crop. Lime is usually not needed for ordinary crops, but liberal applications prove beneficial for the best development of pasture. Most crops can be expected to respond to fairly liberal applications of phosphate.

If it is practicable to secure proper outlets, tile drainage or open ditches might prove helpful on some of these soils, especially on the Lindside and on lower areas of the Ooltewah. Drainage is especially needed to remove excessive surface water and to aid in drying the soil early in spring.

GROUP 12

Soils of group 12 differ from those of group 7 principally in being sloping or rolling instead of gently sloping or undulating. This group is composed of the eroded rolling and rolling phases of Baxter and Dickson cherty silt loams and the eroded rolling phases of Dickson silt loam and Dewey cherty silty clay loam. They are moderately

eroded, well-drained, medium-textured, moderately fertile upland soils on slopes of 5 to 12 percent.

To the extent that good farm management will permit, practices should concern the maintenance or increase of the content of nitrogen, phosphorus, and organic matter and the regulation of the rate of runoff. The soils present a moderate to serious problem in the control of runoff. Their susceptibility to erosion is generally less than that of soils on similar slopes developed from high-grade limestone material, but erosion is sufficient to justify close attention to runoff control measures. Certain areas might be improved by removal of the larger chert fragments, especially if the land is to be used for hay.

The choice and rotation of crops should be such that a leguminous crop is included at moderately short intervals. The time between intertilled crops is slightly longer than the minimum considered good for the soils of group 7. Considered satisfactory is a rotation as follows: Cotton or corn, 1 year; small grain, then lespedeza and grass, 2 years. Sericea lespedeza or red clover can be used instead of red clover and grass, but both of these require heavier fertilization and liming than the lespedeza. Vegetable crops can be grown in place of cotton or corn in such a rotation. In general, a leguminous sod-forming crop can be used 2 or 3 years in the rotation. The period of leguminous sod may be shortened if a winter legume is turned under as green manure before the intertilled crop.

The rotations suggested are to be fertilized in about the same way as those for soils of group 7. If the rotation used is longer than those suggested for the soils of that group, somewhat heavier applications of lime and phosphorus are advisable under the leguminous crop, or light applications under another crop in the rotation. If vegetables are grown in the rotation, heavy applications of fertilizer supplemented by lime generally bring a good response. Probably additional phosphorus should be added for the leguminous crop. The fertilizer applied to the legumes and vegetables has sufficient residual effect to meet the needs of other crops in a 4- or 5-year rotation.

Little or no alfalfa is grown on these soils, but heavy applications of lime, phosphorus, and probably potash are required where it is sown. Sericea lespedeza has shown promising growth. Manure generally produces very favorable results in most of the common crops.

Tillage should be on the contour to as great an extent as good farm management will permit. Terracing is generally not necessary for the control of runoff if the requirements of good rotation, good fertilization, and proper tillage are met. Where intertilled crops are grown frequently in the rotation, terracing is an effective means of runoff control on the longer slopes of some soils. Strip cropping is desirable in some places.

The soils can be tilled throughout a relatively wide range of moisture conditions. They should not be left without vegetative cover for extended periods. Winter legumes are grown in the rotation when the soil would otherwise be bare over winter. The legume cover serves two purposes—it provides a cover to control runoff and, when turned under as a green-manure crop in spring, it aids in maintaining the content of nitrogen and organic matter.

Good pasture management is similar to that suggested for the soils of group 7. The additional problem in control of runoff presented by these soils can be solved largely by practices that aid in the establishment and maintenance of a good pasture sward. If done carefully, contour furrowing aids in the conservation of water for plant growth. Removal of larger chert fragments is important to the best development of a sod, and it makes possible proper clipping of the pasture.

GROUP 13

The soils of group 13 differ from those of group 9 chiefly in the chert content. With the exception of the Capshaw, the soils in group 9 are cherty on the surface and often in the profile. The soils composing group 13 are the undulating phases of Greendale and Humphreys cherty silt loams; Ennis silt loam, shallow phase; and Ennis cherty silt loam. Ennis silt loam, shallow phase, is underlain by a thick layer of water-worn chert, and in a few spots the chert extends to the surface.

These colluvial and low-terrace soils are medium-textured and nearly level to undulating. They are well drained to imperfectly drained but flooded during periods of heavy rainfall. Except for the chert, they have physical conditions favorable to the absorption and retention of moisture. They are not susceptible to accelerated erosion except for scouring during flooding. Heavy floods sometimes leave heavy deposits of chert and soil.

These soils are not highly productive in their natural state, and they are only moderately productive under good management. They are lower in organic matter and most plant nutrients than those of group 9. The content of nitrogen, phosphorus, and potash is generally limiting to plant growth. Through leaching, soluble fertilizer is lost somewhat more rapidly than from those of group 9.

Dependent on the operating limitations of the individual farm, the choice and rotation of crops are planned to increase fertility. A rotation that keeps these soils in hay or pasture a large part of the time proves satisfactory because their chertiness interferes with tillage. Where the soils must be tilled, corn is most frequently grown, but some vegetables are planted on Ennis cherty silt loam.

The fertilizer treatments suggested for soils of group 9 are satisfactory for this group. Frequent applications of small quantities of fertilizer aid in preventing the leaching caused by floodwaters. Liberal use of lime and phosphate aids in establishing a growth a legumes in the pasture sod. No special practices of tillage or cropping are necessary for the control of too rapid runoff. The removal of large chert fragments aids considerably in tilling crops, harvesting hay, and developing a better pasture stand. Permanent pastures do fairly well, even without special management practices. To permit proper grazing or clipping, it is important to remove larger chert fragments and scatter the droppings.

GROUP 14

The soils of group 14—Sango, Taft, and Lawrence silt loams—present a somewhat difficult problem in management. Surface drainage is slow and the subsoil is imperfectly drained. In most places at 16 to 24 inches is a developed or partly developed claypan that prevents free movement of water. The soils remain wet until late in spring, and in dry fall seasons become very dry. They are medium-textured soils of the nearly level uplands and colluvial and low ter-

races. Much of the material making them up is underlain by cherty limestone or has been washed from soils underlain by cherty limestone. The soils are strongly acid throughout.

Soils of this group are probably best used for pasture, hay, corn, and soybeans. Some small grain can be produced, but generally the soils are not so well suited to perennials or winter annuals. Management practices that aid in maintaining organic matter and plant nutrients at levels adequate for good production should receive first consideration.

The following rotation is considered satisfactory: Corn interplanted with a manure crop of soybeans; small grain and lespedeza; and soybeans for seed and grass for hay or pasture, 2 or 3 years. A longer period of pasture or lespedeza hay can be substituted for the short rotation. Winter legumes make slow start on these soils and are winterkilled to some extent. Sericea lespedeza is a satisfactory perennial hay crop on areas where the claypan is fairly deep and the ground is not too wet in winter.

The content of nitrogen and organic matter is especially limiting to plant growth, and the supply of lime, phosphorus, and potash is also limiting. Moderate applications of lime for the combined seeding of small grain and lespedeza benefit the crops of the rotation, and moderate to heavy applications of potassium and phosphorus in the rotation are beneficial. Manure is highly beneficial, and it can replace part of the potash in the commercial fertilizer. Frequent moderate applications of fertilizer are more desirable on these soils than heavy applications at long intervals.

Pastures on these soils usually grow up to relatively undesirable plants unless they are adequately fertilized. A moderate application of lime and phosphorus every 3 or 4 years is desirable. If cattle droppings are properly scattered, they may supply sufficient potassium, but if a potassium deficiency develops, it can be supplied in the form of commercial fertilizer. Clipping pastures is important in controlling weeds and encouraging the growth of white clover.

These soils require no special tillage practices for the control of runoff. In some instances it is helpful to provide drainage for removal of excess water in rainy seasons. These soils can be tilled through a relatively wide range of moisture conditions, but special precautions should be taken to prevent puddling and clodding. As a rule, the soils cannot be tilled early in spring because they are late in drying out. Fall plowing can be done safely because the soils are not subject to appreciable accelerated erosion.

GROUP 15

Soils of group 15 are usually fairly steep, cherty, or severely eroded. These soils are Mimosa cherty silty clay loam, eroded rolling phase; the eroded hilly phases of Maury silt loam and Mimosa cherty silty clay loam; the severely eroded rolling and severely eroded hilly phases of Maury clay loam; and Mimosa cherty silt loam, hilly phase. With the exception of Mimosa cherty silty clay loam, eroded rolling phase, they are generally unsuited to clean-tilled crops. They are fairly high in phosphorus, and if properly managed can be made to produce good pasture. In some instances, Mimosa cherty silty clay loam, eroded rolling phase, produces fairly good crops, but its high chert content makes tillage difficult.

Applications of lime and potash are necessary to establish good permanent pasture. The lime and possibly a part of the potash should be applied at the time the land is being prepared for seeding. The pasture mixture should include both grass and legumes. One of the more satisfactory mixtures is made up of common white clover, lespedeza, Kentucky bluegrass, orchard grass, and Dallis grass. A vigorous sod should be kept on the ground at all times.

Contour furrows, ridges, or terraces are advantageous in controlling runoff on steeper slopes, especially on those where considerable erosion has already developed. Clipping undesirable herbage is worthwhile in maintaining a pasture vegetation of high quality. Where feasible, the removal of weeds is suggested, because they compete with desirable plants for moisture.

GROUP 16

The soils of group 16 have steeper slopes than those of group 5 and are generally more severely eroded. In comparison with soils of group 12, they are more severely eroded and in some instances steeper in slope. Control of runoff and the consequent problems of conserving water and soil materials are greater on these soils than on those of either group 5 or 12. The severely eroded rolling phases of Decatur, Cumberland, Dewey, and Cookeville silty clay loams; the severely eroded rolling phases of Dewey and Baxter cherty silty clay loams; the eroded hilly phase of Dewey silty clay loam; and the severely eroded hilly phases of Dewey-Decatur silty clay loams comprise this group.

Considerable subsoil material is incorporated with the plow layer in most places; the supply of available plant nutrients, especially nitrogen, is lower, and the maintenance of good tilth and an adequate supply of moisture are more difficult than on the soils of groups 5 or 11. Dewey silty clay loam, eroded hilly phase, and Dewey-Decatur silty clay loams, severely eroded hilly phases, occupy slopes of 12 to 30 percent; the other soils are on slopes of 5 to 12 percent.

Clean-cultivated crops should be grown on these soils as little of the time as a good system of farm management will permit. Close-growing crops, as small grain and hay, should occupy the soils most of the time. Providing other management requirements are met, a 5- to 6-year rotation of cotton or corn, small grain, and alfalfa can be used successfully. Another suggested rotation is the following: Cotton or corn; small grain; clover; orchard grass and timothy, 2 years. Cotton or corn can be omitted from this last rotation to good advantage. If the soils have been restored to productivity by management that builds up the organic-matter content of the surface layer and improves the ability of the soil to absorb water, a rotation like that for soils of group 5 can be used safely on all except the steeper phases. This rotation, however, is successful only if other management requirements are met.

These soils are generally lower in organic matter and most plant nutrients than those of groups 3 or 5. The restoration of severely eroded phases to productivity can be begun by growing a green manure crop the first year. This crop is plowed under before starting the rotations suggested. The rotation should be fertilized in such way that nitrogen is supplied until a leguminous crop is established. Manure is especially beneficial to most crops on these soils, and particularly good results have been obtained when it was used before the

seeding of alfalfa and similar legumes. Legume crops are difficult to establish the first time and in rotations probably should receive heavy applications of lime, phosphorus, and potassium until the soil fertility has been somewhat restored. Once this is accomplished, fertilization similar to or slightly heavier than that described for the soils of group 4 can be used successfully.

The soils cannot be tilled through so wide a range of moisture conditions as those of groups 5 and 7. Tillage should be on the contour, and strip cropping can be used to good advantage on the longer slopes. Hillside ditches and terraces may prove beneficial on some of the longer slopes of the severely eroded areas, but, as a rule, they can be avoided if other management requirements are met. The construction of ditches and terraces on the steeper phases is questionable because these soils probably should be kept in sod that will hold them together and prevent or greatly retard their erosion.

In many places these soils can be used to best advantage for pasture. To obtain good pasture heavy applications of lime and phosphorus are usually necessary, and in some places potash. Kudzu might be used the first few years for increasing the nitrogen and organic matter in the soil. Once pastures are established, management similar to that described for the soils of group 4 will be satisfactory in most places.

GROUP 17

In group 17 are the steeply rolling to hilly, moderately to severely eroded, moderately fertile soils of the uplands. These soils are the eroded hilly phases of Dewey cherty silty clay loam, of Baxter cherty silt loam, and of Bodine cherty silt loam; the hilly phases of Baxter and Bodine cherty silt loams; and the severely eroded hilly phases of Baxter and Mimosa cherty silty clay loams. Slopes range from 12 to 30 percent, and all the soils are subject to rapid runoff and rather serious erosion.

The soils of this group are poorly suited to crops requiring tillage. If those crops must be produced, they should be grown in a rotation that includes close-growing and sod-forming crops for long periods. Intertilled crops should be grown as little of the time as good farm management will permit. When they are grown, a rotation probably suitable is an intertilled crop, small grain, clover and grass hay, and pasture for 2 or 3 years.

Where growing of an intertilled crop is not required, small grain can be used as a nurse crop in the seedings necessary to reestablish hay or pasture. Limited experience indicates that a contour-furrow seeder, recently introduced in Tennessee, can be used to good advantage in seeding small grain in unplowed hay or pasture sod. Lespedeza or other legumes and grasses can be broadcast in the small grain in spring to reestablish hay or pasture.

A few of these soils will produce fair to good alfalfa if they are properly fertilized, but there would be some difficulty in harvesting hay because the soils are cherty and slopes are steep. Under certain conditions alfalfa is used as a grazing crop. Sericea lespedeza can be used to check erosion and add nitrogen and organic matter. Sericea lespedeza pasture might do well on severely eroded spots or those subject to severe erosion. The alfalfa should retain a sod for 4 or 5 years without reseeding; the lespedeza stand should last indefinitely.

The rotations suggested should receive heavy applications of lime and phosphorus. Both are best applied under the leguminous hay crops. Light to moderate applications of potash benefit some crops in the rotation. If alfalfa is grown, it should receive a heavier application of lime and phosphorus than that necessary for good production of red clover and grass. Manure is highly beneficial on severely eroded spots and improves all the soils for most crops.

Tillage should be on the contour, as for other soils on such steep slopes, and strip cropping is desirable where it can be practiced. Terracing is generally not feasible because the slopes are too steep. All the soils except severely eroded phases can be worked throughout a relatively wide range of moisture conditions without destruction of good tilth. They should not be bare of vegetation any longer than absolutely necessary, and winter legume cover crops should be grown where the soil would otherwise be left bare over winter.

The soils of this group are better suited to some kind of permanent pasture than they are to crops requiring tillage. After an initial heavy application, permanent pastures should receive moderate quantities of lime at relatively short intervals and rather large applications of phosphorus. Potash may aid in obtaining a good stand, particularly on the severely eroded soils, but once a good pasture sod is established, scattered droppings will probably provide sufficient potash for good production. An application of manure aids greatly in reestablishing a good sod on severely eroded areas. These soils need more care than those of group 12.

GROUP 18

In group 18 are the poorly drained soils of first bottoms, terraces, or colluvial lands. Two of the three represented, the Melvin and Robertsville silt loams, are relatively high in content of nutrients and organic matter and neutral to medium acid. Guthrie silt loam is strongly acid and relatively low in plant nutrients, organic matter, and lime. In most places there is no appreciable accelerated erosion, but fresh alluvium is deposited periodically. Unless they are drained, these soils are poorly suited to most crops requiring tillage. They are fair to good for corn and hay when they are artificially drained and properly limed and fertilized. For good corn production, the Guthrie soil needs considerable additional organic matter.

A rotation suggested for the drained soils is corn for 1 year, followed by red clover or alsike clover and grass for 2 years. Corn can be grown in successive years on the drained soils without appreciably lowering the productive capacity. A cutting of hay can be obtained the year it is planted if the soil is well managed. Alfalfa, small grains, and most vegetables are poorly suited.

Liming is not particularly necessary on the Melvin and Robertsville soils if they are planted to the crops to which they are suited. The Guthrie soil responds to rather heavy applications of lime. Phosphorus applied in moderate quantities to the hay crops in the rotation generally produces good results on both the hay and the corn crop that follows. Potash may be lacking in some areas. Nitrogen can generally be maintained by the use of legumes in the rotation if the soils are drained. If the soils are not drained, frequent crop failures are to be expected because of excessive moisture and flooding.

Soils of this group are well suited to permanent pasture. Good pasture management is obtained largely by improving drainage, applying moderate quantities of phosphorus every 3 or 4 years, grazing moderately close, scattering droppings, and mowing excess herbage. If the soils are not drained, water-tolerant plants dominate the pasture at the expense of more desirable legumes and grasses. Undergrazing favors the growth of undesirable pasture plants at the expense of such plants as bluegrass and white clover, and it is probably more harmful than exceptionally close grazing. Where the Guthrie soil is used for pasture, moderate applications of lime will be helpful.

Drainage is highly beneficial to most crops grown on these soils, but it is difficult to establish. The chief difficulty is lack of fall for drainage outlets. For pasture, the drainage necessary in most places is only that needed for the quick removal of excess surface water after rains. Open ditches are generally used for field crops, but tile drains can be used to advantage in some instances. Diversion ditches at the base of adjacent slopes are especially beneficial in some areas.

Good tilth is difficult to maintain if these soils are used for crops requiring tillage. They should be tilled at the proper moisture condition, and rotations and amendments should provide for the maintenance of a high content of organic matter in the plowed layer. In general, these soils are better suited physically to permanent pasture than to crops, but under careful management, including drainage, fair to good yields of corn and hay can be produced. At times, soybeans grown for seed produce unusually good crops.

GROUP 19

The soils of group 19 are the steep and eroded steep phases of Baxter cherty silt loam; Dickson cherty silty clay loam, severely eroded rolling phase; Limestone rockland; Rough gullied land (Decatur, Dewey, and Cumberland soil materials); and Made land. These soils are not well suited to crops or pasture and are best used for forest. Slopes are steep, fertility is low, and moisture relations are poor. The soils are difficult to work, low in productivity, and very subject to erosion. Where better soils are not available on the farm, limited areas may be used for pasture or very long rotations.

A suitable forest cover will establish itself in places if it is properly protected against fire and grazing, but sometimes planting will be necessary. Shortleaf or loblolly pines are among the species more suitable for the exposed or otherwise less favorable growing sites. On the better growing sites where moisture relations are more favorable for plant growth, black locust, yellow-poplar, and certain other deciduous trees are suitable for planting.

Most of the management practices employed in the production of forest can be grouped as follows: (1) Maintenance of a full stand of the species, (2) systematic cutting and weeding of trees, (3) harvesting mature trees in such manner that desirable species may succeed them, and (4) the control, so far as possible, of fires, browsing, trampling, and damage from use of harvesting machinery or from other causes.

The soils of this group cover a total area of approximately 22 square miles, and all but about 3 square miles of this is now in cut-over forest. The individual tracts are chiefly along the steep slopes adjacent to

TABLE 7.—*Expected average acre yields of the principal crops on Limestone County, Ala., soils*

[In columns B—yields under management practices followed by majority of farmers in county; in columns C—yields under management considered the best the majority of farmers could feasibly follow]

Soil	Cotton (lint)		Corn		Wheat		Oats		Lespedeza hay		Soybean hay		Cowpea hay		Alfalfa		Potatoes		Sweetpotatoes		Pasture (cow-acre-days)[1]		Workability[2]	Conservability[3]	Land class[4]
	B	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C			
	Lb.	Lb.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Bu.	Bu.	Bu.	Bu.					
Abernathy fine sandy loam	280	360	20	30	8	10	20	30	0.7	1.1	1.3	1.8	0.5	0.8	3.2	3.6	105	120	112	170	[5]90	110	Very good	Very good	Second.
Abernathy silt loam:																									
Level phase	500	600	50	55	13	15	25	30	1.4	1.5	2.0	2.2	.8	.9	3.2	3.6	128	135	120	180	[5]145	160	do	Excellent	First.
Undulating phase	500	600	43	53	15	20	30	38	1.5	1.6	2.2	2.8	1.0	1.1	3.6	4.0	135	150	135	200	[5]130	145	do	do	Do.
Baxter cherty silt loam:																									
Eroded hilly phase	100	160	10	15	(6)	(6)	10	15		.4		.6		.3	(6)	(6)	(6)	(6)	(6)	(6)		35	Poor	Very poor	Fourth.
Eroded rolling phase	260	320	20	30	8	10	20	30	.7	.9	1.5	1.8	.6	.8	(6)	1.4	53	75	45	100	30	60	Fair	Good	Third.
Eroded steep phase																							Very poor	Very poor	Fifth.
Eroded undulating phase	340	440	23	38	13	16	23	38	.8	1.1	1.8	2.1	.7	.9	1.8	2.4	98	120	112	170	55	85	Fair	Very good	Second.
Hilly phase[7]	140	200	15	40	(6)	8	15	20	.3	.5	.5	1.0	.2	.4	(6)	(6)	(6)	53	(6)	60	20	35	Poor	Poor	Fourth.
Rolling phase	400	500	25	38	13	16	25	40	.9	1.2	1.7	2.4	.7	.9	1.8	2.4	90	105	112	170	60	85	Fair	Very good	Second.
Steep phase[7]	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)				.6							20	80	20	40	Poor	Very poor	Fifth.
Undulating phase	400	520	25	38	11	15	25	40	.9	1.2	1.8	2.1	.8	.9	1.8	2.4	113	128	120	180	60	90	Good	Very good	Second.
Baxter cherty silty clay loam:																									
Severely eroded hilly phase	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	30	Very poor	Very poor	Fifth.
Severely eroded rolling phase	140	200	10	15	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	15	35	do	Poor	Fourth.
Bodine cherty silt loam:																									
Eroded hilly phase	80	160		13				13		.4		.6		.2							15	30	Poor	Very poor	Do.
Hilly phase[7]	140	300	13	18		8	13	18		.4	.5	1.0	.2	.4				60		60	20	35	do	do	Do.
Bruno fine sandy loam[8]	360	460	28	35	8	10	28	35	.9	1.2	1.7	2.0	.7	.8	2.4	3.0	105	120	112	170	[5]90	110	Excellent	Good	Second.
Capshaw loam	400	500	30	38	16	20	30	38	1.1	1.2	2.0	2.4	.8	.9	3.2	3.6	135	158	120	200	80	100	do	Very good	Do.
Cookeville silt loam:																									
Eroded rolling phase	240	300	20	30	8	10	20	30	.7	1.0	1.5	1.8	.6	.8	1.2	1.6	60	90	55	110	35	60	Good	Fair	Third.
Eroded undulating phase	400	480	23	30	11	15	25	38	.9	1.2	1.8	2.1	.8	.9	2.2	3.0	113	128	112	170	60	90	do	Good	Second.
Undulating phase	360	500	23	30	13	16	20	40	1.0	1.4	1.8	2.0	.8	.9	2.2	3.0	120	135	112	170	60	90	do	do	Do.
Cookeville silty clay loam, severely eroded rolling phase	140	200		15				15				.5										30	Poor	Poor	Fourth.
Cumberland clay loam, eroded undulating phase	400	500	25	38	13	16	25	40	1.0	1.4	1.8	2.2	.8	1.0	3.0	3.6	120	135	125	190	70	105	Good	Good	Second.
Cumberland fine sandy loam, undulating phase	500	600	33	40	20	24	28	35	1.4	1.6	2.2	2.6	.9	1.1	3.4	3.8	143	165	135	200	95	120	Excellent	Very good	First.
Cumberland gravelly silty clay loam, eroded rolling phase	240	320	23	35	8	10	23	35	.9	1.1	1.5	2.2	.6	.9	2.4	3.6	60	90	60	120	35	60	Fair	Fair	Third.
Cumberland silt loam:																									
Level phase	500	600	38	50	19	23	40	50	1.3	1.6	2.2	2.8	.9	1.1	3.8	4.4	135	150	135	200	100	120	Excellent	Excellent	First.
Undulating phase	500	600	35	45	21	25	40	50	1.4	1.6	2.2	2.8	.9	1.1	3.8	4.4	135	150	135	200	100	120	do	do	Do.
Cumberland silty clay loam:																									
Eroded rolling phase	300	440	23	35	8	10	23	35	.9	1.2	1.5	2.2	.5	.9	2.4	3.2	60	90	55	100	35	60	Good	Fair	Second.
Eroded undulating phase	400	500	28	40	14	18	28	40	1.0	1.4	1.8	2.4	.8	1.0	3.0	3.6	105	128	120	180	75	110	do	Good	Do.
Severely eroded rolling phase	240	320	10	15		10	10	15		.4		.9		.4					38	60	20	40	Poor	Fair	Fourth.
Decatur silt loam:																									
Level phase	500	600	35	43	19	23	33	45	1.3	1.6	2.1	2.6	.9	1.1	3.8	4.4	135	150	142	220	120	140	Very good	Excellent	First.
Slightly eroded undulating phase	480	560	30	40	16	20	30	45	1.2	1.5	2.0	2.5	.8	1.0	3.4	4.0	128	143	135	200	100	120	do	Very good	Do.
Decatur silty clay loam:																									
Eroded rolling phase	400	500	25	38	14	18	25	40	1.0	1.4	1.8	2.4	.7	.9	3.0	3.6	105	128	120	180	70	110	Good	Fair	Second.
Eroded undulating phase	400	500	25	38	14	18	25	40	1.0	1.4	1.8	2.4	.7	.9	3.0	3.6	105	128	120	180	70	110	do	Good	Do.
Severely eroded rolling phase	220	300	10	15			10	15		.4		.8		.3					38	60	20	40	Poor	Fair	Fourth.
Dellrose cherty silt loam:																									
Eroded hilly phase	260	360	28	38	8	10	23	33	.4	.7	.8	1.3	.3	.5	1.2	2.0	45	60	45	80	60	90	Fair	do	Do.
Hilly phase[7]	320	400	30	40	9	11	30	40	1.0	1.2	2.0	2.4	.8	.9		2.4	60	75	60	120	70	100	do	Good	Third.
Dewey cherty silty clay loam:																									
Eroded hilly phase	260	360	20	30	5	10	20	30	.5	.7	.8	1.3	.3	.5		1.4			45	60	35	50	Poor	Fair	Fourth.
Eroded rolling phase	260	320	23	35	9	11	23	35	.7	1.2	1.6	2.5	.7	1.0	2.6	3.4	68	98	60	120	45	70	Fair	Good	Third.
Severely eroded rolling phase	240	320	10	15		8	10	15		.4		.8									20	40	Poor	Poor	Fourth.
Dewey-Decatur silty clay loams, severely eroded hilly phases																					20	40	Very poor	do	Do.
Dewey silt loam:																									
Level phase	500	600	40	50	21	25	40	50	1.4	1.6	2.4	2.8	1.0	1.1	3.8	4.4	143	165	142	220	120	140	Very good	Excellent	First.
Slightly eroded undulating phase	480	560	35	45	19	23	33	45	1.3	1.6	2.1	2.6	.9	1.1	3.6	4.2	135	150	135	200	110	130	do	Very good	Do.
Dewey silty clay loam:																									
Eroded hilly phase	260	360	20	30	5	10	20	30	.5	.7	.8	1.3	.3	.5	1.2	1.6		53	45	60	35	50	Poor	Fair	Fourth.
Eroded rolling phase	340	440	30	43	16	20	28	38	1.0	1.4	1.8	2.2	.8	.9	2.8	3.6	113	128	125	190	65	110	Good	Good	Second.
Eroded undulating phase	400	500	30	43	16	20	30	43	1.0	1.4	2.0	2.5	.8	1.0	3.2	3.8	113	135	125	190	75	115	do	do	Do.
Severely eroded rolling phase	240	320	15	20		10	15	20		.4		1.0		.4					45	68	20	40	Poor	Fair	Fourth.
Dickson cherty silt loam:																									
Eroded rolling phase	240	300	20	30	9	11	20	30	.7	.9	1.4	1.7	.6	.7		.8	45	60	45	100	25	50	Fair	Good	Third.
Eroded undulating phase	340	480	23	35	13	16	20	38	.8	1.0	1.8	2.0	.7	.8		2.0	90	105	100	150	50	80	do	Very good	Second.
Rolling phase	340	500	23	35	13	16	23	35	.9	1.2	1.7	2.0	.7	.8		1.2	98	113	90	140	40	70	Good	do	Do.
Undulating phase	400	500	25	38	13	16	25	38	.9	1.2	1.7	2.0	.7	.8		2.2	98	113	90	140	55	80	Fair	do	Do.
Dickson cherty silty clay loam, severely eroded rolling phase																						35	Very poor	Very poor	Fifth.
Dickson silt loam:																									
Eroded rolling phase	260	320	20	30	8	10	20	30	.7	.9	1.5	1.8	.6	.8		.8	45	68	45	100	25	50	Good	Fair	Third.
Eroded undulating phase	340	480	23	35	13	16	20	38	.8	1.0	1.7	2.0	.7	.8	1.4	2.0	105	120	100	150	50	80	Very good	Good	Second.
Level phase	320	440	23	35	13	16	23	35	.9	1.2	1.7	2.0	.7	.8	1.6	2.2	113	128	100	150	55	85	do	Very good	Do.
Undulating phase	360	500	23	35	13	16	23	35	.9	1.2	1.7	2.0	.7	.8	1.6	2.2	113	128	80	150	55	85	do	do	Do.
Egam silty clay loam	300	460	30	38	10	15	28	35	1.0	1.4	2.0	2.4	.7	.9	2.4	3.0	75	90	80	140	[5]65	95	Fair	do	Do.
Ennis cherty silt loam[8]	200	300	18	28	5	10	18	25	.7	.9	1.4	1.7	.6	.7			60	75	55	100	[5]35	70	do	do	Third.
Ennis silt loam[8]	320	400	23	33	8	10	23	33	.7	1.1	2.0	2.2	.8	.9		2.0	83	105	60	120	75	95	do	do	Second.
Shallow phase[8]	180	240	18	35		8	18	25	.4	.6	1.4	1.7	.5	.6			30	45	45	80	40	60	Good	do	Third.
Etowah silt loam:																									
Level phase	480	560	38	50	19	25	40	50	1.3	1.6	2.4	2.9	1.0	1.1	3.6	4.4	143	165	142	220	120	140	Very good	Excellent	First.
Undulating phase	500	600	38	50	19	25	40	50	1.3	1.6	2.4	2.9	1.0	1.1	3.6	4.4	143	165	142	220	120	140	do	Very good	Do.
Etowah silty clay loam, eroded undulating phase	400	500	33	40	16	20	33	40	1.1	1.4	2.0	2.4	.8	1.0	3.2	3.6	128	143	125	190	80	120	Good	Good	Second.
Greendale cherty silt loam, undulating phase	200	300	18	28	5	10	20	30	.7	.9	1.4	1.7	.6	.7	1.6	2.0	60	75	55	100	40	70	Fair	Very good	Third.
Greendale silt loam:																									
Level phase	500	560	40	45	13	19	33	40	1.4	1.5	2.5	2.8	1.0	1.1	3.2	3.6	135	150	135	220	100	125	Very good	do	Second.
Undulating phase	480	560	30	38	13	18	30	38	1.2	1.4	2.2	2.5	.9	1.0	2.8	3.2	128	150	120	180	90	110	do	do	Do.
Guthrie silt loam										.4		.8		.3							[5]60	90	Poor	do	Fourth.
Hollywood silty clay, level phase	320	480	38	45		10	33	40	.9	1.1	2.0	2.5	.7	.9	2.4	3.0	60	75	45	80	65	95	Fair	do	Second.
Humphreys cherty silt loam, undulating phase	300	440	18	28	5	10	20	30	.7	.9	1.4	1.7	.6	.7	1.6	2.0	60	75	55	100	40	70	do	Good	Third.
Humphreys silt loam, level phase	360	500	28	38	13	16	25	40	1.0	1.4	2.0	2.4	.8	1.0	3.2	3.6	105	120	100	160	80	115	Very good	do	Second.
Huntington silt loam	400	500	50	55	10	11	25	28	1.4	1.5	2.1	2.2	.9	.9	2.4	3.0	128	135	120	120	145	160	do	Excellent	First.
Lawrence silt loam	160	240	13	18		10	13	18	.4	.5	.8	1.3	.3	.5			38	53	35	60	[5]35	60	Poor	Very poor	Third.
Limestone rockland																							Very poor	do	Fifth.
Lindside silt loam[8]	300	460	33	40		15	23	35	.9	1.1	2.1	2.5	.8	1.0		2.2			60	90	[5]100	130	Good	Excellent	Second.
Made land																									Fifth.
Maury clay loam:																									
Severely eroded hilly phase				15				15														40	Very poor	Very poor	Fourth.
Severely eroded rolling phase	140	240		15				15		.5		.8		.3							20	40	do	Poor	Do.
Maury silt loam:																									
Eroded hilly phase	160	240	10	18	5	8	10	18	.4	.5	.8	1.0	.3	.4						60	60	80	Fair	do	Do.
Eroded rolling phase	260	320	23	35	11	14	23	35	.7	1.0	1.6	2.0	.6	.8	2.4	3.0	60	90	60	100	50	75	Good	Fair	Second.
Eroded undulating phase	400	500	23	38	15	20	28	38	1.0	1.4	2.2	2.5	.9	1.0	2.8	3.4	105	120	112	170	65	105	do	Good	Do.
Melvin silt loam[8]			8	20					.6	.9	1.0	2.0	.3	.6							[5]90	130	Poor	Very good	Fourth.
Mimosa cherty silt loam, hilly phase[7]	160	240	10	18	8	10	10	18	.4	.6	.8	1.0		.3							25	40	do	Poor	Do.
Mimosa cherty silty clay loam:																									
Eroded hilly phase			10	15		8	10	15		.5		.8		.3							20	35	Very poor	do	Do.
Eroded rolling phase	240	300	20	33	10	13	20	33	.7	1.0	1.5	1.7	.5	.7		1.2	45	68	40	80	30	50	Poor	Good	Third.
Severely eroded hilly phase																							Very poor	Very poor	Fifth.
Ooltewah silt loam[8]	320	500	33	40	8	15	23	40	1.2	1.5	2.2	2.6	.9	1.0	2.4	2.8	90	113	45	90	[5]140	150	Good	Excellent	Second.
Robertsville silt loam[8]			8	20						.4		.6		.3		.3					[5]60	90	Poor	Very good	Fourth.
Rough gullied land (Decatur, Dewey, and Cumberland soil materials)																							Very poor	Very poor	Fifth.
Sango silt loam	160	240	15	20		8	15	20	.4	.6	1.0	1.3	.4	.5			38	53	45	80	[5]40	60	Good	Very good	Third.
Taft silt loam	160	240	15	20		10	15	20	.4	.6	1.0	1.3	.4	.5			38	53	38	70	40	70	do	do	Do.
Wolftever silt loam	400	520	38	45	15	20	38	50	1.2	1.4	2.2	2.5	.9	1.0	3.2	3.8	105	120	105	170	80	115	do	do	Second.

[1] See footnote 8, p. 37.
[2] Workability refers to the ease of tillage, harvesting, and other field operations.
[3] Conservability refers to the ease with which the productivity and the workability of the soil can be maintained.
[4] Soils are classified in five groups according to their relative suitability for use: First-class soils are those especially well suited physically to the crops generally grown and Fifth-class soils are the most poorly suited to crops.
[5] Current practices include practically no treatment of pasture.
[6] Crop is not ordinarily grown on this soil.
[7] Uneroded areas of this soil are practically all under a cover of trees.
[8] High water causes damage every 6 to 8 years.

Level phase	[illegible]	[illegible]	First.
Undulating phase	500	60	Do.
Etowah silty clay loam, eroded undulating phase	400	50	Second.
Greendale cherty silt loam, undulating phase	200	30	Third.
Greendale silt loam:			
Level phase	500	56	Second.
Undulating phase	480	56	Do.
Guthrie silt loam			Fourth.
Hollywood silty clay, level phase	320	48	Second.
Humphreys cherty silt loam, undulating phase	300	44	Third.
Humphreys silt loam, level phase	360	50	Second.
Huntington silt loam	400	50	First.
Lawrence silt loam	160	24	Third.
Limestone rockland			Fifth.
Lindside silt loam [6]	300	46	Second.
Made land			Fifth.
Maury clay loam:			
Severely eroded hilly phase			Fourth.
Severely eroded rolling phase	140	24	Do
Maury silt loam:			
Eroded hilly phase	160	24	Do.
Eroded rolling phase	260	32	Second.
Eroded undulating phase	400	50	Do.
Melvin silt loam [6]			Fourth.
Mimosa cherty silt loam, hilly phase [7]	160	24	Do.
Mimosa cherty silty clay loam:			
Eroded hilly phase			Do.
Eroded rolling phase	240	30	Third.
Severely eroded hilly phase			Fifth.
Ooltewah silt loam [8]	320	50	Second.
Robertsville silt loam [5]			Fourth.
Rough gullied land (Decatur, Dewey, and Cumberland soil materials)			Fifth.
Sango silt loam	160	24	Third.
Taft silt loam	160	24	Do.
Wolftever silt loam	400	52	Second.

[1] See footnote 8, p. 37.
[2] *Workability refers to the ease of tillage, harvesting, and othe*
[3] Conservability refers to the ease with which the productivit
[4] Soils are classified in five groups according to their relative s well suited physically to the crops generally grown and Fifth-

840450—53 (Face p. 109)

stream valleys. These cut-over areas need more protection from fires, and greater attention should be paid to improving stands. The remaining areas are scattered over the county, mainly in the rough uplands. They are potential forest land, though some of them are not especially good for that use. Some areas support a few dogwood, red and post oaks, hickory, redcedar, and black locust trees, with a growth of brush, principally persimmon, sassafras, wild plum, and sumac. Most of this land should be planted to black locust, pine, oak, and yellow-poplar trees. In recent years small scattered areas have been put in pine, but other areas are badly in need of planting.

ESTIMATED YIELDS

Expected yields for various crops are estimated in table 7 for the soils of the county. The estimates are according to two levels of management, as follows: (1) Ordinary management, or that practiced by the majority of farmers; and (2) good management, or the best practical management the majority of farmers in the county could be expected to follow. In columns B of the table are the expected yields of commonly grown crops under ordinary management and in columns C are expected yields under good management.

Correct interpretation of the yield data given in table 7 depends on a knowledge of what is considered good management and what is ordinary management. The requirements of good management for each soil group have already been presented in Soil Use and Management, and that subsection should be referred to in interpreting the yields given in columns C of the table. A definition of ordinary management is difficult because the management on any given soil in the county is as varied as the farms on which it exists. Nonetheless, it is usually possible to select the one or two types of management most frequently practiced on the soil, or a group of soils, and on that basis some of the important elements of ordinary management are defined in the following paragraphs.

Fertilization under ordinary management varies according to the crop grown and the soil on which it is produced. Cotton and vegetables usually receive heavy applications of complete commercial fertilizer, but applications for corn, small grain, and hay are lighter, or none is applied. Corn and vegetables are fertilized heavily on Ennis soils, but other bottom-land soils do not receive much fertilizer. Manure may supplement or replace applications of commercial fertilizer on some farms.

Winter cover crops usually receive moderate quantities of basic slag or superphosphate. If alfalfa is grown, it generally receives moderately heavy applications of lime and phosphate at seeding. Management for this crop is probably at a higher level than that for any other crop commonly grown in the county because of its exacting requirements. It is difficult and on some soils impossible to obtain good stands of alfalfa without adequate fertilization and liming.

Rotations ordinarily practiced vary according to the soils. On bottom-land soils crops are rotated to some extent, but in many cases the rotations are not planned with any special regard for the maintenance of productivity and good tilth. Corn and other intertilled crops are commonly grown year after year on the first bottoms. On

some of the less productive bottom lands, hay or small grain crops are introduced at relatively long intervals.

On upland soils cotton or corn crops are grown 1 to 3 years or more in succession, and then followed for 1 or 2 years by small grain and lespedeza, soybean, or similar hay crops. A few upland areas have been planted to cotton year after year for long periods, but farmers are following this practice less and less, and now the cotton is more often followed by a winter crop of vetch, which is followed in spring by corn.

Tillage is ordinarily on the contour for hilly and steep soils, but on less steep ones it is generally not used. Strip cropping is not a general practice, but terracing is becoming commonly used in rolling to hilly country. Terracing is not ordinarily used on the undulating to sloping land, especially in the red lands part of the county.

Pasture management is changing in the county. Permanent pasture once received little lime or fertilizer, but now many farmers are applying superphosphate and potash in moderate quantities. For permanent pasture there are two commonly practiced systems of management. The first, essentially no management at all, is the unregulated grazing of permanent pastures that receive no lime and fertilizer and no manure except the droppings from the animals grazed. The second type of management involves reseeding of soils that have been used for crops requiring tillage. These are commonly reseeded to lespedeza, redtop, orchard grass, Kentucky bluegrass, Dallis grass, or common white clover. The pastures do not receive amendments after reseeding in this management, but ordinarily benefit to a small extent from the lime and phosphorus applied to the crops preceding. The applications of amendments to those crops have generally been light, and therefore the benefits derived by the reseeded pastures are small. Reseeding does provide pasture plants more desirable than those commonly existing on unimproved permanent pasture. Many of the plants are tolerant of low nutrient levels, and though their productivity could be increased by good pasture management, their carrying capacity is commonly above that of unimproved pasture.

Furthermore, the yield data for ordinary management (columns B) are based largely on observations, interviews, and the local experience of farmers and agricultural workers. Crop yield data by soil types over a period of years are used wherever available. Under the management commonly practiced, a summation of local experience is a fairly reliable basis for estimates of expected yields.

Data on the crop yields farmers have obtained under good management are scarce, and therefore the estimates of expected yields under good management (columns C) are based largely on the best judgment of men who have had experience with the soils and crops. The estimates are subject to errors of judgment. The yields in columns C are considered to be goals that can be reached by the majority of farmers in the county if good management practices are used to the limits practical. On most soils, the same goal probably can be reached by more than one combination of practices.

The best choice of management depends on the farm as a business unit. On one farm it may be feasible, desirable, and profitable to manage a soil in such way that yields exceed the goal; on others good management may give yields in excess of the goal for one crop on a specified soil and yields below the goal for another crop on the same soil. An idea of the response to be expected from crops under a feasibly good level of management can be obtained by comparing the yields in columns C with those of columns B.

WATER CONTROL ON THE LAND

Water control on the land consists of those practices concerned with the regulation of runoff and the maintenance of moisture conditions in the soil that are favorable for the growth of a particular crop or group of crops. These practices are (1) control of runoff, (2) protection from floods, (3) drainage, and (4) irrigation. Many soils could be improved in such way that absorption and retention of moisture would be increased.

Protection of lands from floods has been limited to some straightening and clearing of stream channels and the building up of a few small dikes to protect bottom lands. Considerable damage is still done at times by floodwaters, resulting in considerable scouring of soils and also delay in planting. Since floods usually occur early in spring before crops are planted, the crops are not greatly damaged.

Drainage could be improved by greater use of open ditches and tile drains, which would be especially useful for the quick removal of surface water from potential pasture land. Only a limited amount of tile drainage has been done in the county.

Irrigation would doubtless increase crop production on many soils in dry seasons, but it is now of little or no importance. It might be economically practical to supplement rainfall by irrigation where truck crops, gardens, or other high-value crops are grown.

Two direct and undesirable results of too rapid runoff are (1) loss of water that would otherwise be useful to plants and (2) loss of soil. The loss of water always results, while the loss of soil material may or may not occur. Of the two, the loss of soil material is the most apparent because it leaves the land in an eroded condition, and the effects of erosion are generally cumulative. Erosion is not to be corrected by itself, because the loss of useful water and valuable soil material are intimately associated in their causes, in their effects, one on the other, and in the practices designed for their control. The conservation of both soil and water is based on the proper control of the water that falls on the land.

In the Tennessee Valley, of which this county is a part, a series of dams have been constructed to control and use the water in the larger streams for the betterment of the people. The dams make navigation possible on the important waterways, decrease floods by regulating the volume of flow, and provide a source of water for the production of electric energy. The effectiveness of the dams is largely dependent on their ability to regulate the volume of flow in the larger streams. Most of these streams are feeders of the main river system. Any measure that regulates the flow of water from the land drained by these streams increases the effectiveness of the entire system of dams. Moreover, the principal means of controlling floods on these feeder streams is that of holding the water on the land where it falls.

Water is absolutely necessary in the growth of plants, and even in a region having as high an annual rainfall as this county, lack of water at the critical time of the year is frequently a limited factor. Any measure that results in a more nearly adequate and even supply of water on the land during the growing season will encourage increased production of the plants on which the people depend for their livelihood. Water is a natural resource that can be exploited profitably both on the land and in the streams.

Runoff is retarded by vegetation in proportion to the density of the cover and its ability to induce a soil condition that favors the absorption and retention of water. In addition, the vegetative cover, its root system, and its debris reduce the rate of runoff and bind the soil particles so that the loss of soil material is decreased in the runoff that does occur. Forests are effective in controlling runoff, as are also hay, pasture grasses, legumes, and other sod-forming plants. Small grains and other close-growing crops are somewhat less desirable in runoff control, and intertilled crops are generally the least desirable.

Several soil characteristics have a direct bearing on the problem of runoff control, but slope is of outstanding importance. Other characteristics being similar, steeply sloping soils are the most susceptible to damage by runoff and have the most restricted suitability for agricultural use. Those soils having a smooth or nearly level surface are the least susceptible to damage by runoff and in general have the greatest range in suitability for agricultural use. Other characteristics of the soil having an important bearing on runoff control are consistence, texture, and depth to bedrock. To the extent that soils are susceptible, land use and crop rotations should generally be adjusted to protect the land against runoff hazards by use of vegetative cover.

If the vegetative cover is to be of maximum effectiveness, it must be vigorous in growth. Proper applications of lime, manure, and fertilizer and the use of legumes in the rotation improve the vegetative cover and indirectly are a means of controlling runoff. These practices are desirable not only for control of runoff but also for effective use of the water in crop production. 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 a good physical condition in the soil. Mineral fertilizers supply nitrogen, phosphorus, potash, and minor nutrient elements. If properly inoculated, legumes fix nitrogen from the air, and their root systems add organic matter and aid in maintaining a good physical condition in the soil.

The soil should be tilled so as to leave it in a condition that will retard runoff and favor absorption of water. The time and manner of tillage should be arranged to leave the soil bare of vegetation as little as possible. Contour tillage is desirable on many slopes to retard runoff. Contour strip cropping, generally most feasible and most desirable on long slopes where the land is to be used for intertilled crops, may be useful on steeper slopes.

Terracing and other engineering methods of water control are usually expensive. Terracing leaves many soils in such condition that they can be restored to high productivity only after considerable effort. The terraces also require maintenance, for if they are not maintained, they may cause more damage than if the land were left unterraced. Engineering methods have a place in water control, but as a rule they are to be resorted to only where runoff cannot be controlled by those methods of good soil management that are essential for good production.

Control of water is not an isolated problem, but one involving all the practices of good soil management that would ordinarily be employed. It is a part of successful crop production and can be accomplished largely through good farming practices, including proper choice and rotation of crops, proper fertilization and tillage, the control of insects, pests, and diseases, and, in some places, application of engineering methods.

MORPHOLOGY, GENESIS, AND CLASSIFICATION OF SOILS

FACTORS OF SOIL FORMATION

Soil is the product of soil-forming processes acting on 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 existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time the forces of soil development have acted on the soil material. The effect of climate on soil development depends not only on such factors as temperature, rainfall, and humidity, but also on the physical characteristics of the soil or soil material and the relief, which in turn strongly influences drainage, aeration, runoff, erosion, and exposure to sun and wind.

Climate and vegetation (including all biotic forces) are the active factors of soil genesis. They influence the parent material and change it from a heterogeneous mass of inert matter to a body having a definite genetic morphology. The effects of climate and vegetation on parent material are guided or limited to varying degree by the modifying influence of relief and the way in which it affects drainage, the quantity of water that percolates through the soil, the rate of natural erosion, the vegetation that grows on the soil, and other conditions. The nature of the parent material itself also guides the action resulting from the forces of climate and vegetation. Parent material is important in determining the effective climate of a soil and the kinds of vegetation it supports.

Finally, time is involved. Changes occur over a period of time, and therefore the age of a soil is a factor in its genesis. Time reflects the degree to which a soil has developed into a body in equilibrium with its environment. Development toward equilibrium depends not only on time, however, but also on the rate at which the forces of climate and vegetation act. The rate of their action is in turn 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 if conditions are not specified for the others. They are so complex in their interrelations that many of the processes taking place in the development of soils are unknown.

849450—53——8

ENVIRONMENT AND GENERAL CHARACTERISTICS OF SOILS

The parent material of the soils can be considered in two broad classes: (1) Material residual from the weathering of rock in place, and (2) material transported by water or gravity and laid down as unconsolidated deposits of clay, silt, sand, and larger rock fragments. Material in the first class is related directly to the underlying rocks from which it was derived, and material of the second class, to the soils or rock from which it has washed or fallen.

The residual parent material has its source in residuum weathered from consolidated sedimentary rocks—limestone and cherty limestone; the soils developed from this material strongly reflect many of its characteristics. Geologically, the rocks are very old, as they were laid down as unconsolidated sediments and gradually converted to consolidated rock. Nearly all of the rock formations of the county are level-bedded.

The soils developed from residual material are generally associated with particular rock formations or parts of them. Decatur and Dewey soils are commonly associated with high-grade limestone of the Tuscumbia (St. Louis and Warsaw formation of the Carboniferous system) and with the Chickamauga of the Ordovician system. Maury, Mimosa, and Hollywood soils generally overlay high-grade argillaceous limestone rock of the Chickamauga formation. Baxter, Dickson, Bodine (pl. 9, *A*), Lawrence, and Sango soils overlay rocks of the Fort Payne chert of the Mississippian system.

The character of the transported material in the second class is also reflected in the soils derived from it. Nearly all of the Capshaw soil, derived from a mixture of transported materials of limestone, sandstone, and shale, is along the Elk River, which rises in the area of sandy soils in Tennessee. Soils of the Dellrose, Greendale, Abernathy, Ooltewah, Guthrie, Cumberland, Etowah, Wolftever, Taft, Robertsville, Humphreys, Huntington, Egam, Lindside, Melvin, Ennis, and Bruno series are derived from transported material consisting mainly of the products of limestone decomposition.

Though there is a rather consistent relation between the soils and the kinds of parent material, some soil characteristics, especially those of regional significance in soil genesis, cannot be correlated with the kinds of parent material and must be attributed to other factors.

The climate of the county is temperate and continental. It is 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, and bases and such soluble materials are leached completely from the soil, with the less soluble materials and colloidal matter translocated downward. Because the soil is frozen for short periods and to shallow depths in winter, the processes of weathering are intensified and the translocation of materials accelerated. Climatic conditions vary little within the county, and therefore differences in the soil are closely associated with those in parent materials.

Higher plants, micro-organisms, earthworms, and other forms of life on and in the soil contribute to its morphology. The changes they bring about depend, among other things, on the kinds of life present and the life processes peculiar to each. The kinds of plants and animals living on and in the soil are determined by many factors of environment, including climate, parent material, relief, age of the soil, and other organisms in or on the soil. The influence of climate is most apparent but not always most important in determining the kinds of higher plants that grow on the well-drained, well-developed soils. Because climate does exert this influence on higher plants, it has a powerful indirect influence on the morphology of soils. Climate and vegetation acting together are the two active factors of soil genesis.

At the time of early settlement, an oak-pine-hickory-chestnut forest association covered the well-drained, well-developed red soils. Except for the lack of pine, the association was the same for the gray soils. The density of the stands, the relative proportions of species, and the associated ground cover probably differed. Among the well-drained, well-developed soils of the county, however, few marked differences in morphology are the direct result of differences in the vegetative cover.

The trees that commonly grow in this area feed moderately deep to deep on the plant nutrients in the soil. To a large extent they are deciduous trees. According to species, the leaves differ considerably in their content of various plant nutrients, but in general the leaves of deciduous plants return to the soil a high quantity of bases and phosphorus in comparison with that returned by coniferous trees. In this area the essential plant nutrients are therefore returned to the upper part of the soil from the lower, and the depleting action of percolating waters is retarded.

Considerable organic litter is added to the soil in the form of leaves, twigs, roots, and entire plants. Practically all of this is added to the upper soil layers. There it is acted upon by micro-organisms, earthworms, and other forms of life, and changes also occur by direct chemical reactions. Little is known of the micro-organisms, earthworms, and other population of the soil, but their importance in soil development is probably no less than that of the higher plants. Organic material decomposes rather rapidly in this area because temperature and moisture conditions are favorable to the maintenance of the micropopulation. Organic material does not accumulate on well-drained sites in this county to the extent that it does on sites of equally good drainage in cooler regions.

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

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

Analyses of soil samples were not included in this survey, but the analyses of a number of comparable soils from Jefferson County, Tenn.,

can be expected to apply to these (*13*). In those analyses, the silica content decreased and the alumina and iron contents increased in the profile 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 solum. In general, the loss on ignition was low, indicating a low content of very tightly held water. The soils were medium, strongly, or very strongly acid throughout. The quantity of silt usually decreased with depth, and from the A_1 horizon through the C the quantities of clay and colloid increased with depth. The colloid content of the B horizon was much higher than that of the A_2 horizon.

The foregoing characteristics are common to the profiles of all well-developed, well-drained soils that have been subjected to similar climate and vegetation. They are therefore common to soils of zonal extent and can be called zonal soils. Zonal soils, members of one of the classes of highest category in soil classification, are defined as any one of the great groups of soils having well-developed soil characteristics that reflect the influence of the active factors of soil genesis—climate and living organisms (*18*). In some places in the county where parent material not extreme in physical or chemical character has been in place a long time without being subject to extreme conditions of relief, the soils developed from it have the characteristics of zonal soils.

Where parent material has been in place only a short time, as in the case of very recently deposited transported material, the soils have very poorly defined genetic horizons, or none. These soils are young and have few or none of the characteristics of zonal soils and are therefore called azonal soils (*12*). Azonal soils are members of a second class in the highest category of soil classification and are defined as any group of soils without well-developed profile characteristics, owing to their youth or conditions of parent material or relief that prevent the development of normal soil-profile characteristics (*18*).

Azonal soils of this county are characterized by an A_1 horizon moderately dark to very dark in color and apparently moderate to fairly high in content of organic matter. Also distinguishing them is the absence of a zone of illuviation, or B horizon, and parent material usually lighter in color and similar to or coarser or finer in texture than the A_1 horizon. These may be referred to as AC soils because the B horizon is absent.

In relief the soils of the county range from level to steep. On some of the steep areas the quantity of water percolating through the soil is relatively small and much of the water runs off. On such steep areas the rapid rate of runoff contributes to relatively rapid geologic erosion and the soils are therefore young. The materials are constantly renewed or mixed, and changes brought about by vegetation and climate may be so slight that the soils have an AC profile. These soils are also classed as azonal.

On some nearly level areas in the county where both internal and external drainage are restricted, or where geologic erosion is very slow, the soils formed from materials that have been in place a long time. They are marked by certain well-developed profile character-

A, Cut through Bodine cherty silt loam, hilly phase, showing the cherty residuum (*a*) from the Fort Payne chert formation and the massive rock (*b*) of Chattanooga shale along the base of the cut.
B, Severely eroded area of hilly Maury and Mimosa soils in which bedrock has been exposed by accelerated erosion owing to poor management.
C, Cut in Dellrose cherty silt loam, eroded hilly phase, showing the depth of the cherty colluvial material (*a*) over residuum in place and (*b*) from argillaceous limestone.

istics that zonal soils do not have. Such soils are associated geographically with the zonal soils and are called intrazonal (*12*). They are defined as soils with more or less well-developed soil characteristics that reflect the dominating influence of some local factor of relief, parent material, or age over the normal effect of the climate and vegetation (*18*). The characteristics of intrazonal soils in this county are generally those resulting from a level relief, and they have been influenced greatly by the kind of parent material and vegetation.

Soils of each of the three broad classes—zonal, azonal, and intrazonal—may be derived from similar kinds of parent material. The major differences among the soils in any one of these classes is closely related to differences in the kinds of parent material from which they have been derived. The soils developed from residual material vary in thickness over the rock from which they have formed. This variation is caused partly by the resistance of the rock to weathering, by the volume of the residue after weathering, and by the rate of geologic erosion. The chemical and physical nature of the parent material modifies the rate and direction of chemical changes resulting from the action of climate and vegetation. The kind of parent material also exerts a pronounced influence on the kinds of vegetation.

Rocks also have contributed to differences among soils through their effects on relief. The rock formations in much of the county are very old and almost level-bedded. The present relief probably results largely from the geologic weathering and erosion of those formations. The higher lands are capped by the more resistant kinds of rock, and the valleys are underlain by those less resistant. The ridges of the northern part of the county are capped by Fort Payne chert, whereas the deep valleys in that part are underlain by argillaceous and shaly limestone. The ridges and valleys of the red lands, or southern part of the county, are underlain by high-grade limestone.

The nearly level soils in the limestone areas have exceptionally good internal drainage because the water is carried away through caverns and crevices in the fairly level-bedded rock strata. This excellent subterranean drainage in the areas underlain by limestone counteracts the effects that nearly level relief usually has on drainage. The nature of the parent rock therefore is allowed to dominate in determining local differences among the well-developed, well-drained soils formed from residual material—soils that are subject to similar forces of climate and vegetation in this county.

CLASSIFICATION OF SOILS

The classification of soils is here based on their characteristics. In soil taxonomy the normal soil profile serves as a basis for comparing soils. In this county, the normal profile is characterized by a fairly light-colored and coarse-textured surface layer, or A horizon; a uniformly colored and rather fine-textured subsoil, or B horizon; and a lighter colored and, in general, coarser textured parent-material layer, or C horizon.

The three most frequently used units of classification have been described in Soil Survey Methods and Definitions, but they are reviewed here for convenience. The simplest unit of classification is the soil

phase, which has the narrowest range of all observable characteristics, both external and internal. It is the unit about which the greatest number of statements can be made most precisely.

A soil type has a wider range in characteristics, and fewer and less specific statements can be made about it than about the soil phases that constitute the type, unless there is only one soil phase in the type.

Soil types having layers, or horizons, similar in such characteristics as color, thickness, and arrangement but different in texture and associated characteristics, as consistence, are grouped in series. In general, differences in texture among soil types of the same series are reflected in all layers, but the types are defined in terms of the texture of the surface layer. Fewer and less specific statements can be made about the soil series as a whole than about any of its types, unless there is only one soil type in the series.

Soil series may be grouped in higher categories. Members of the highest category are called soil orders. There are three soil orders, namely—zonal, intrazonal, and azonal. In table 8 the soil series of the county are classified by soil orders and great soil groups.

GREAT SOIL GROUPS

The classification of soil series in higher categories is based on limited data, principally those characteristics that can be observed in the field. The correct classification of some of the soil series is not known; that of others is 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.

Limestone County is in the region of Red and Yellow Podzolic soils and contains zonal order soils of both the Red and Yellow Podzolic great soil groups. The intrazonal order is represented by soils of the Planosol and Rendzina great soil groups; the azonal order, by soils of the Lithosol and Alluvial groups. A classification of the soil series of the county in higher categories and some of the factors contributing to their morphology are given in table 8.

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 on an illuvial red horizon. This group has developed under a deciduous or mixed forest in a warm-temperate moist climate (*18*). The soil-forming processes involved are laterization and podzolization.

The Red Podzolic soils in this county have the common characteristics of Red Podzolic soils and apparently have developed under relatively similar conditions of climate and vegetation. They are well drained, and, although they range somewhat in degree of maturity, are sufficiently old to have at least a moderately well developed Red Podzolic soil profile. In relief they range from level to steep, but differences among their profiles probably do not result primarily from slope differences. There are marked differences among the parent materials of the various soils with which many of the differences among soil profiles can be correlated.

Soils of the Baxter series are residual from cherty limestone or limestone interbedded with thin layers of chert. The material from which the soil is derived is relatively high in insoluble matter, particularly silica, which occurs in the form of chert. Generally the quantity of insoluble material in the parent rock increases from the Decatur through the Dewey and Cookeville soils to the Baxter, and the colors of the A and B horizons become lighter in the same progression, those of the Baxter being lightest.

The Baxter soils occur mainly on rolling to steep lands, but some areas have undulating relief. In general the soils occupy areas that break down from broad tracts of the Dickson, where better oxidation has taken place. Judging by the relatively thin layer of Baxter soil over bedrock, the parent material breaks down rather slowly. Erosion is relatively slow in forested areas but rather rapid in cultivated ones.

These soils are developed in a warm-temperate moist climate under a deciduous cover of post, red, and white oaks; elm; sweetgum; hickory; yellow-poplar; dogwood; and other associated trees. The timber growth has been rank on the Decatur and Dewey soils, slightly lighter on the Cookeville and Baxter, and still lighter on the Dickson soils.

The following is a profile description of Baxter cherty silt loam, rolling phase, in a virgin forested area having a slope range of 5 to 12 percent and no apparent erosion.

A_0. 2 to 0 inches, dark brown forest litter underlain by fine granular cherty silt loam.

A_1 A_2. 0 to 10 inches, grayish-brown cherty silt loam; chert present in hard flintlike fragments or porous and very light fragments.

B_1. 10 to 16 inches, yellowish-brown friable silty clay loam; contains many angular chert fragments of various sizes and shapes.

B_2. 16 to 30 inches, bright brownish-yellow very cherty clay loam.

B_3. 30 to 40 inches, yellowish-red very cherty clay loam or silty clay loam.

C. 40 to 48 inches, light brownish-red, mottled with yellow and gray, very cherty clay loam to silty clay loam; more intensely mottled with yellow and gray in lower part; below depth of 48 inches material consists of partly disintegrated cherty limestone that is underlain at a lower depth by less weathered hard cherty limestone.

Soils of the Cookeville series are residual from cherty limestone or high-grade limestone interbedded with thin layers of chert. These formations are only moderately high in insoluble material, as silica. Where silica occurs, it is in the form of chert. In general, the quantity of insoluble material in the parent rock increases from the Decatur through the Dewey to this series, and in general the colors of the A and B horizons become lighter in the same progression.

The Cookeville soils generally occur on undulating to gently rolling areas. In many cases the border areas of Dewey soil are between areas of the Decatur or Dewey and large tracts of the nearly level Dickson. As a rule, erosion has been rather slow in forested areas and only moderately rapid in cleared fields. These soils evidently developed in a warm-temperate moist climate under a cover of red, white, scarlet, and post oaks; elm; hickory; yellow-poplar; dogwood; other decidous trees; and underbrush common to the area. Apparently the timber growth was rank on the Decatur and Dewey soils, somewhat lighter on the Cookeville, and still lighter on the Baxter and Dickson.

TABLE 8.—*Classification of the soil series of Limestone County, Ala., in higher categories, and three factors that have contributed to differences [1] in soil morphology*

Great soil group and series	Relief	Parent material	Time [2]
ZONAL SOILS			
Red Podzolic:			
Baxter	Undulating to steep	Residuum from weathering of cherty limestone	Medium to long.
Cookeville	Undulating to rolling	Residuum from weathering of mixed high-grade and cherty limestone.	Long.
Cumberland	Nearly level to hilly	Alluvium from limestone, shale, and sandstone	Do.
Decatur	Nearly level to rolling	Residuum from weathering of high-grade limestone.	Do.
Dewey	Nearly level to hilly	do	Do.
Etowah	Nearly level to undulating	Alluvium from limestone, shale, and sandstone	Medium.
Maury	Undulating to hilly	Residuum from weathering of phosphatic limestone.	Long.
Yellow Podzolic:			
Capshaw	Nearly level	Alluvium from limestone, shale, and sandstone	Do.
Dellrose (lithosolic)	Hilly	Colluvium from cherty limestone and overlying phosphatic limestone.	Short to medium.
Greendale	Gently sloping or nearly level	Colluvium from cherty limestone	Do.
Humphreys	Nearly level	Alluvium derived from cherty limestone	Medium.
Mimosa	Gently rolling to hilly	Residuum from weathering of argillaceous limestone.	Do.
INTRAZONAL SOILS			
Planosols:			
Dickson	Nearly level to rolling	Residuum from weathering of cherty limestone	Very long.
Guthrie	Nearly level or slightly depressed	Residuum and local alluvium from limestone and shale.	Do.
Lawrence	Nearly level or depressional	Residuum from weathering of cherty limestone	Do.
Robertsville	Nearly level	Alluvium from limestone and shale	Do.
Sango	do	Residuum from weathering of cherty limestone	Do.
Taft	do	Alluvium from limestone and shale	Do.
Wolftever	do	do	Long.
Rendzina:			
Hollywood	do	Local alluvium from weathering of argillaceous limestone.	Short.
AZONAL SOILS			
Lithosols: [3]			
Bodine	Hilly and steep	Residuum from weathering of cherty limestone	Short to medium.
Alluvial:			
Abernathy	Nearly level or slightly depressed	Local alluvium from limestone	Very short.
Bruno	Nearly level	Alluvium from sandstone and to some extent from limestone.	Do.
Egam	do	Alluvium chiefly from limestone	Do.
Ennis	do	Alluvium from cherty limestone	Short.
Huntington	do	Alluvium chiefly from limestone	Very short.
Lindside	do	do	Do.
Ooltewah	Nearly level or slightly depressed	Local alluvium from limestone	Do.
With glei layer:			
Melvin	Nearly level	Alluvium from high-grade limestone and cherty limestone.	Very short to medium.

[1] Two factors, climate and vegetation, are relatively uniform throughout the county and therefore cannot account for the broad differences in the soils.

[2] The relative length of time that the material appears to have been in place, as manifested by the degree of profile development.

[3] Two miscellaneous land types—Limestone rockland and Rough gullied land (Decatur, Dewey, and Cumberland soil materials)—are also classified as Lithosols.

The following profile description of Cookeville silt loam, undulating phase, is in a virgin forested area having a slope range of 2.5 to 5 percent and no apparent erosion.

A_0. 1 to 0 inch, dark grayish-brown silt loam; contains a large quantity of organic litter and only a small quantity of mineral matter; apparently material has not been burned in many years.

A_1. 0 to 5 inches, grayish-brown friable to mellow silt loam; contains many small roots and root and insect holes; very gradual transition to layer below.

A_2. 5 to 11 inches, yellowish-brown friable silt loam with slightly reddish-brown feathering; crumb to nutlike structure; numerous root and insect holes stained by organic material from overlying layers; many medium-sized roots.

B_1. 11 to 20 inches, brownish- to reddish-yellow heavy silt loam with crumb structure; some pores caused by roots and insects through which some organic stains have filtered from above; material easily spaded.

B_2. 20 to 24 inches, light yellowish-red silty clay loam; contains some reddish soft rock fragments and a few small chert fragments; material is compact but shows crumb structure when broken; fewer roots in this layer than in those above.

B_3. 24 to 28 inches, yellowish-red silty clay compact in place; nut to crumb structure when spaded; contains a few small chert fragments, a few live roots, and some root holes; faint yellow mottling in lower part.

C_1. 28 to 38 inches, compact and mottled yellowish-red, gray, and yellowish silty clay loam; appears to be a layer of hardpan; contains small chert fragments and only a few roots and worm holes; difficult to dig when dry but when dug breaks into irregular fragments.

C_2. 38 to 66 inches +, brownish-red silty clay mottled in some places but free of mottling in others; material packed in places but not so much as that of layer above; breaks into fragments when dug out; some small chert fragments are in nearly all parts.

The profile just described is slightly deeper than it is in some places. The soil is strongly acid in all layers except the uppermost, which is medium acid. Undisturbed soil in forested areas generally has a 1- to 2-inch covering of forest litter.

The Cumberland are well-developed Red Podzolic soils on high terraces. The relief ranges from level to hilly but is mostly undulating to rolling. The soils are derived from old alluvium consisting chiefly of material washed from lands underlain by high-grade limestone. Their substrata are more open and porous and they are slightly more friable throughout than the Decatur or Dewey soils. The relatively high content of bases in the parent material would be expected to retard impoverishment of the eluvial horizon in these soils, but the material has been in place sufficient time to allow development of a Red Podzolic soil comparable to the Decatur or Dewey.

The Cumberland soils are relatively fertile and good in moisture-holding capacity. These two factors probably explain the relatively high content of organic matter in the upper layer, which has resulted, at least in part, from a more luxuriant vegetative cover than that on soils of lower fertility. These soils have developed in a warm-temperate moist climate under a forest cover of oaks, hickory, yellow-poplar, sweetgum, dogwood, and other hardwood deciduous trees with which a few pines are intermixed in places.

The following describes a profile of Cumberland silt loam, undulating phase, that has been cultivated for many years:

A_p. 0 to 5 inches, brown to reddish-brown friable granular silt loam; contains some organic matter and is easily plowed or spaded; change to the layer below is rather abrupt, as this one extends to plow depth.

A_3. 5 to 8 inches, reddish-brown to brown friable silt loam; darker in some spots, lighter in others; contains some sand and a few dark-brown ironlike concretions; some root and insect holes and roots present.

B_1. 8 to 15 inches, reddish-brown silt loam; slightly heavier than the layer above; contains a few sand particles, some fine mica flakes, water-worn gravel, ironlike concretions, and many pores caused by penetration of roots and insects; breaks into rather large fragments that crush to particles of medium-crumb size.

B_2. 15 to 21 inches, yellowish-red friable silt loam; less brown and more red than the layer above; contains many fine mica fragments, some fine sand, and an occasional water-worn piece of gravel; breaks into nutlike particles easily crushed to a crumbly mass; transition is gradual from layer above and to layer below.

B_3. 21 to 39 inches, red to slightly yellowish-red friable and firm silt loam to silty clay loam; contains a few purplish-red splotches, fine sand and mica particles, and many pores; granular to crumblike in structure and not difficult to spade.

C_1. 39 to 66 inches, bright-red friable silty clay loam slightly tinged with yellow; firm in place but fine sand and mica particles present tend to make spading easy; contains some small concretions and purplish rock fragments; lumps of material readily crushed to a granular mass.

In virgin areas a layer of forest litter ½ to 1 inch thick covers the surface, and the A_1 layer is 2 to 4 inches thick. The soil is medium acid in all parts of the profile when it occurs in such forested areas.

Soils of the Decatur series are characterized by their red subsoil horizons. The soil is friable when broken up but relatively tight in place. The position, relief, and thickness of the soils suggest rapid weathering of the limestone from which they are derived. After weathering, the limestone leaves only a small quantity of insoluble residue. The soils erode rather readily when cultivated but apparently not so rapidly under natural vegetation. Erosion probably accounts in part for their thickness over bedrock. Like other zonal soils in the county, these have developed under a deciduous to somewhat mixed forest vegetation and a warm-temperate moist climate. They are strongly to medium acid throughout the profile.

Following is a description of a virgin profile of Decatur silt loam, slightly eroded undulating phase:

A_0. ½ inch of forest litter.

A_1. 0 to 2 inches, dark grayish-brown granular mellow to friable silt loam containing many small roots; more gray appears when material is dry; reaction, acid.

A_2. 2 to 6 inches, light-brown to yellowish-brown friable and fairly mellow silt loam; contains a fairly good quantity of organic matter; reaction,[9] medium acid.

B_1. 6 to 14 inches, yellowish-red to bright-red friable silty clay loam that breaks into angular fragments; rather firm in place but somewhat tight when dry; penetrated by few roots; reaction, strongly acid.

B_2. 14 to 30 inches, yellowish-red to brownish-red silty clay loam that breaks into angular fragments; as in layer above, material is rather tight in place and difficult to spade when dry; material bores out with a slick gloss when not too wet.

B_3. 30 to 40 inches, brownish-red to red silty clay loam; breaks into fragments when only moist to dry; somewhat tight in place and difficult to dig when dry; very gradual transition to the layer below.

[9] Approximate pH of the materials described in this section was determined in the field by the use of several single-indicators at the time the soil was described.

C. 40 to 60 inches, more nearly yellowish-red silty clay loam than layer above; contains some grit and fine chert fragments in lower part; breaks into small fragments when dry.

Soils of the Dewey series are developed from the residuum of limestone higher in content of some insoluble materials, particularly silica, than is the rock underlying soils in the Maury or like series. On the average these soils are possibly less thick over bedrock than the Decatur. Thickness over bedrock varies from place to place in both soils, but variation is possibly greater in this series. As with the Decatur, the soil is developed under a deciduous to somewhat mixed forest vegetation and a warm-temperate moist climate, but it is somewhat lighter in texture and color and not so firm or compact in the subsoil. Before the land was cleared, the forest included red, black, Spanish, and white oaks; hickory; dogwood; sweetgum; other hardwoods; and, in places, some pine. Soils of this series are strongly acid throughout the profile.

The profile is rather deep compared to that in some other areas. The following is a profile description of Dewey silt loam, slightly eroded undulating phase, in a cultivated field:

A_2. 0 to 6 inches, brown to light-brown mellow silt loam; contains some organic matter and occasionally a chert fragment; rather abrupt change to lower layer, partly because this is at the plow depth.

A_3. 6 to 11 inches, brown to light reddish-brown friable silt loam to silty clay loam streaked with darker brown; material crushes to granular mass when fairly dry; occasional chert fragments; very gradual change to layer below.

B_1. 11 to 27 inches, yellowish-red heavy silt loam to silty clay loam; a few pores, fine roots, and worm holes appear; material crushes readily to a granular mass; some darker streaks and stains and fine roots extend down from layer above; not difficult to spade.

B_2. 27 to 37 inches, yellowish-red silty clay loam that breaks into angular fragments; material lightly compacted in place; hard when dry; a few pores and some dark stains on surface of fragments; gradual change to lower layer.

B_3. 37 to 42 inches, yellowish-red silty clay loam to silty clay; material compact and hard and breaks into fragments when spaded; contains an occasional chert fragment; rather abrupt change to layer below.

C_1. 42 to 52 inches, dark-red to slightly lighter red silty clay slightly feathered with gray; material tight in place but falls apart into angular fragments when broken loose; contains some chert fragments.

C_2. 52 to 61 inches, red silty clay with some gray and yellow mottling; tight in place and breaks out in fragments; contains some chert particles.

C_3. 61 inches +, dark-red mottled lightly with gray and yellow; compact and difficult to spade; texture, silty clay to clay; some chert fragments included.

Soils of the Etowah series are moderately well-developed Red Podzolic soils of the low terraces. They occupy level to undulating relief and range from weakly acid in the surface layer to medium acid in other parts. They are derived from moderately old alluvium washed mainly from soils underlain by high-grade limestone. Their rather open substrata favor leaching, but the relatively high content of bases in the parent material would be expected to retard impoverishment of the eluvial horizon. The parent material is similar to that of the Cumberland, but it has been in place a shorter time. Apparently age is the principal factor of difference between the two series.

This series developed under a cover of hardwood forest—oak of the moderately low land, hickory, sweetgum, beech, wild cherry, dogwood,

redcedar, sycamore, redbud, and numerous shrubs like huckleberry. The climate is warm-temperate and moist. In many characteristics, particularly color, the more nearly mature soils of this series resemble the Dewey, but they generally have a more friable subsoil.

The profile description following is that of Etowah silt loam, level phase, in a lightly forested newly prepared pasture area that had apparently received an application of some form of limestone a short time previous to examination.

A_1. 0 to 2 inches, grayish dark-brown mellow silt loam; contains many roots, stems, and leaves in all stages of decay; easily spaded and grades rather sharply into layer below.

A_2. 2 to 10 inches, brown to grayish-brown mellow silt loam; contains some organic stains from layer above and many live roots and root and insect holes; crushes easily to a granular-crumb mass when moderately moist and spades easily.

B_1. 10 to 23 inches, yellowish-red or yellowish-brown friable and granular silt loam; stained slightly with organic material from the overlying layer; roots, root holes, and insect holes not so numerous as in layer above.

B_2. 23 to 32 inches, yellowish-red to yellowish-brown silt loam to silty clay loam; lightly compacted in place; easily spaded and falls into fragments; few roots or root and insect holes.

B_3. 32 to 41 inches, reddish-yellow lightly compacted silty clay loam; slightly sticky when wet; some pores but few live roots at this depth; a few brown ironlike concretions are present.

C_1. 41 to 52 inches, light reddish-yellow or brownish-yellow lightly compacted silty clay loam; spades easily and falls into a fragmentary mass; some feathering or mottling of gray in lower part; very gradual change to material below.

C_2. 52 inches +, silty clay loam to clay loam very mottled with dark brown, grayish yellow, and rust brown; contains some soft ironlike concretions; material compacted or lightly cemented and spades into a mass of irregular fragments; water table probably occurs much of the wetter part of the year; tests indicate layer is slightly less acid than some of those above.

Maury soils are characterized by brown and yellowish-brown subsoil horizons. The parent material is from phosphatic limestone, a distinguishing feature from Dewey soils. When wet, these soils are only slightly more plastic in the subsoil than the Dewey soils. Their depth to limestone bedrock varies considerably but is generally at a depth of 8 to 10 feet. As they occur here, the Maury areas are only remnants of Central Basin materials, and they may not be so fully representative of the series as areas farther north in Tennessee. Apparently the parent rocks weather rather rapidly, and erosion is rapid (pl. 9, *B*). The soils have developed mostly under a forest cover of deciduous trees in a warm-temperate moist climate. The forest cover is usually a mixture of oaks, hickory, beech, and a few redcedar and maple. The soils are undulating to rolling or strongly rolling. They are medium acid in all parts but a little less acid at depths below 66 inches.

The profile description following is that of Maury silt loam, eroded undulating phase, as it occurred in a field idle for 2 years—a field on a narrow ridge top having a slope range of 2.5 to 5 percent. This profile is somewhat deeper than that found in some places.

A_2. 0 to 4 inches, brown to grayish-brown mellow silt loam containing many roots, some dead insects, and decaying roots and stems; crushes easily to a granular mass; darker than layer below and contains a small quantity of sand.

A_3. 4 to 15 inches, brown mellow to slightly heavy silt loam; contains some rodent holes through which dark organic matter has come down; material clings to spade when slightly wet but spading is not difficult; material becomes grayer on drying.

B_1. 15 to 28 inches, yellowish-brown compact silt loam containing a few small rocks weakly cemented in place; structure, mixed fragmentary and nut; material easily crushed to granular mass when moist but becomes hard when dry; layer contains some dark streaks like those made by manganese, a few roots, some grayish spots, and thin sand lenses.

B_2. 28 to 40 inches, yellowish-brown friable silt loam weakly compacted in place; contains a few dark-brown streaks, an occasional root, and a small quantity of fine sand in form of thin lenses; crumblike structure; material crushes to granules when moist; only an occasional rock fragment is present and spading is easy.

B_3. 40 to 54 inches, brownish-yellow silty clay loam of fragmentary structure; contains a few rock fragments; not difficult to spade.

C_1. 54 to 66 inches, mottled brown, yellowish, and gray silty clay loam; moderately sticky when wet; mixed mass has a color slightly lighter than that of layer above; a few sand lenses occur.

C_2. 66 to 100 inches, mottled brown and gray silty clay; moderately sticky when wet; material grayer when dry.

YELLOW PODZOLIC SOILS

Yellow Podzolic soils are a zonal group of soils having thin organic and organic-mineral layers over a grayish-yellow leached layer that rests on a yellow horizon. These soils have developed under the coniferous or mixed forest in a warm-temperate moist climate (*18*).

The Yellow Podzolic soils in this county have undulating to steep relief and are developed under a forest vegetation mainly of deciduous trees and in some places a small admixture of conifers. There may have been a somewhat less luxuriant and different kind of ground cover on the Yellow Podzolic than on the Red Podzolic soils, since the character of the ground cover is not known. Climatic conditions on the soils of the two groups were apparently similar. The parent material of the Yellow Podzolic soils was derived from argillaceous limestone or highly siliceous limestone, shale, and, to a small extent, high-grade limestone.

The causes for the development of the pronounced color differences between the Yellow Podzolic and the Red Podzolic soils are not known. The Yellow Podzolic soils in this county, however, are generally associated with parent material either lower in bases or less well drained internally than those parent to the Red Podzolic soils.

Soil of the Capshaw series is on very level to flat relief on fairly low-lying terraces. It consists of stream-terrace material washed chiefly from soils underlain by limestone and sandstone, but to some extent it is influenced by shale. The material has evidently come from areas of sandstone in Tennessee because all or nearly all the areas are along the Elk River near the northern Alabama line. The soil is readily pervious to water, and the parent material is naturally low in bases. Relief, vegetation, and climate are similar to that for the Etowah soils, but more of the parent material is from sandstone.

The soil has developed under a forest cover of deciduous trees, including sweetgum, hickory, buckeye, sycamore, lowland oak, and a heavy growth of underbrush and vines.

The following profile description of Capshaw loam was taken in a field that had been in cotton, corn, or similar crops for many years:

A_2. 0 to 7 inches, grayish-brown granular fine sandy loam; contains many fine roots and is exceptionally easy to plow or spade.

A_3. 7 to 12 inches, yellow-brown mellow fine sandy loam; contains a few chert fragments; fairly sharp but regular change to layer below.

B_1. 12 to 20 inches, brownish-yellow friable fine sandy clay; contains chert fragments up to 1 inch thick and many worm holes; some dark streaks caused by material coming from above; easily spaded; no uniform transition to underlying layer.

B_2. 20 to 35 inches, pale-yellow fairly friable clay loam; sticky when wet; compact; contains small chert fragments; falls to a fragmentary to granular mass when spaded out; irregular gradation to the layer below.

B_3. 35 to 44 inches, mottled gray, yellow, and brown silty clay loam; contains worm holes and some small chert fragments; material is a little more compacted than the overlying layer and yellower than the one below.

C_1. 44 to 51 inches, highly mottled gray, rust-brown, and orange compact silty clay loam; falls to fragments when spaded; contains insect holes and a few small chert fragments.

C_2. 51 inches +, highly mottled gray and brown silty clay loam; contains spots of heavy gray clay, chert fragments, and holes resembling those made by crawfish; usually wet, with water rising in holes in moderately wet seasons.

Under virgin forest, there is a 1½- to 2-inch layer of forest litter, chiefly decaying leaves and other organic matter from plants. The profile is moderately acid in all layers, but a little more weakly acid in the upper 20 inches.

The hilly Dellrose soils have formed largely from drifted material of the Baxter and Dickson soils of the Highland Rim. They are on slopes leading down from the Highland Rim to the Central Basin. The parent material appears to have drifted down far enough to be influenced by seepage water issuing from phosphatic rocks of the Central Basin formations, as the soils apparently are not poor in phosphate. They are medium acid in all parts. Though not extensive, they are rather outstanding from the standpoint of productivity and the relative lack of accelerated erosion. The soils have developed under a rather vigorous growth of beech, hickory, walnut, elm, chestnut, buckeye, sweetgum, dogwood, and other deciduous trees, with an undercover of brush and vines.

The profile varies considerably from place to place, both in character of material and in total thickness over residual material. The profile description that follows is of Dellrose cherty silt loam, eroded hilly phase. The soil had been planted to the common crops of the county for a long time, and at the time of examination was idle and growing up to weeds. This description was made from a fairly new road cut (pl. 9, *C*) and the depth of material varies from a few inches to about 8 feet within a short distance. In one part of the road cut, the profile was as follows:

A_0. 0 to 1½ inches, in forested areas this layer consists of decaying leaves, twigs, and other vegetative matter.

$A_{1\,2}$. 0 to 8 inches, dark-brown to brown friable and mellow cherty silt loam; organic content is fairly high for land long in crops; contains chert fragments up to 4 inches thick.

B_1. 8 to 16 inches, brown to chocolate-brown heavy silt loam to silty clay loam; contains considerable fine and some coarse chert; friable, with nut and granular structure.

B_2. 16 to 24 inches, yellowish-brown silty clay loam; crumblike structure; easily crushed to a granular mass; contains much chert.

B_3. 24 to 36 inches, brownish-yellow somewhat mottled moderately friable cherty silty clay loam; slightly hard when dry; gradual transition to underlying layer.

C_1. 36 to 48 inches, mottled yellow, orange, and yellowish-gray silty clay loam; contains many pieces of chert; breaks into irregular fragments; when dug this appears to be the lower part of the colluvial material; the change to the underlying material is rather abrupt.

C_2. 48 to 60 inches, mottled light-yellow, orange, and rust-brown cherty silty clay; breaks into moderate-sized fragments; probably represents the former surface layer of a buried soil.

C_3. 60 to 125 inches, highly mottled grayish-yellow, gray, and dark-brown material containing orange-colored spots; hard when dry and sticky when wet.

In other places, the Dellrose profile varies in depth or shows only poorly defined layers, and, therefore, the foregoing profile represents only one condition of the soils. Under virgin forest, for example, there is a 2-inch layer of forest litter, chiefly of decaying leaves and other vegetative organic matter. The Dellrose profile is acid throughout. The Dellrose soils are classed as lithosolic Yellow Podzolic soils because they are probably not true Lithosols. In places they are fairly deep over bedrock and have some Yellow Podozolic profile characteristics, but in general they are thin over bedrock and in some places the bedrock is exposed.

The Greendale soils have developed mainly from local alluvium washed from adjacent areas of the Dickson and the lighter red Baxter soils. Compared with most of the Yellow Podzolic soils of the county, they are relatively young. As mapped, they vary from place to place in the degree to which they have developed a textural profile and many areas of azonal soils belonging to the Alluvial great soil group were included. The included areas consist of recently deposited material and in most places could not have been separated feasibly from the zonal Greendale soils.

The following profile description of Greendale silt loam, undulating phase, is of an area that was cleared and cropped for many years.

A_1. 0 to 6 inches, grayish-brown or light yellowish-brown mellow silt loam; crushes to a crumbly or granular mass; fairly high in content of organic matter, even where cultivated; contains only a few chert fragments.

A_2. 6 to 10 inches, gray to yellowish-gray mellow granular silt loam; slightly darker than layer above and rather porous; contains a few soft brown concretions.

B_1. 10 to 20 inches, yellowish-brown porous mellow silt loam; spades out easily into large soft fragments that crush easily to a granular mass; very gradual transition to underlying layer.

B_2. 20 to 29 inches, brownish-yellow firm porous friable silt loam; spades easily into large lumps that crush easily to medium-crumb particles; changes fairly abruptly to the lower layer.

B_3. 29 to 37 inches, pale-olive heavy silt loam; spades out into various-sized fragments; contains only a few roots and insect holes; abrupt change to the underlying layer.

C_1. 37 to 52 inches, mottled gray, pale-yellow, rust-brown, and reddish-brown compact and hard cherty silty clay; sticky when wet and hard when dry; rather abrupt change to the underlying layer.

C_2. 52 inches +, mottled reddish-brown, pale-yellow, and gray material; compact and difficult to spade; contains gritty material; before colluvial material accumulated on it, this layer may have been a surface soil.

The Humphreys soils are closely associated geographically with the Ennis series. They occupy level to slightly undulating areas on the relatively low terraces along the streams that come from areas of

Dickson, Bodine, and the less-red Baxter soils. They are developed from material washed mainly from soils of the Highland Rim, which are derived largely from dolomitic limestone or very siliceous limestone, as contrasted to the high-grade limestone of the Cumberland and Etowah series. Some areas are free of chert and others are very cherty. They are well drained, but owing to the relatively short time the soil material has lain in place, the profile is not highly developed. Nearly all the areas are inundated for short periods during extremely high floods.

The soils of this series are developed in a warm-temperate moist climate under a deciduous forest cover that includes white, post, chestnut, and Spanish oaks; hickory; elm; sweetgum; sycamore; buckeye; hornbeam; and many shrubs and vines.

The following profile, strongly acid in all parts, was observed in a field that had been planted to cotton, corn, hay, and similar crops for many years:

A_2. 0 to 6 inches, grayish-brown granular mellow to friable silt loam; tilling and spading are very easy if soil is in good moisture condition; contains only occasional chert fragment and little organic matter.

A_3. 6 to 11 inches, yellowish-brown friable silt loam of crumb structure; contains many worm and root holes; very gradually blends into underlying layer.

B_1. 11 to 26 inches, yellowish-brown friable porous silty clay loam or silt loam; contains a few brown soft concretions and some brown spots.

B_2. 26 to 38 inches, light yellowish-brown heavy silt loam; shows shades of gray when exposed to sun and wind; contains many pores; spades easily to a crumb or granular mass.

B_3C_1. 38 to 72 inches, gray or grayish-olive silty clay loam; compact in place but easily spaded to a fragmentary mass; heavier material in lower few inches consists of alternate spots of sand and clay; platy structure evident in upper two-thirds of layer.

C_2. 72 inches+, mottled brown, dark-brown, gray, and pale-yellow coarse sand or fine gravel and angular chert fragments; material loose and easily spaded; remains fairly wet even during moderately dry seasons.

Under virgin forest, there is a 1½- to 2-inch layer of forest litter, chiefly decaying leaves and other vegetative organic matter.

The Mimosa soils are geographically associated with the Dellrose and the Maury. In fact, the Dellrose soils are developed from accumulations resting on Mimosa soil material. The inextensive Mimosa soils occur along the rolling to steep slopes of the outer Central Basin, which extends into the northern part of the county in the vicinity of the Elk River. Judging from the comparative thinness of the soil layer over bedrock, the soils sheet erode fairly rapidly, and the rock from which they developed is subject to rather rapid disintegration.

The soils are characterized by a tough to plastic subsoil and by chert on the surface and in the subsoil. The parent material is residual from rather high-grade argillaceous limestone. A fair content of phosphate is present when compared with soils of Highland Rim. Reaction is medium acid in all parts of the profile but slightly less acid in the lower layers.

These soils have developed in a warm-temperate moist climate under a heavy growth of hardwood trees—hickory, hackberry, redcedar, oaks, and a few chestnut, dogwood, and elm. Redcedar was probably the first timber growth, but as the soil layer became thicker,

849450—53——9

other trees appeared. This tree is now confined mainly to the areas of soil having a more shallow profile.

Areas for sampling are somewhat limited. The following profile was taken from a cotton field that had been in crops for several years:

A_1. 0 to 5 inches, grayish-brown to yellowish-brown friable cherty silt loam; contains many chert fragments up to 5 inches thick that probably tend to retard erosion.

A_2. 5 to 12 inches, dark yellowish-brown mellow cherty silty clay loam; contains sufficient chert to make spading difficult; gradual transition to underlying layer.

B. 12 to 18 inches, yellowish-brown cherty silty clay loam; slightly sticky when wet.

C_1. 18 to 24 inches, mottled light brown, yellow, and gray tough and plastic cherty silty clay; less chert than in layers above.

C_2. 24 to 56 inches, highly mottled yellow and brown very tough and plastic clay; contains a few dark-brown soft concretions but very little chert; yellow mottling decreases and brown motting increases with depth.

In forested areas there is generally a ½- to 2-inch layer of decaying leaves, stems, grass, and roots. All the phases and types of Mimosa soil mapped are cherty.

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. These soils have developed upon nearly flat upland surface under grass or forest vegetation in a humid or subhumid climate (*18*).

Seven of the soil series in the county have been designated as Planosols—the Dickson, Guthrie, Lawrence, Robertsville, Sango, Taft, and Wolftever. The Wolftever and Guthrie soils are less definitely Planosols than the others. All these soils have level or depressional to sloping relief and are imperfectly or poorly drained. All are characterized by a B horizon more compact than that of most zonal soils, but the degree of development in this horizon varies among the seven series.

Climatic conditions are similar to those under which the zonal soils are developed, but much of the time the soils are more moist and less well aerated than the zonal soils. Some difference probably existed in the kinds of vegetation on the Planosols and the Red or Yellow Podzolic soils, but in this county deciduous forest was on all three of these great soil groups.

Morphologically, the Planosols are older than the Red or Yellow Podzolic soils, but the causes of such development are not fully known. The relief is such that geologic erosion is slow, but that factor alone is not the cause of their formation. The material itself is not older in years than that of associated zonal soils having similar relief. It is possible that relatively dense layers in the parent material caused slow internal drainage, and this combined with slow external drainage and the unusual siltiness of the parent material, resulted in abnormal concentration or cementation of the soil in or below the illuvial horizon.

The level to rolling Dickson soils are characterized by light grayish-brown silty surface layers in cultivated fields and by their tendency to develop a siltpan at a depth of 22 to 28 inches. Disintegrated highly cherty limestone, which is largely Fort Payne chert, is the source of the parent material. External drainage is fair to good, but the siltpan hinders the movement of the soil moisture. Internal drainage is sufficient for most of the ordinary shallow-rooted crops but might prove somewhat deficient for alfalfa or similar deep-rooted crops.

These soils have developed in a warm-temperate moist climate. The forest cover consisted of thin stands of moderate-sized deciduous trees, as post, red, black, and white oaks; hickory; and possibly some pine. The underbrush has always been rather thin and stunted. The parent material is very much like that of the Baxter series, but the soils differ in several respects. Probably the siltpan in these soils results in part from their more level topography and attendant changes in the internal movement of moisture. There are indications of a partly developed siltpan in some areas of Baxter, but it is at much greater depth than in this series and apparently has little influence on crops. Below the B horizon these soils are less well aerated than the Baxter. From the standpoint of morphology they are old, but the material itself is not old.

The following profile description is of Dickson silt loam, level phase, in a virgin forest well protected from fires for several years past. The reaction is medium acid in the surface layer but strongly acid in all the other layers.

A_0. ½ to 0 inch, dark-brown decaying litter of leaves, grass, stems, and roots; layer is so thin that some mineral soil is admixed.

A_1. 0 to 14 inches, pale-yellow or grayish-yellow friable silt loam; much lighter in color when dry; spades out easily to a crumbly mass; a few root and insect holes give soil a porous appearance.

A_2. 14 to 22 inches, light yellowish-brown friable but firm silt loam to light silty clay loam; contains some roots; like above layer, the soil is much lighter colored when dry; abrupt change to underlying layer.

B_1. 22 to 28 inches, mottled yellow, brown, gray, and orange fragmentary silty clay loam; material tight in place and difficult to spade.

B_2. 28 to 34 inches, mottled rust-brown, pale-yellow, gray, orange, and red silty clay loam; material spades out with difficulty and falls into a mass of fragments.

B_3. 34 to 45 inches, mottled reddish-brown, light-yellow, gray, and orange silty clay loam; fragmentary structure; material compact when in place.

C. 45 to 60 inches, mottled red, yellow, and orange silty clay; material is sticky and tight, making spading difficult.

The Guthrie soil in this county occupies depressions or areas at the heads of intermittent streams. It developed from local wash, the source of which is adjacent residuum from weathered high-grade or cherty limestone. In some localities, the limestone residuum has contributed directly to the parent material. The soil has the characteristics ordinarily associated with poor drainage and generally has a compact heavy-textured layer in the lower part of the profile. It is comparable to the Robertsville soil in drainage conditions and sometimes water stands on it for long periods. In most places the Guthrie soil has developed under a fairly thin stand of hardwood timber, including black and water oaks, sweetgum, winged elm, and hornbeam.

The following profile, strongly acid in all layers in nearly all places, is that of Guthrie silt loam in a forested depression surrounded by soils underlain by high-grade limestone.

1 to 0 inch, dark-gray silt loam mixed with decaying leaves and stems and stained with organic matter.

0 to 6 inches, light-gray mellow to mealylike silt loam mottled with yellowish streaks; crumb to granular structure.
6 to 14 inches, very light-gray mealylike silt loam that crushes readily to a fine granular mass; becomes sticky when wet.
14 inches +, mottled gray, brownish-yellow, and yellowish-brown heavy clay loam to clay; very sticky when wet and very hard when dry.

The Lawrence series, represented in this county by Lawrence silt loam, occupies level to flat areas that have slow surface runoff and impeded internal drainage. Lawrence silt loam occurs in association with the Sango and Guthrie soils and is intermediate between the two in position on the land and in natural drainage. This series is a little less well drained than the Sango, and the siltpan layer is usually thinner. The two developed under much the same climatic conditions, however, and from practically the same material. Little difference exists in the vegetative cover, though there are a few more water-loving trees on the Lawrence.

A few areas of the Lawrence soil are mapped with the Decatur and Dewey, or in the red lands part of the county. Here the high-grade limestone has apparently weathered to such an extent that spots of Fort Payne chert material are exposed. The profile and drainage condition resulting is much the same as that of Lawrence soil occurring in other parts of the county.

The following profile description of Lawrence silt loam is in a virgin forested area where fires have been frequent and rather severe. The surface layer is medium acid, but all the others are strongly acid.

A_{00}. ½ to 0 inch, dark grayish-brown heavy silt loam, largely of decaying leaves, stems, and roots; passes abruptly into the layer below.
A_2. 0 to 2 inches, gray to very light-gray friable silt loam; contains many fine roots and some pores caused by roots and insects; layer varies considerably in thickness from place to place.
B_1. 2 to 16 inches, very mottled yellow, orange, and gray silty clay loam; contains some fine chert fragments and many roots; tongues of gray extend into this layer from the one above.
B_2. 16 to 22 inches, very mottled grayish-yellow and rust-brown silty clay loam; material is puttylike when wet; chert fragments are common.
B_3. 22 to 28 inches, mottled gray, rust-brown, and yellow silty clay; contains reddish soft rock fragments; compacted or cemented in place and very hard, but breaks into irregular fragments when dug out.
C_1. 28 to 42 inches, very mottled gray, yellow, and rust-brown silty clay loam; cemented and very hard; contains some chert fragments and concretions; splotches of gray are common.
C_2. 42 inches +, mottled gray, yellow, and rust-brown cherty silty clay loam; contains chert fragments up to 3 inches thick; water rises to the top layer, even in moderately wet seasons.

The soil of the Robertsville series is developed from limestone material similar to that giving rise to the Etowah, Wolftever, and Taft. It occupies nearly level areas in the depressions, most of which are on low or intermediate terraces. The soil is less well drained than the Taft, more dense in the compact layer common to both, and apparently more highly leached in the A horizon. External drainage is generally slower than on the Taft; in fact, the soil is covered with water much of the time in rainy seasons. The ordinary lowland growth of hardwood timber includes hickory, sweetgum, beech, wild cherry, hornbeam, chestnut oak, ash, sycamore, and persimmon.

In this county some areas formed from material washed from cherty limestone or cherty limestone soils have been included. Where the material is largely from high-grade limestone, the reaction is medium to strongly acid; if cherty limestone is the source of the material, the reaction is strongly acid in all layers.

The Robertsville silt loam profile description that follows was taken from an area that very recently had been cleared and burned over. The material apparently was washed from both high-grade and cherty limestone.

A_1. 0 to ½ inch, gray to dark-gray silt loam that changes to a very light gray after a few years of tillage.
A_2. ½ to 12 inches, gray silt loam mottled with yellow and rust brown; contains a few chert fragments and nearly all the roots that occur in the profile.
B_2. 12 to 20 inches, mottled gray, yellow, and brown silty clay loam; contains a few chert fragments; tongues of dark-brown material reach upward into layer and in wet seasons crawfish are usually present.
B_3. 20 to 26 inches, highly mottled brown, yellow, and gray silty clay; material compact and hard but falls into fragments of various sizes and shapes when dug out; contains cemented ironlike concretions.
C. 26 inches+, gray very hard and cemented material lightly mottled with yellow and rust brown; contains many chert fragments and much ironlike cementation; spading almost impossible in some places but not extremely difficult in others.

The level or flat Sango soil is closely associated with the Dickson soils and is apparently from the same parent material. It differs from the Dickson in its lack of slope sufficient to permit good drainage and in having developed a siltpan closer to the surface. The soil has been developed under the same climatic conditions as the Dickson, but it is not so highly developed morphologically. It occupies positions between the Dickson and Lawrence soils.

Available plant nutrients are low. The timber cover apparently was a thin growth of rather small deciduous trees, as post, white, and red oaks; hickory; sweetgum; blackgum; and possibly a few willow or similar lowland trees. Very few of these trees reached saw-timber size.

The following profile of Sango silt loam was taken from a cut in a virgin forest where forest fires have been frequent and severe. In this profile, the surface layer is medium acid; to a depth of 33 inches, the other layers are strongly acid; and below 33 inches, medium acid.

A_1. 0 to 1 inch, dark grayish-brown silt loam; contains some organic matter and organic stains and many live roots.
A_2. 1 to 3 inches, light-gray friable silt loam; contains some chert fragments and brownish concretions; material slightly porous and of crumb structure; gradual transition to underlying layer.
A_3. 3 to 15 inches, yellowish-gray silty clay loam; sticky when wet but friable when dry; penetrated by many roots; spades into nutlike fragments that readily crush to fine granules; abrupt change to the lower layer.
B_1. 15 to 20 inches, mottled yellow, orange, and gray silty clay loam; contains small chert fragments; firm in place; rather sharp change to underlying layer.
B_2. 20 to 33 inches, highly mottled gray, yellow, and light-brown silty clay; compact and hard; contains many brown ironlike concretions; sharp transition to layer below.
C_1. 33 to 47 inches, mottled yellow, gray, and rusty-brown material containing some concretions and chert fragments and spots of clay and silt; material weakly cemented and becomes hard when dry.
C_2. 47 inches +, mottled yellowish-gray and rusty-brown material heavier than that in overlying layer; contains chert fragments and concretions.

The Taft soil occupies low or slightly depressional positions on terraces and is derived from limestone material similar to that giving rise to the Etowah and Wolftever soils. The general type of vegetative cover, relief, and climate are relatively similar for all three of these series, but internal drainage is slower in the Taft than in either of the other two. This soil has developed a heavy compact layer to a greater degree than the Wolftever series, and internal drainage is correspondingly slower.

The following profile description is of Taft silt loam under a forest cover including hickory, sweetgum, loblolly pine, and red, post, and water oaks. The pine had been cut recently for saw timber, and the area was heavily burned over.

- A_1. 0 to 1 inch, dark grayish-brown silt loam mixed with leafmold and other organic materials; a few small chert fragments are scattered over the surface.
- A_2. 1 to 5 inches, light brownish-gray silt loam slightly tinged with yellow in lower part; contains small chert fragments; has crumb structure and can be crushed to a granular mass.
- A_3. 5 to 17 inches, pale-yellow or grayish-yellow friable silty clay loam having a crumb structure; contains some small chert fragments and in the lower part some faint splotches of gray and orange.
- B_{12}. 17 to 26 inches, mottled gray, rust-brown, and yellow silty clay loam to clay loam; contains some chert fragments and a few soft concretions that are apparently in the first stage of formation; material is tight but falls into fragments when spaded; rather abrupt transition to underlying layer.
- B_3C_1. 26 to 42 inches, bluish-gray silty clay mottled with rust brown and yellow; material laminated, compact, and tight; breaks into irregular fragments; contains some chert fragments and a few weak concretions that are in process of formation; a heavy concentration of concretionary material similar to a bog-iron formation is in some places.
- C. 42 to 52 inches, highly mottled yellowish-gray and rust-brown clay; contains pockets of heavy clay material; yellow mottlings tend to be slightly stronger yellow than those in overlying layer.

As determined with a quick test, using a single indicator, the surface layer of the profile just described is medium acid, but all the others are strongly acid. In cultivated land the A_1 layer is very light gray instead of the grayish brown common to forested areas.

The Wolftever soil occupies low-lying terraces and is closely associated with the Huntington and Egam soils on the first bottoms, in places being at a level only slightly higher than the Huntington. It is formed from alluvial material washed mainly from lands underlain by limestone, but to a lesser extent from shale and other rock. This material has been laid down comparatively recently but is considered rather old morphologically. The relief is nearly level to sloping, and external drainage is generally fair. Internal drainage is impeded by a compact layer in the subsoil but is generally adequate for most of the common crops.

The Wolftever series has developed from material similar to that parent to the Etowah soils, and the climate, vegetation, and relief are also similar. Internal soil climate is more moist and the soil is less well aerated below the A horizon than the Etowah. The soil undoubtedly contains more material washed from shale or shaly soils, and floodwaters cover it a little more often than the Etowah.

The following profile description is of Wolftever silt loam planted to cotton, corn, and other common field crops for many years:

- A_{12}. 0 to 7 inches, grayish-brown or light yellowish-brown mellow and granular silt loam containing an occasional chert fragment.
- A_3. 7 to 16 inches, yellowish-brown silt loam to heavy silt loam of crumb structure; material slightly packed and porous but spades out easily; gradual transition to layer below.
- B_1. 16 to 28 inches, pale-brown or light yellowish-brown porous silty clay loam that falls into fragments; contains some small pieces of chert and brown concretions; concretions are disrupted when material is spaded and cause brown streaks or markings on the spaded surface; discoloring caused by concretion is very pronounced on nearly all cut surfaces.
- B_2. 28 to 38 inches, pale-brown or light yellowish-brown silty clay loam with streaks of gray—the outstanding or characteristic layer in the Wolftever soil; very tight and compact but porous because of many root and insect holes; contains many soft ironlike concretions.
- B_3. 38 to 53 inches, mottled yellowish-brown, gray, and dark-brown silty clay loam; porous and compact but falls into fragments when spaded; spaded fragments coated with gray to whitish material.
- C. 53 inches +, mottled light-gray, brown, and yellow silty clay; hard and compact, but breaks into fragments, some coated with whitish material and others brownish on the inside; contains a few insect holes.

In forested areas there is generally a layer up to 1½ inches thick of decaying leaves, branches, roots, and other organic material. The upper 16 inches of the profile just described is apparently medium acid, and the rest, strongly acid.

RENDZINA SOILS

Rendzina soils are an intrazonal group of soils, usually with brown or black friable surface horizons underlain by light-gray or yellowish calcareous material. They have developed under grass vegetation or mixed grasses and forest in humid and semiarid regions from relatively soft, highly calcareous parent material (*18*). The soil-development process is calcification.

Hollywood silty clay, level phase, is the only Rendzina soil mapped in the county. It is imperfectly to poorly drained and has developed from local alluvium and colluvium. It occupies gently sloping, nearly level, or slightly depressional positions at the base of stony land or limestone outcrop areas and is affected by seepage water. When rain water falls on the higher stony lands or areas of limestone outcrop, it may spread over the adjacent areas of this soil and deposit a small quantity of freshly disintegrated limestone. The concentration of organic matter is relatively high in the mucky or peaty uppermost layer.

The following profile, neutral in reaction in all layers, is of Hollywood silty clay, level phase, in a cleared field that had been in crops for several years.

- 0 to 7 inches, dark grayish-brown silty clay loam; very sticky when wet; contains some small chert and limestone fragments; organic content is apparently rather high.
- 7 to 20 inches, very dark-gray to black clay of fragmentary structure; tough and plastic when wet.
- 20 to 26 inches, light-gray to gray mottled steel-gray, yellow, and brown clay; very sticky and plastic when wet and hard when dry; contains many small rock fragments that are brown on a cut surface.
- 26 inches +, highly mottled gray, yellow, and brown clay; very hard when dry; contains a few small rock fragments.

LITHOSOLS

Lithosols include miscellaneous intrazonal and azonal soils varying greatly in character and degree of soil development, nature and depth of soil and soil material, and in external features of relief, stoniness, and drainage. For the most part, however, these are shallow soils on rough hilly or mountainous terrain. They are stony in many places and commonly have little soil development and no definite profile. Parent soil materials or underlying bedrock are exposed in many places, though in others there is a fairly well-developed soil. The native vegetation is grass in some areas and in others largely brush or thin open stands of timber (*18*).

In this county the Bodine series is classed as a member of the Lithosols great soil group. This series is shallow over bedrock and has developed from chert beds or very cherty limestone, mostly of the Fort Payne formation. The Bodine soils occupy hilly to steep slopes and are associated with the Dickson, Baxter, and Dellrose soils. They are yellowish brown in the subsoil, whereas the Baxter soils are light reddish brown in equivalent layers. These are developed in a warm-temperate moist climate under a fairly thin forest cover of deciduous trees. Red, white, black, and Spanish oaks; hickory; chestnut, sweetgum; and an occasional walnut and redcedar are among the trees included.

The Bodine profile varies from place to place, but the following one is fairly typical of forested areas:

0 to 2 inches, dark grayish-brown mellow cherty silt loam; strongly acid; organic content fairly high.

2 to 8 inches, light grayish-brown mellow cherty silt loam; strongly to medium acid.

8 to 30 inches, light yellowish-brown friable strongly acid cherty clay loam; faintly splotched with red, yellow, and gray, especially toward the lower part.

30 inches +, beds of chert interspersed with splotches of red, yellow, or brown clay loam; material strongly to medium acid; layer rests on stratified cherty bedrock.

In addition to the Bodine series, two miscellaneous land types—Limestone rockland and Rough gullied land (Decatur, Dewey, and Cumberland soil materials)—are classed as Lithosols. In most places no true soil exists in these miscellaneous land types. Limestone rockland consists mainly of limestone outcrops, and very little soil is formed because of geologic erosion. Rough gullied land is the result of accelerated erosion.

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 (*18*). These soils are on first bottoms along the streams and in depressions in the uplands. They have nearly level to depressional relief and medium to very slow internal drainage. The main characteristic held in common is the lack of a soil profile in which the horizons are genetically related.

Alluvial soils from similar parent material may differ in drainage, which results in some differences in characteristics. Such soils have been differentiated mainly on the basis of those characteristics that are

ordinarily associated with good, imperfect, or poor drainage. Collectively, the soils with these three degrees of drainage constitute a soil catena. A soil catena is defined as a group of soils within one zonal region developed from similar parent material but differing in characteristics of the solum, owing to differences in relief or drainage (*18*). To bring out relations among the alluvial soils of the county, they are discussed according to their catenary positions.

The soils of the Abernathy and Ooltewah series are well drained and imperfectly drained members, respectively, of a catena whose soils are derived from local alluvium washed mainly from soils underlain by limestone. The Abernathy is somewhat comparable with the Huntington, and the Ooltewah with the Lindside, but both differ in being derived from local rather than general alluvium. They are commonly not underlain by strata of sand and gravel, as are the Huntington and Lindside soils, and they are generally slightly more acid. External drainage is slow on both the Abernathy and Ooltewah soils, and most of the internal drainage is through cracks and crevices in the underlying limestone bedrock. Through Abernathy soils, internal drainage is rapid to medium rapid, but it is somewhat impeded in the Ooltewah.

Abernathy silt loam, level phase, is young and medium to strongly acid. It is dark reddish-brown to brown mellow silt loam to a depth of 32 inches or more. Ooltewah silt loam is generally reddish-brown mellow silt loam to a depth of 10 to 15 inches, but below that depth it is brownish-gray silt loam mottled with darker gray, brown, and yellow. It is generally slightly or medium acid. Considerable variation occurs in both these soils from place to place as a result of differences in the quantity of recently deposited material. In some places enough fine sand drifted into Abernathy silt loam, level phase, to make necessary the mapping of areas as Abernathy fine sandy loam.

The Huntington, Lindside, and Melvin series form a catena of soils derived from general alluvium made up mainly of weathered limestone material. All three are neutral or slightly acid. The Huntington soils are well drained; the Lindside, imperfectly drained; and the Melvin, poorly drained. The Huntington soils are brown or yellowish brown to depths of 20 or 30 inches; the Lindside are brown or yellowish brown to depths between 12 and 18 inches, below which they are mottled gray and yellow; and the Melvin soils have a gray surface layer underlain by gray material, which is mottled with yellow and brown below a depth of 5 to 8 inches.

The texture of the lower layers of the Lindside soil are generally intermediate between those of the corresponding layers of the Huntington and Melvin. The differences in texture among the three are thought to be mainly accidents of deposition. These textural differences and variations in the height of the water table have contributed to differences in drainage. In the Melvin soil there is some indication that the heavier lower layers may be partly the result of soil-forming processes. These lower layers have some of the characteristics of the glei horizons of Half-Bog soils, and the Melvin soil can therefore be considered an Alluvial soil with a glei layer.

The Egam and Huntington soils are often intimately associated and intermingled. As a rule the Egam soil occupies positions a little lower than the Huntington, but in some instances it may be on the same level or even slightly higher. The two are derived from similar kinds

of material but characterizing the Egam soil is a layer at a depth of 16 to 20 inches that is more heavy-textured and compact than the corresponding one in the Huntington.

The Egam soil may be older morphologically or it may be the result of particular periods in which coarse and fine materials were deposited. In many places the compact layer characteristic of the soil is dark, suggesting an old surface layer. The soil is subject to flooding and often receives new deposits of alluvial material. The heavy layer therefore is not entirely the result of illuviation from the ones above, and consequently the Egam soil has been placed in the Alluvial great soil group.

The upper 15 inches of this soil is generally brown to yellowish-brown mellow silt loam or silty clay loam. Underlying this is a 12- to 20-inch layer of dark grayish-brown moderately compact silty clay. This underlying material is generally coarser in texture and less compact than that above; it is slightly mottled with gray, yellow, and brown in the upper part and more mottled with depth. The soil is neutral or slightly acid throughout.

The Ennis soils are closely associated with the Humphreys, Etowah, and Taft series. They occupy level or nearly flat relief on the wide high bottoms along some of the streams coming from Highland Rim. The parent material has been washed from high-grade limestone soils and those high in silica. In this county more surface material seems to be from high-grade limestone. The deposited material has been in place for a comparatively short time and therefore the Ennis soils can be considered relatively young. A layer of cherty gravel extends nearly everywhere under this series, and in places where it is within about 30 inches of the surface, the soil is mapped as a shallow phase.

Nearly all areas are flooded every few years. This series is more poorly drained than the Etowah, Humphreys, or Wolftever soils but has slightly better internal drainage than the Taft. The soils appear to be a little more productive than the Taft but do not equal the Humphreys. They are developed in a moist warm-temperate climate under a forest cover of deciduous trees, including sweetgum, blackgum, Spanish oak, hickory, elm, sycamore, and an occasional redcedar. They are strongly acid throughout the profile.

The following description of Ennis soil is in a cut-over forest area that contains considerable underbrush:

½ to 0 inch, dark-brown leafmold and forest litter.

½ to 8 inches, brown to yellowish-brown silt loam; contains many live roots, a few chert fragments, and much decaying organic material; breaks into fragments and granules when spaded.

8 to 16 inches, yellowish-brown silt loam; compact in place but digs out into irregular fragments: a few roots penetrate the layer; in places, the layer is not so strongly developed as here described.

16 to 24 inches, yellowish-brown friable fragmentary silt loam; less packed than layer above and more easily spaded.

24 to 32 inches, mottled grayish-brown, yellow, and gray silt loam to silty clay loam; porous and mellow under good moisture conditions; spades out into irregular fragments.

32 to 50 inches, mottled gray, brown, and yellow silty clay loam; contains a few rounded pieces of gravel and is underlain by gravel; easily spaded; saturated with water during wet seasons.

The Bruno series is formed of recent alluvium washed from soils underlain by sandstone, limestone, and shale. The areas are on nearly level natural levees along the larger streams in some places, but in others they spread out over parts of the fairly large bottoms and extend from the stream bank landward. Bruno fine sandy loam is the only type in the county. It is closely associated with the Huntington, Lindside, and Melvin soils and is neutral to slightly acid in reaction. It is well drained to excessively drained in a few places. In a few places the slope may range up to 2 or 3 percent. The surface 24 to 28 inches is brown to light yellowish brown. Below this is mottled gray, yellow, and brown fine sandy clay loam. The texture becomes finer with depth and mottling increases.

LITERATURE CITED

(1) ADAMS, G. I., BUTTS, C., STEPHENSON, L. W., and COOKE, W.
1926. GEOLOGY OF ALABAMA. Ala. Geol. Survey Spec. Rpt. 14, 312 pp., illus.

(2) ALABAMA AGRICULTURAL EXPERIMENT STATION.
1934. LESPEDEZA. Ala. Agr. Expt. Sta. Leaflet No. 6, 4 pp. (Rev. 1936.) (Reprinted, 1937.)

(3) ———
1934. SOYBEANS. Ala. Agr. Expt. Sta. Leaflet No. 2, 4 pp. (Rev. 1935 and 1937.)

(4) ———
1935. GRADES OF FERTILIZER FOR CORN AND COTTON. Ala. Agr. Expt. Sta. Cir. 70, 14 pp. (Rev. 1936.)

(5) ———
1936. HAIRY VETCH AND AUSTRIAN WINTER PEAS FOR SOIL IMPROVEMENT. Ala. Agr. Expt. Sta. Cir. 74, 12 pp., illus.

(6) ALABAMA POLYTECHNIC INSTITUTE.
1941. HANDBOOK OF ALABAMA AGRICULTURE. Ed. 3, 414 pp., illus. Auburn, Ala.

(7) ARANT, F. S.
1934. TIME OF TURNING LEGUMES AND PLANTING CORN TO AVOID INJURY FROM THE SOUTHERN CORN ROOT WORM. Ala. Agr. Expt. Sta. Cir. 65, 10 pp., illus. (Reprinted, 1937.)

(8) BAILEY, R. Y., and SEAL, J. L.
1931. SMALL GRAIN CROPS IN ALABAMA. Ala. Agr. Expt. Sta. Cir. 60, 19 pp., illus. (Rev. 1938.)

(9) ——— WILLIAMSON, J. T., and DUGGER, J. F.
1930. EXPERIMENTS WITH LEGUMES IN ALABAMA. Ala. Agr. Expt. Sta. Bul. 232, 44 pp., illus. (Reprinted, 1933).

(10) FENNEMAN, N. M.
1938. PHYSIOGRAPHY OF EASTERN UNITED STATES. 714 pp., illus. New York and London.

(11) KELLOGG, C. E.
1937. SOIL SURVEY MANUAL. U. S. Dept. Agr. Misc. Pub. 274, 136 pp., illus.

(12) MARBUT, C. F.
1935. SOILS OF THE UNITED STATES. U. S. Dept. Agr. Atlas of American Agriculture, pt. 3, Adv. Sheets No. 8, 98 pp., illus.

(13) MOON, J. W., HIGBEE, H. W., ROBERTS, W., and others.
1941. SOIL SURVEY OF JEFFERSON COUNTY, TENNESSEE. U. S. Dept. Agr., Bur. Plant Indus., Ser. 1935, No. 20, 104 pp., illus.

(14) RUFFIN, W. A
1932. THE HOME GARDEN. Ala. Polytech. Inst. Ext. Cir. 134, 26 pp., illus. (Rev. 1935, 1936, 1937, 1938, and 1939.) (Reprinted, 1933, 1934, and 1940.)

(15) STURKIE, D. G.
1937. EXPERIMENTS WITH HAY CROPS IN ALABAMA. Ala. Agr. Expt. Sta. Cir. 79, 20 pp., illus. (Rev. Cir. 58.)

(16) TENNESSEE VALLEY AUTHORITY.
1941. FORESTRY DATA FOR THE TENNESSEE VALLEY. Dept. Forest Relations, Forest Bul. No. 3, pt. 1, 155 pp. Norris, Tenn.

(17) TIDMORE, J. W., and SIMMONS, C. F.
1934. THE USE OF LIMESTONE IN MIXED FERTILIZERS. Ala. Agr. Expt. Sta. Cir. 67, 88 pp. (Reprinted, 1936.)

(18) UNITED STATES DEPARTMENT OF AGRICULTURE.
1938. SOILS AND MEN. U. S. Dept. Agr. Yearbook 1938, 1232 pp., illus.

(19) WILLIAMSON, J. T.
1929. FERTILIZER EXPERIMENTS WITH COTTON. Ala. Agr. Expt. Sta. Bul. 228, 31 pp. (Reprinted, 1934.)

(20) ——— APPLETON, W. H., and HELMS, H. B.
1927. FERTILIZER EXPERIMENTS WITH CORN. Ala. Agr. Expt. Sta. Cir. 52, 12 pp. (Reprinted, 1931 and 1938.)

U. S. GOVERNMENT PRINTING OFFICE: 1953

For sale by the Superintendent of Documents, U. S. Government Printing Office
Washington 25, D. C.

SOIL SURVEY

Limestone County, Alabama

Errata Sheet

For SOIL GROUPS in the map legend substitute:

Management Groups 7 and 12 for Management Group 7

Management Groups 9, 11, and 14 for Management Group 9

Management Group 13 for Management Group 11

Management Group 15 for Management Group 12

Management Group 16 for Management Group 13

Management Group 18 for Management Group 14

Management Groups 17 and 19 for Management Group 15